PROFITABILITY AND RESOURCE-USE EFFICIENCY IN PINEAPPLE PRODUCTION IN DELTA STATE, NIGERIA

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ABSTRACT
The study was on Profitability and Resource Use Efficiency in Delta State, Nigeria. Two hundred and ten pineapple farmers were selected using a two-stage sampling procedure with well-structured questionnaire used for collecting data. The gathered data were analysed using descriptive statistics, gross margin analysis and multiple linear regression. Majority of the farmers were males (77.62%) and were found to be in their active age group (33.81) and they were fairly educated with 84.76%. The Net Farm Income was found to be ₦717,207.12, Gross Margin ₦657,772.12 and profitability index was 3.27 . The estimated regression variables showed that farm size and cost of labour were significant at 5% level of probability respectively. While, cost of planting materials was significant at 1% level of probability and cost of fertilizer was significant at 10% probability level. The resources were over utilised ($P<0.01$). The production of pineapple is profitable and resource-use efficient in the study area. Some of the constraints that farmers complained about were poor road network, lack of credit facilities, disease, high cost of land, high transportation and lack of extension services.
KEYWORDS: Pineapple, Production, Market, Gross Margin, Resource-Use Efficiency

INTRODUCTION
The third most important tropical fruit in the world after banana (*Musa spp*) and *Citrus spp* is pineapple (Esiobu *et al,* 2014a). The countries that produce it mostly are Brazil, India, China, Nigeria, Mexico and Colombia, the fruit is produced primarily for fresh fruit markets and for processing industry. Pineapple is an important fruit crop in Nigeria and is grown throughout the country, making Nigeria the leading producer in Africa as well as the 6th on the list for world pineapple production with nearly 800,000 tonnes produced annually (CADP Manual, 2012).
Fruits have been significantly singled out in human nutrition for the supply of minerals, vitamins, some hormone precursors in addition to protein and energy, Taylor (1999). Despite the importance of fruits in human diet, per capita consumption of fruits is only 100g as compared with 400g of daily consumption per head as recommended by World Health Organisation (WHO) (FAO, 2013). Fruits such as Citrus species, pawpaw, pineapple, coconut, guava, plantain and bananas are produced in large quantities in Nigeria and the figures given as estimated annual production varies.
Until recently, about 80% of pineapple produced in Nigeria came from small scale farms mostly managed under mixed cropping system. Access to international markets, enhanced value of fresh fruits, resuscitation of pineapple cultivation and local processing have recently encouraged the development of few large scale farms where pineapple is produced as a mono crop Adesope (2009). Despite the position of Nigeria in Pineapple production in the world, Nigeria still has a small share of 5% in the worldwide pineapple production (FAOSTAT 2010 and Mark 2010).
Since pineapple production is a fast growing agricultural business in Nigeria, the profitable production of the crop is essential. Thus, the need for this study can be seen as a desire to increase the level of productivity in pineapple production and also to identify the problems associated with its production in the study area particularly and Nigeria in general. As a result of this, this study estimated profitability and the resource-use efficiency in pineapple production in Delta State. It is expected that the findings will help to provide information and proffer solution to the decreasing productivity and yield of pineapples per hectare, leading to an improvement in pineapple production.

METHODOLOGY

The study was conducted in Delta State, Nigeria. The land area of Delta State is estimated at 18,050km^2 and it lies between latitudes 5^{0}00' and 6^{0}30' North and longitudes 5^{000} and 6^{0}45' North-East. Delta State is bounded in the North by Edo State, in the East by Anambra State, in the South-East by Bayelsa State and on the Southern flank is the Bight of Benin which covers approximately 160kilometers in the State's coastline. The average rainfall ranges from about 267cm in the coastal areas to 191cm in the northern part of Delta State (MANR, 2015). The State has an estimated population of about 4,112,445 (NPC, 2006). The temperature is high, ranging between 28°C and 34°C with an average temperature of 30°C (81°F). The State has a tropical climate marked by distinctive seasons, the dry and rainy seasons. It is made up of three Agro-ecological zones namely; Delta North, Delta Central and Delta South (Delta State Official website).

A simple purposive sampling and availability sampling was used to capture pineapple farmers in the study area. These purposive sampling was used for the L.G.As., because they are known to produce pineapple and the availability sampling, was used to select the villages because the farmers were concentrated there from the two Agricultural zones in Delta State (Delta North and Delta Central).

Table 1: Showing L.G.As., Villages and Number of Respondents in Study Area.

