ANALYSIS OF THE PROFIT MARGIN ALONG THE PLANTAIN VALUE CHAIN IN OSUN STATE, NIGERIA

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ABSTRACT

Plantain is a crop of economic value and can serve as a source of foreign exchange if given proper attention. There is, thus, the need to explore this potential, especially as regards the profit accrued by the various actors in the plantain value chain. This study sought to estimate the profit margin of players along the plantain value chain, examine the factors affecting the margins of actors and identify the constraints faced by them. Random sampling technique was used to select 125 producers, processors and marketers in Osun state. The primary data used were collected using well-structured interview schedule. Gross margin, net marketing margins; ordinary least square regression; and Likert-type scale were used for data analysis. The study revealed that the gross margin accrued to plantain producers was ₦639,148.31/ha per annum, while the net marketing margin/bunch for the plantain processors and marketers were ₦1836.61 and ₦204.96 respectively. Household size, quantities of labour, suckers, and pesticide used were factors affecting the gross margin of producers. Total input cost significantly affected the marketing margin of the processors, while it was transportation cost for the marketers. The major constraint faced by the plantain farmers was high cost of labour whilethe processors and marketers had the challenges of high cost of plantain and lack of a uniform unit of measurements respectively. The study concludes that the plantain value chain is profitable for all the actors, and recommends that the government should provide incentives that would encourage more people to go into plantain production, processing, and marketing.

Keywords: Plantain, Value chain, Actors, Profit margin, Constraints

INTRODUCTION

Plantain (*Musa paradisiaca*) is one of the common horticultural crops cultivated in Nigeria. Its production requires an optimum temperature of 30^0C, mean monthly rainfall of 100mm, soil pH of 4.5-7.5 and a partly drained sandy-loam soil (Ajiboye and Olaniyan, 2016). Plantain is a multipurpose crop that serves as food as well as raw materials for beverages, many delicacies, and snacks (Aina et al., 2012). According to IITA (2009), plantain is among the primary sources of carbohydrates in humid tropical Africa as it contains about 35% carbohydrate, 0.2 to 0.5% fats, 1.2% protein, and 0.8% ash. Adejoro et al., (2010) opined that plantains have the potential to contribute to national food security and eliminate rural poverty. Plantain is ranked fourth after rice, wheat, and maize, as the most important food crop in the world (IITA, 2014). It is an important staple food crop for both rural and urban areas and occupies a strategic position for rapid food production in Nigeria. Food and Agricultural Organization (FAO) (2016) noted that Nigeria is one of the largest producers of plantain in West Africa with an annual output of about 2.74 million metric tons. Traditionally, growing of plantain has been left in the hands of subsistence farmers who account for about 80 percent of Nigerian agricultural output (FAO, 2016).

The consumption of plantain has risen tremendously in Nigeria in recent years probably as a result of increased urbanisation and the high demand for comfortable and convenient foods by non-farming population. The growing industry of plantain flour and plantain chips which are the two most common products from processed plantain is believed to be responsible for the high demand for plantain currently being experienced in the country (IITA, 2014). It is important to note that these products are not only sought for in Nigeria but also outside the shores of the nation. Hence, sales of plantain processed products can serve as a potential source of income generation for Nigeria.

Value chain analysis of a product describes the full range of activities that are required to bring a product or services from production, through the different actors involved until it reaches the final consumer (Henry-Ukoha et al., 2015). The value chain approach has gained tremendous acclaim as a tool for addressing problems in developing countries. This is because the nature of agricultural development and the way food is produced, processed, and sold is changing rapidly. Over the years, there exist a knowledge gap as regarding the profit the actors in the plantain value chain stand to make, and the challenges they face. Potential areas for intervention and improvement in the plantain value chain analysis as it directly affects the gains of actors in the value chain have not been adequately investigated. Furthermore, not much has been done in identifying the factors militating against maximising the profit of the different players in the plantain value chain. Also, by not identifying constraints these actors face with the aim of proffering solution to them may hinder the

benefits of improved plantain production, processing, and marketing that the players ought to enjoy.

Therefore, the specific objectives of the study were to estimate the profit margin of actors along the plantain value chain, examine the factors that affect the profit of actors in the value chain, and identify the constraints faced by the different actors in the plantain value chain.

