SUB-THEME 1: E-BUSINESS AND VALUE CHAIN DEVELOPMENT IN THE AGRICULTURAL SECTOR

ASSESSMENT OF PLANTAIN VALUE CHAIN IN OSUN STATE

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ABSTRACT
Plantains are crops of economic value and can serve as a source of foreign exchange if given proper attention. Not much has been documented on this potential especially as regards the profit accrued by the various actors in the plantain value chain. The study estimated the profit margin of players along the plantain value chain, examined the factors affecting the gain of actors and identified the constraints faced by the actors. Stratified sampling technique was used to select 125 producers, processors and marketers in Osun state. Primary data was collected using well-structured interview schedule. Gross and marketing margin, 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 ₦207,777.42/ha per annum, while the marketing margin/bunch for the plantain processors and marketers was ₦415 (41.5%) and ₦378 (37.8%) respectively. Household size, quantities of labour, suckers and pesticide used were factors that affected the gross margin of producers. Total input cost and transportation cost contributed to the marketing margin of processors and marketers. Major constraint faced by plantain farmers was the high cost of labour. The high cost of plantain and lack of a uniform unit of measurement were the most severe constraints among processors and marketers respectively. The study concluded that the plantain value chain was profitable for all the actors, and recommended that the government should formulate incentives that would encourage more people to go into plantain production, processing and marketing.

KEYWORDS: Plantain, Gross margin, Marketing margin, Marketing efficiency, Constraints, Osun State.

INTRODUCTION
Plantain (Musa paradisiaca) is a perennial crop that takes the appearance of trees as they mature. Plantain is ranked fourth after rice, wheat and maize, as the most important food crop in the world (IITA, 2014). Plantain is used as food and beverages. Plantain is an important staple food crop for both rural and urban areas, and it 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 annual production 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. The consumption of plantain has risen tremendously in Nigeria in recent years probably because of the rapidly increasing urbanization and the great demand for comfortable and convenient foods by non-farming population. The growing industry of plantain flour and plantain chips which are the two commonest 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 country. Hence, sales from these 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 (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 profitability of actors in the value chain have not been adequately investigated. Furthermore, not much has been done in identifying the factors militating against maximizing profit of the different players in the plantain value chain. Also, not identifying constraints these actors face to proffering solution may hinder the benefits of improved plantain production, processing and marketing that the players ought to enjoy.

The specific objectives of the study are therefore 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, Nigeria. A three-stage stratified sampling method was used for the survey. The first stage involved the purposive selection of five Local Government Areas 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 ten communities. Five percent of the total plantain producers were randomly chosen from the list of producers from each community to give a sample size of 50 plantain growers. One market was randomly selected from each of the five local government areas. Five percent of the total marketers were randomly chosen from the list of marketers in each market to give a sample size of 40 marketers used for the study. Snowball sampling technique was used to generate a sampling frame for the processors. Five percent of the listed processors were randomly selected to give a sample size of 35 processors. Data collection was with the aid of a well-structured interview schedule. The interview schedule was subjected to both validity and reliability tests. A Cronbach's alpha value of 0.842 obtained indicates a high level of assurance.

Analytical Techniques

Gross 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 (GM) = Gross Value of Output (GVO) – Total Variable Cost (TVC)..(1)

where; Gross value of plantain = quantity of plantain bunches in Kg (Q) × price/Kg (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.

Marketing margin and marketing efficiency were calculated for plantain processors and marketers.

Where;

$$\text{Marketing margin} = \frac{Selling\ price - Producers\ price}{selling\ price} \quad \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

$$\text{Marketing efficiency} = \frac{Marketing\ margin}{marketing\ cost} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Regression analysis

Ordinary Least Square Multiple regression analysis was used to estimate the factors that influence profit of the actors in the value chain. Explicitly, the model for this study is stated as: $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \ldots\ldots + \beta_{10}X_{10} + \beta_{11}D_1 + \beta_{12}D_2 + \beta_{13}D_3 + e$.....(5)

Where;

β_0 = intercept, β_1- β_9 = coefficients

Y = Gross margin (₦) (for producers), and 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)

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} = transportation cost (₦) (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....(6)
where n = frequency of each constraint for each rating.

(ii) Mean Score (MS) = $\frac{total\ score\ of\ each\ constraint}{total\ number\ of\ actors}$ .....(7)

(iii) Rank - The values of the MS 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.

Socio-demographic characteristics of the actors

Information on the socio-demographic characteristics of the actors in the plantain value chain is presented in this sub-section.