METHODOLOGY

Sampling techniques

The study was carried out in Osun State, which is located in the South-western part of Nigeria. A three-stage random sampling method was used for the survey. The first stage involved the purposive selection of five Local Government Areas (Oriade, Atakunmosa-west, Ilesha-east, Ilesha-west, and Irewolede) in the state known for intense plantain production activities. Two villages were then randomly selected from the list of villages in the LGAs to give a total of ten villages. Proportionate sampling was used to randomly choose 50 plantain growers from the list of producers from each selected village. One market was randomly selected from each of the five local government areas selected. Proportionate sampling was used to randomly choose 40 marketers from the list of marketers in each market. Snowball sampling technique was used to generate a sampling frame for the processors. Proportionate sampling was also used to randomly select 35 processors for the study. Data collection was with the aid of a structured interview schedule which was administered between January and April 2017. The interview schedule was subjected to both validity and reliability tests. A Cronbach's alpha value of 0.842 was obtained, which indicates a high level of reliability.

Analytical techniques

Gross margin and marketing margin

The gross margin analysis was used to determine the costs and returns of producers along the plantain value chain. This was given as:

Gross Margin (naira/ha) = Gross Value of Output (GVO) – Total Variable Cost (TVC)……..(1)

where;

G*ross value of plantain = quantity of plantain bunches in Kg (Q) × price (P)….(2)*

Total variable cost = cost incurred for labour and purchased inputs for the production season.

Gross margin was calculated on per hectare basis for plantain producers.

Gross and net marketing margins, as well as marketing efficiency, were calculated for plantain processors and marketers. This was given as:

Gross marketing margin (in naira) = Selling price – Producers price - TVC ……..(3)

Net marketing margin (in naira) = Gross marketing margin – Total fixed costs (TFC) ….(4)

Marketing efficiency (%) = $\frac{Net\ marketing\ margin}{Total\ marketing\ cost}$ x 100 ……..(5)

Where; TVC = Total variable costs and Total marketing cost = TVC + TFC

Regression analysis

Ordinary Least Square Multiple regression analysis as used by Osondu (2015) was used to determine the factors that influence margins of the actors in the value chain. Explicitly, the model for this study is stated as:

For producers

$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_{11}D_1 + \beta_{12}D_2 + \beta_{13}D_3 + e$……..(6)

For processors

$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}D_1 + \beta_{12}D_2 + \beta_{13}D_3 + e$……..(7)

For marketers

$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}D_1 + \beta_{12}D_2 + \beta_{13}D_3 + e$……..(8)

where;

β_0 = intercept, β_1- β_9 = coefficients

Y = Gross margin (for producers), and Net marketing margin (for processors and marketers)

X_1 = age (in years)

X_2 = household size (number of people feeding from the same pot)

X_3 = highest level of education (number of years of successful schooling)

X_4= plantain production/processing/marketing experience (in years)

X_5= farm size in ha (for producers)

X_6= pesticide quantity in litres (for producers)

X_7= quantity of suckers used (for producers)

X_8 = quantity of labour in man-days (for producers)

X_9 = total input cost (₦) (for processors and marketers)

X_{10} = Distance to market (km) (for processors and marketers)

D_1 = gender (1 = male; 0 = otherwise)

D_2 = membership of agricultural association (1 = yes; 0 = otherwise)

D_3 = access to credit (1 = yes; 0 = otherwise) for marketers

e= error term.

The Likert-type scale

The four-point Likert-type scale was used to identify the constraints faced by each of the actors in the value chain. A rating of very severe = 4, severe = 3, less severe = 2 and not severe at all = 1 was used. The scores were then calculated as follows:

(i) Weighted score (WS) = 4n +3n+2n+1n =Total score for each constraint….(9)
where n = frequency of each constraint for each rating.

(ii) Rank – The values of the WS was then used to rank the severity of the limitations faced by the players in the value chain.

RESULTS and DISCUSSION

This section presents the results of the analysis done for data collection.

Gross margin and marketing margin along the plantain value chain

The result of the gross margin and marketing margin analysis is presented in this sub-section.

Gross margin of plantain producers

The gross margin for the producers is provided in Table 1.

Table 1: Gross margin analysis for plantain producer

Variables		Values (₦/ha)
The gross value of plantain (A)		845,745.37
Cost of labour		131,266.16
Cost of pesticides/fertilizers	TVC (B)	8,315.48
Cost of planting material		67,015.42
Gross margin (C) = (A) - (B)		639,148.31
Operating ratio = B/A		0.25

Note: 1dollar = ₦360

Source: Field survey, 2017

The result for gross margin analysis for the plantain producer indicates that for every hectare of land used for plantain production per annum, the farmer stands to make a margin of ₦ 639,148. The value of the operating ratio implies that the producers spent about 25 percent of

their gross income from plantain production as operating expenses. It is worth noting that labour cost accounted for about 64 percent of the total cost incurred in plantain production. This agrees with the findings of Olumba (2014) and Fakayode et al. (2011). Pesticide cost accounted for just four percent, while the remaining cost was incurred from the purchase of planting materials. On the average, 1340 suckers were planted per hectare. Average number of bunches harvested per hectare was 1120 with a mean selling price of ₦756/bunch.

Marketing margin and marketing efficiency for plantain processors

This subsection presents the analysis of the marketing margin and marketing efficiency of the plantain processors.

Table 2: Marketing margin and efficiency analysis for plantain processors

Variables		Values (₦/bunch)
Selling price (A)		3,105.11
Producers price (B)		593.95
Cost of labour		221.14
Cost of processing materials	TVC (C)	349.48
Cost of transportation		28.57
Total fixed cost (rent, taxes security) (D)		75.36
Gross marketing margin (E) = (A) - (B+C)		1,911.97
Net marketing margin (F) = (E) – (D)		1,836.61
Marketing efficiency (%)		145

Note: TMC = Total marketing costs
Source: Field survey, 2017

The processed products encountered in the study area were plantain chips and plantain flour. Average bunch of plantain in the study area weighed eight kilograms. Majority of the plantain processors were engaged in chips processing. This may have been because the returns from chips processing was higher than that from the flour processing. It is also worth noting that the chips processors incurred higher costs in their processing activities due to the high cost of purchasing the vegetable oil used in frying. Overall, the value of the net marketing margin for

plantain processors calculated implies that for every bunch of plantain processed in a period of one month, the processors stand to make a margin of about ₦1,837. The value of the marketing efficiency shows that for every naira spent on processing plantain, the processors would make about 145kobo.

Marketing margin for marketers

This subsection presents the analysis of the marketing margin for plantain marketers.

Table 3: Marketing margin and efficiency analysis for plantain marketers

Variables		Values (₦/bunch)
Selling price (A)		1,027.56
Producers price (B)		706.65
Cost of loading and offloading	TVC (C)	19.02
Cost of transportation		76.50
Cost of storage, rent & taxes	(TFC) D	20.43
Gross marketing margin (E) = (A) - (B+C)		225.39
Net marketing margin (F) = (E) – (D)		204.96
Marketing efficiency (%)		177

Source: Field survey, 2017

The value for the net marketing margin for plantain marketers implies that for every bunch of plantain sold, the marketers make a net profit of about ₦205. The study revealed that cost incurred in the transportation of the plantain bunches from the point of purchase to the point of sale contributed the most total marketing cost. Other costs incurred in marketing plantain include storage, loading, and off-loading costs. The costs for levies/taxes paid by the marketers contributed the least to total cost. The value of the plantain marketing efficiency calculated means that the marketers gain ₦1.77 for every naira spent on marketing plantain. Overall, the study has revealed that plantain production, processing, and marketing is profitable for all the actors.

Factors affecting the gross margin of actors

The results of the regression analysis to determine the factors that affect the gross margin for the actors in the value chain are presented below.

Factors influencing gross margin of plantain producers

Table 4: Result of regression analysis of the determinants of the gross margin of producers

Variables	Coefficient	Standard error	t-values
Constant	3601.08	138823.20	0.05
Age (X_1)	-7.37	1490.59	-0.00
Sex (D_1)	-104667.60	57598.68	-1.82
Household size (X_2)	18195.14**	7374.35	2.46
Highest level of education (X_3)	-6876.97	29263.39	-0.24
Farm size (X_5)	23437.03	27286.20	0.86
Quantity of pesticide (X_6)	43418.86***	12253.42	3.54
Quantity of suckers (X_7)	185.27*	92.88	1.99
Quantity of labour (X_8)	26832.76***	9293.79	2.89
Membership of agricultural association (D_2)	-40354.56	24665.21	-1.64
Access to credit (D_3)	-47538.95	29343.62	-1.62

R^2 = 0.816; Adjusted R^2 = 0.753;***, **and *-- significant at the 1%, 5% and 10% level.
Source: Field survey, 2017.

The Adjusted R^2 value of 0.753 implies that 75.3% of the variability in gross margin of the producers was accounted for by the specified independent variables in the model. The household size, labour used, as well as quantities of suckers and pesticide used were found to be significant. The positive sign of these significant coefficients implies that a unit increase in the quantities of these variables increases gross margin. The positive and significant coefficient of household size conforms to *a priori* expectations and agrees with the findings of Mbanasor and Kalu (2008). Larger households may imply the availability of family labour for plantain production activities. Also, the significant coefficient for labour buttresses the significant contribution of labour to plantain production activities.

Factors affecting marketing margin of plantain processors

The variables that contribute to the marketing margin of the processors are presented in Table 5.