Table 1: Socio-demographic characteristics of the actors in the plantain value chain

S/N	Characteristics	Producers(n=50)	Processors (n=35)	Marketers (n=40)
1	**Sex**			
	Male	49(98.00)	2 (5.71)	0 (0.00)
	Female	1 (2.00)	33 (94.29)	40 (100.00)
2	**Age of farmers (years)**			
	31- 40	6 (12.00)	14 (40.00)	19 (47.50)
	41-50	19 (38.00)	13 (37.14)	16 (40.00)
	51-60	20 (40.00)	8 (22.86)	4(10.00)
	> 60	5 (10.00)	0 (0.00)	1 (2.50)
	Mean	50.58	43.37	42.00
3	**Household size of farmers**			
	1 – 5	23 (46.00)	25 (71.43)	18 (45.00)
	6 -10	27 (54.00)	10 (28.57)	19 (47.50)
	> 10	0 (0.00)	0 (0.00)	3 (7.50)
	Mean	6	5	6
4	**Highest level of education**			
	Primary	29 (58.00)	19 (54.29)	16 (40.00)
	Secondary	20 (40.00)	14 (40.00)	22 (55.00)
	Tertiary	1 (2.00)	2 (5.71)	2 (5.00)
5	**Membership of agricultural association**			
	Yes	42 (84.00)	10 (28.57)	21 (52.50)
	No	8 (16.00)	25 (71.43)	19 (47.50)
6.	Experience			
	1-5	36 (72.00)	31 (88.57)	22 (55.00)
	6-10	11 (22.00)	3 (8.57)	13 (32.50)
	> 10	3 (6.00)	1 (2.86)	5 (12.50)
	Mean	5	3	7
7	**Access to credit**			
	Yes	12 (22.00)	8 (22.86)	16 (40.00)
	No	38 (78.00)	27 (77.14)	24 (60.00)
8	**Access to extension contact**			
	Yes	7 (14.00)	0 (0.00)	0 (0.00)
	No	43 (86.00)	35 (100.00)	40 (100.00)

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

The sex distribution of the plantain producer as seen in Table 1 revealed that almost all of them were male. This may be attributed to the tedious work involved in plantain cultivation. The reverse was the case for the plantain processors where only about 6% were male. For the plantain marketers, the result showed that all of them were female. This may be due to the fact that the marketing of agricultural produce is mainly dominated by women as reported by Adeoye et al, 2013 and Cauthen et al, 2013. The age distribution of the plantain producers revealed that majority of them were between ages 41 and 60 years of age, with mean age of about 51 years. Similar trend was seen in the case of the plantain processors, who had a mean age of 43 years. However, for the plantain marketers, almost half of them were between the ages of 30 and 40 years, and had a mean age of 42 years. This implies that they were relatively younger than the producers and processors. The distribution for the household size revealed that majority of actors had household sizes of between 1 –10 persons. This could be as a result of the extended family system that is commonly practiced in Nigeria. This in turn may mean availability of family labour for agricultural activities. Distribution

of highest level of education shows that majority of the plantain producers and processors had primary education, while it was secondary education for the marketers. The distribution according to membership of agricultural association showed that majority of the plantain producers and marketers belonged to an agricultural based association. The reverse was the case for the plantain processors. The farming experience of plantain producers showed that almost all of the respondents had between 1-10 years' experience with mean farming experience of 5 years. This suggests that they were fairly new in the plantain producing business. For the plantain processors, the modal range of processing experience was between 1-5 years with a mean age of 3 years. A similar trend was noticed for the plantain marketers, although, their mean marketing experience was 6 years. The distribution for access to credit showed that only about one-quarter of the plantain producers and processors had access to credit facilities during the last production season. A similar trend was noted for the marketers although the percentage of those who got credit was a bit higher. Similarly, results for access to extension contact revealed that almost all the actor had zero extension contact during the production/processing/marketing season.

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 Producer

The gross margin for the producers is provided in Table 2.

Table 2: Gross margin analysis for plantain producer

Variables		Values (₦/ha)
Gross value of plantain (A)		376,766.67
Cost of labour	TVC (B)	148,422.22
Cost of chemicals		8,746.56
Cost of planting material		11,820.47
Gross margin (C) = (A) - (B)		207,777.42
Operating ratio = B/A		0.45

The gross margin for the plantain producer was estimated to be ₦207, 777.42/ha. The result means that for every hectare of land used for plantain production per season, the farmer stands to make a margin of ₦207,777.42. The value of the operating ratio implies that the producers spent about 45 percent of their gross income from plantain production as operating expenses.