Table 5: Result of regression analysis of the determinants of marketing margin of processors

Variables	Coefficient	Standard error	t-values
Constant	-5.309	5.312	-1.00
Age (X_1)	-2.479	2.182	1.14
Sex (D_1)	0.802	0.860	1.57
Household size (X_2)	-0.942	1.294	-0.73
Highest level of education (X_3)	0.210	1.158	0.18
Plantain processing experience (X_4)	0.205	0.852	0.24
Membership of processors association (D_2)	-1.589	1.341	-1.19
Total input cost (X_9)	3.220**	1.369	2.35
Distance to market (X_{10})	1.480	1.264	1.17
Access to credit (D_3)	-0.115	0.421	-0.27

R^2=0.622, Adjusted R^2=0.566, **Significant at the 5% level. Source: Field survey, 2017.

The regression analysis for plantain processor showed the coefficient of variability (R^2) to be 0.622. This implies that 62.2% of the variability in marketing margin was accounted for by the specified independent variables in the model. Total input cost was significant at the 5% level. This implies that as total input cost increases due to more plantain processing, processing margin also increases. Total input cost includes the cost of purchasing the plantain bunches, cost of energy for processing (firewood and charcoal), cost of vegetable oil for frying, milling cost and cost of packaging materials.

Factors affecting marketing margin of plantain marketers

Table 4: Regression analysis of the factors affecting marketing margin of marketers

Variabl6s	Coefficient	Standard error	t-values
Constant	0.221	2923.558	-1.40
Age (X_1)	-0.068	66.482	-0.41
Household size (X_2)	-968.779	1301.165	-0.74
Highest level of education (X_3)	401.181	303.258	1.32
Plantain marketing experience (X_4)	1004.119*	530.467	1.98
Membership of marketing association (D_2)	-904.119	1008.882	-0.90
Access to credit (D_3)	498.812	877.841	0.57
Total input cost (X_9)	0.837	2.144	0.39
Distance to market (X_{10})	-8.039**	3.433	2.34

R^2=0.524, Adjusted R^2=0.381, *, **; Significant at the 5% and 10% level. Source: Field survey, 2017.

The significant coefficient of the marketing experience implies that a one unit increase in this variable will increase the marketing margin for the plantain marketers by the value of their coefficient. This may be because the more years the marketers spend in the marketing of plantain, the more they can harness the tricks/experiences they have gained to foster the increase in their profitability. On the other hand, the negative coefficient of distance to market implies that increasing this variable by one unit will reduce the marketing margin of the marketers. This may be attributed to the fact that the further the marketers have to travel to sell the plantains, the more transportation cost they will incur and this will, in turn, reduce the margins they make.

Constraints encountered in the plantain value chain

This subsection presents the various constraints experienced by the different actors in the plantain value chain.

Table 7: Constraints to production in the plantain value chain

The severity of limitations encountered by plantain farmers is shown in Table 7.

S/N	Constraints	Very Severe	Severe	Less Severe	Not a constraint	Weighted score	Rank
1	High cost of labour	36(72)	9(18)	3(6)	2(4)	179	1st
2.	Poor access to credit	26(52)	17(34)	6(12)	1(2)	168	2nd
3.	High cost of input	22(44)	23(46)	3(6)	2(4)	165	3rd
4.	Lack of extension services	9(18)	29(58)	11(22)	1(2)	146	4th
5.	Low produce price	5(10)	30(60)	13(26)	2(4)	198	5th
6.	Unavailability of land	7(14)	22(44)	20(40)	1(2)	135	6th
7.	Inadequate buyers	3(6)	21(42)	24(48)	2(4)	125	7th
8.	Incidence of pest	4(8)	12(24)	31(62)	3(6)	117	8th
9.	Lack of good planting materials	2(4)	15(30)	30(60)	2(4)	115	9th
10.	Poor storage facilities	3(6)	11(22)	31(62)	5(10)	112	10th
11.	Incidence of theft	1(2)	6(12)	22(44)	21(42)	87	11th

Figures in parenthesis are percentages. Source: Field survey 2017.

The high cost of labour ranked first amongst the limitations. This may have been because labour cost was the highest in the total variable cost analysis. The weighted score of 179 out of a possible 200 showed that it was a very severe constraint amongst the farmers. This finding agrees with similar studies by Idumah *et al* (2016) and Akinyemi *et al* (2013) that also cited that high cost of labour was a major constraint faced by plantain producers in Nigeria. Inadequate access to credit facilities and the high cost of inputs ranked second and third with

a weighted score of 168 and 165 respectively. Again, these constraints were considered to be very severe constraints. Other limitations encountered were the lack of extension service, low produce price, unavailability of land, inadequate buyers, the incidence of pest, and scarcity of healthy planting materials, inadequate storage facilities as well as the rate of theft. These were all considered to be severe constraints.

Constraints of the processor in plantain value chain

The severity of constraints encountered by plantain processors is shown in Table 8.

Table 8: Constraints faced by processors

S/N	Constraints	Very Severe	Severe	Less Severe	Not a constraint	Weighted score	Rank
1	High cost of plantain	18(51.43)	15(42.86)	1(2.86)	1(2.86)	120	1st
2.	High cost of processing	19(54.29)	12(34.29)	2(5.71)	2(5.71)	118	2nd
3.	Poor access to credit	12(34.29)	18(51.43)	4(11.43)	1(2.86)	111	3rd
4.	High transportation cost	6(17.14)	15(42.86)	14(40.00)	0(0.00)	97	4th
5.	Inadequate buyers	7(20.00)	13(37.14)	13(37.14)	3(8.57)	95	5th
6.	High cost of inputs	9(25.71)	10(28.57)	12(34.29)	4(11.43)	94	6th
7.	Low pricing	3(8.57)	16(45.71)	13(37.14)	3(8.57)	89	7th
8.	Poor storage facilities	1(2.86)	13(37.14)	18(51.43)	3(8.57)	82	8th
9.	High cost of packaging	0(0.00)	5(14.28)	26(74.29)	4(11.43)	71	9th
10.	High cost of labour	4(11.43)	4(11.43)	14(40.00)	13(37.14)	69	10th

Figures in parenthesis are percentages. Source: Field survey 2017.

Constraints analysis of the processors showed that high cost of plantain bunches, the high cost of processing and inadequate access to credit ranked first, second and third respectively. The high cost of plantain and processing may have been due to the rising cost of commodities generally in the market. On the other hand, reduced access to credit may be attributed to the fact that three –quarters of the processors had no access to credit for processing activities during the production year. High transportation cost, inadequate buyers, the high cost of inputs, low pricing, poor storage facilities, the high cost of packaging were all

ranked as severe constraints. However, the high cost of labour was ranked least with a weighted score of 69.

Constraints of marketers in plantain value chain

The severity of constraints encountered by plantain marketers is shown in Table 9.

Table 9: Constraints faced by marketers

S/N	Constraints	Very Severe	Severe	Less Severe	Not a constraint	Weighted score	Rank
1	High cost of plantain	17(42.50)	22(55)	1(2.50)	0(0.00)	136	1st
2.	Lack of uniform weight	18(45.00)	15(37.50)	4(10.00)	3(7.50)	128	2nd
3.	Poor access to credit	16(40.00)	15(37.50)	6(15.00)	3(7.50)	124	3rd
4.	High transportation	6(15.00)	28(70.00)	4(10.00)	2(5.00)	118	4th
5.	Poor storage facilities	11(27.50)	18(45.00)	8(20.00)	3(7.50)	117	5th
6.	Low pricing	8(20.00)	17(42.50)	12(30.00)	3(7.500)	110	6th
7.	Inadequate buyers	1(2.50)	7(17.50)	25(62.50)	7(17.50)	82	7th

Figures in parenthesis are percentages. Source: Field survey 2017.

Table 9 showed the severity of constraints for plantain marketers. The high cost of plantain bunches ranked first. Lack of uniform or standard weight of measurement ranked second with a weighted score of 128 out of a maximum of 160. This may be because the absence of uniform weight of measurement posed a challenge to the marketers, in that buying was based on physical examination and this made pricing a little bit more difficult. Poor access to credit ranked third with a weighted score of 124. High-cost transportation ranked fourth. The severity of this constraint was majorly due to the bad condition of the roads used in the transportation of the plantain bunches. A similar study by Adeoye *et al* (2013) also showed that high transportation cost, lack of storage facilities and the near absence of credit facilities were the major constraints marketers in South-western Nigeria faced. Other constraints encountered by marketers in this study were inadequate storage facilities, low produce pricing, and scarce buyers. Even though inadequate buyers ranked the least, nonetheless, the weighted score 82 out of a maximum of 160 indicated that it was somewhat a severe constraint.

CONCLUSION

Even though specific limitations were encountered by the actors in the plantain value chain, nonetheless, it is an economically viable and profitable enterprise. The study, therefore, recommends the formulation and encouragement of policies that would encourage the actors in the value chain to access credit for their plantain activities. Also, the introduction of a standard unit of measurement for plantain should be looked into to improve the marketing of the produce. The provision of subsidized inputs for the actors will also help to reduce production and processing costs.

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