Marketing margin and marketing efficiency for plantain processors

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

$$\text{Processors marketing margin} = \frac{(1255.12 - 734.29)}{1255.12} = 0.415$$

$$\text{Marketing efficiency for processors} = \frac{520.83 \times 100}{1029.29} = 50.6\%$$

Marketing margin for plantain processors calculated was 0.415 (41.5%). This implies that for every bunch of plantain processed, the processors make a profit of ₦415. Also, plantain processors marketing efficiency was calculated to be 50.6%. This implies that the processors gain ₦0.506 (50.6 kobo) for every naira spent on processed plantain.

Marketing margin for marketers

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

$$\text{Marketing Margin} = \frac{(1028.75 - 651)}{1028.75} = 0.378$$

$$\text{Marketing efficiency} = \frac{377.75 \times 100}{704.75} = 53.6\%$$

Marketing margin for plantain marketers was calculated to be 0.378 (37.8%). This implies that for every bunch of plantain sold, the marketers make a profit of ₦378. Also, plantain marketing efficiency was calculated to be 53.6%. This means that the marketers gain ₦0.536 (53.6 kobo) for every naira spent on marketing plantain.

Factors affecting the margin of actors

The results for regression analysis which assesses the factors that affect gross margin for the actors in the value chain are presented below.

Factors that influence gross margin of plantain producers

The factors that were seen to to contribute to the gross margin of the plantain producers are shown in Table 3.

Table 3: Result of regression analysis of plantain producer

Variables	Coefficient	Standard error	t-values
Constant	3601.08	138823.20	0.05
Age (X_1)	-7.37	1490.59	-0.00
Gender (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 implication of the R^2 value of 0.816 as seen in Table 3 is that almost 82% 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 coefficients implies that as the quantities of these variables increases, gross margin also increase. This finding is similar to that obtained by Fakayode et al, 2011.

Factors affecting marketing margin of plantain processors

The variables that contribute to the marketing margin of the processors are presented in Table 4.

Table 4: Result of regression for plantain processor

Variables	Coefficient	Standard error	t-values
Constant	2050.388	2465.268	0.83
Age (X_1)	-48.123	46.537	-1.03
Gender (D_1)	1241.477	1469.234	0.84
Household size (X_2)	-182.547	266.849	-0.68
Highest level of education (X_3)	-34.423	634.259	-0.05
Plantain processing experience (X_4)	-35.995	181.829	0.20
Membership of processors Association (D_2)	121.676	877.287	0.14
Total input cost (X_9)	1.278**	0.595	2.15
Transportation cost (X_{10})	3.146	5.017	0.63

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 5% level. This implies that as total input cost increases due to more plantain processing, marketing margin also increases. This means that the more plantain they process, the more the gain they stand to make.

Factors affecting marketing margin of plantain marketers

The factors that affected the marketing margin of the marketers is presented in Table 5.

Table 5: Regression result for plantain marketers.

Variables	Coefficient	Standard error	t-values
Constant	-4086.623	2923.558	-1.40
Age (X_1)	-27.522	66.482	-0.41
Gender (D_1)	-968.779	1301.165	-0.74
Household size (X_2)	401.181	303.258	1.32
Highest level of education (X_3)	1004.119*	530.467	1.98
Plantain marketing experience (X_4)	236.406	172.772	1.37
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
Transportation cost (X_{10})	8.039**	3.433	2.34

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

The significant coefficients of the highest level of education and transportation cost imply that a one unit increase in these variables will increase the marketing margin for the plantain marketers by the values of their coefficients. This may be because educated farmers can harness technologies and information better to increase productivity.

Constraints encountered in the plantain value chain

This sub- section presents the various constraints experienced by the different actors in the plantain value chain.

Constraints of producer in the plantain value chain

The severity of limitations encountered by plantain farmers is shown in Table 6.

Table 6: Constraints faced by producers

S/N	Constraints	Very severe (4)	Severe (3)	Less severe (2)	Not at all (1)	Weighted score	Mean score	Rank
1.	High cost of labour	36(72)	9(18)	3(6)	2(4)	179	3.58	1st
2.	Poor access to credit	26(52)	17(34)	6(12)	1(2)	168	3.36	2nd
3.	High cost of input	22(44)	23(46)	3(6)	2(4)	165	3.34	3rd
4.	Lack of extension Service	9(18)	29(58)	11(22)	1(2)	146	2.92	4th
5.	Low produce price	5(10)	30(60)	13(26)	2(4)	198	2.76	5th
6.	Unavailability of Land	7(14)	22(44)	20(40)	1(2)	135	2.70	6th
7.	Inadequate buyers	3(6)	21(42)	24(48)	2(4)	125	2.50	7th
8.	Incidence of pest	4(8)	12(24)	31(62)	3(6)	117	2.34	8th
9.	Lack of good material	2(4)	15(30)	30(60)	2(4)	115	2.30	9th planting
10.	Poor storage Facilities	3(6)	11(22)	31(62)	5(10)	112	2.24	10th
11.	Incidence of theft	1(2)	6(12)	22(44)	21(42)	87	2.08	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 mean score of 3.58 showed that it was a very severe constraint amongst the farmers. Poor access to credit facilities and the high cost of inputs ranked second and third with a mean score of 3.36 and 3.34 respectively. Again, these constraints were considered to be very severe constraints. Other constraints encountered were the lack of extension service, low produce price, unavailability of land, inadequate buyers, the incidence of pest, scarcity of healthy planting materials, poor storage facilities and rate of theft. These were all considered to be severe constraints.

Constraints of processor in plantain value chain

The severity of constraints encountered by plantain processors is shown in Table 7.

Table 7: Constraints faced by processors

S/N	Constraints	Very severe (4)	Severe (3)	Less severe (2)	Not at all (1)	Weighted score	Mean score	Rank
1.	High cost of plantain	18(51.43)	15(42.86)	1(2.86)	1(2.86)	120	3.43	1st
2.	High cost of processing	19(54.29)	12(34.29)	2(5.71)	2(5.71)	118	3.37	2nd
3.	Poor access to credit	12(34.29)	18(51.43)	4(11.43)	1(2.86)	111	3.17	3rd
4.	High transportation cost	6(17.14)	15(42.86)	14(40.00)	0(0.00)	97	2.77	4th
5.	Inadequate buyers	7(20.00)	13(37.14)	13(37.14)	3(8.57)	95	2.71	5th
6.	High cost of inputs	9(25.71)	10(28.57)	12(34.29)	4(11.43)	94	2.69	6th
7.	Low pricing	3(8.57)	16(45.71)	13(37.14)	3(8.57)	89	2.54	7th
8.	Poor storage facilities	1(2.86)	13(37.14)	18(51.43)	3(8.57)	82	2.34	8th
9.	High cost of packaging	0(0.00)	5(14.28)	26(74.29)	4(11.43)	71	2.03	9th
10.	High cost of labour	4(11.43)	4(11.43)	14(40.00)	13(37.14)	69	1.97	10th

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

Constraints analysis of the processors showed that high cost of plantain bunches, high cost of processing and poor 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 in 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, high cost of labour was ranked least with a mean score of 1.97.

Constraints of marketers in plantain value chain

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

Table 8: Constraints faced by marketers

S/N	Constraints	Very severe (4)	Severe (3)	Less severe (2)	Not at all (1)	Weighted score	Mean score	Rank
1.	High cost of plantain	17(42.50)	22(55)	1(2.50)	0(0.00)	136	3.40	1st
2.	Lack of uniform Weight	18(45.00)	15(37.50)	4(10.00)	3(7.50)	128	3.20	2nd
3.	Poor access to credit	16(40.00)	15(37.50)	6(15.00)	3(7.50)	124	3.10	3rd
4.	High transportation	6(15.00)	28(70.00)	4(10.00)	2(5.00)	118	2.95	4th
5.	Poor storage facilities	11(27.50)	18(45.00)	8(20.00)	3(7.500)	117	2.93	5th
6.	Low pricing	8(20.00)	17(42.50)	12(30.00)	3(7.500)	110	2.75	6th
7.	Inadequate buyers	1(2.50)	7(17.50)	25(62.50)	7(17.50)	82	2.05	7th

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

Table 8 showed the severity of constraints for plantain marketers. The high cost of plantain bunches ranked first with a mean score of 3.40. Lack of uniform or standard weight of measurement ranked second with an average score of 3.20; 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 mean score of 3.10. High cost transportation ranked fourth with a mean score of 2.95; this was majorly due to the bad condition of the roads. Other constraints encountered were poor storage facilities, low produce pricing and inadequate buyers. Even though insufficient customers ranked the least, nonetheless, the mean score 2.05 showed that it was a severe constraint.

CONCLUSION

Despite the fact that certain constraints are 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 more people especially the youths to become actors in the value chain. Also, the introduction of a standard unit of measurement for plantain should be looked into to improve marketing of the produce.

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