S/No.	L.G.A.	Villages	Number Of Respondents
1	Okpe	Jeddo	35
2	Ika South	Emuhu	35
3	Ika North East	Ute-Ogbeji	35
4	Ndokwa East	Obetim-Uno	35
5	Aniocha South	Ogwashi-Uku	35
	Total	**6**	**210**

Source: Field Survey, 2015

The model specifications

Data collected were analysed with descriptive statistics, gross margin analysis (Net Farm Income Analysis) and Resource-Use Efficiency using a multiple linear regression.

$Y = f(P_1,P_2,P_3,P_4,P_5,\mu)$

Where:

Y = Quantity of pineapple produced (Kg)
P_1 = Farm size (Ha)
P_2 = Cost of planting materials (₦)
P_3 = Cost of labour (₦)
P_4 = Cost of fertilizer (₦)
P_5 = Cost of Equipment (₦)
μ = Error term

Gross Margin Analysis

This is taken as the difference between the total value of production and the total variable cost of production.

$GM_P = TRp - TVCp$
Profitability = TR – TC
Where:
GMp = Gross Margin of pineapple
TRp = Total Revenue of pineapple
TVCp = Total Variable Cost of pineapple and
TCp = Total Cost of pineapple

Resource-use Efficiency

The Resource-Use (RE) of the farmers of pineapple in the study area was determined using the Resource-Use efficiency Index by Oladeebo and Ezekiel (2006), which showed that:

Resource-Use (RE) = Marginal Value Product (MVP)
Marginal Factor Cost (MFC)

Where:

MVP = change in output per unit change in input ($MPP_x.P_y$). The estimated coefficients in the linear form are the estimated inputs for elasticities.

MFC = market price of input

If: RE = 1 indicates optimal utilization of resources

RE > 1 indicates underutilization of resources

RE < 1 indicates over utilisation.

RESULTS AND DISCUSSIONS

Socio-economic Characteristics of Pineapple Farmers

From **Table 2**, it can be seen that majority (33.81%) of the farmers were between the age of 21 to 40 years of age, while 24.76% fell between the age of 41 to 50 years and the remaining 24.29% were between the age 51 to 60 years of age and above 60 years 17.14%. This study revealed that the youths were involved in pineapple farming and this can help them to adapt to technological changes to improve on their output/ income in the study area. The number of males in pineapple production was 77.62% and females 22.38%. This indicates that more males are involved in pineapple production in the study area. This could be due to the fact that pineapple

Table 2: Socio-economic Characteristics of Farmers

Age (Years)	Frequency	Percentage (%)
21 – 30	29	13.81
31 – 40	42	20.00
41 – 50	52	24.76
51 – 60	51	24.29
Above 60	36	17.14
	210	100.00
Gender		
Male	163	77.62
Female	47	22.38
	210	100.00
Marital Status		
Single	30	14.29
Married	122	58.00
Divorced	36	17.14
Widowed	22	10.48
	210	100.00
Educational Level		
No formal Education	32	15.24
Primary	87	41.43
Secondary	49	23.33
Tertiary	42	20.00
	210	100.00
Household size		
1 – 5	110	52.38
6 -10	91	43.33
11 – 15	9	4.29
	210	100
Farming Experience		
1 -10	159	75.71
11 -20	43	20.48
21 – 30	8	3.81
	210	100.00

Source: Field Survey, 2015

farming is perceived to be a very tedious activity that needs to be carried out by men. The percentage of married (58.09%) was high as compared to the single respondents and divorced found to be 41.9% and the implication of this is that marriage makes a man have more sense of responsibility and thus, taking the pineapple enterprise as a serious one to enable them takes care of their families. The educational level of the farmers in the study area revealed that 41.43% had primary education, 43.33 had certificates from secondary and tertiary schools and only 15.24% had no formal learning. This shows that the literacy level of the respondents was high and this will help them to understand and accept new farming techniques that will help them to increase their output/income.

The result for household size indicates that 52.38% of the respondents had an household size of between 1 to 5; 43.33% had 6 to 10 persons in their houses and 4.29% had 4.29%. This result showed that they had a large family size and thus, helped to reduce their spending on labour. Farming experience is expected to improve the output/income of the farmers. The result in **Table 2** showed that 75-71% of the farmers had 1 to 10 years' experience and 24.29% had 11 to 30 years' experience in farming of pineapple. This shows that majority of the farmers had many years of experience and thus are expected to be more efficient and have better understanding of the problems involved in pineapple farming and how to approach the issues and still be efficient in production of pineapple.

Table 3 shows the ranking of the major constraints to effective pineapple production in Delta State, Nigeria. The most prevalent constraints are lack of credit facility, poor road network, lack of extension services, high cost of transportation and high cost of land. This conformed with the findings of Akilomen *et al.,* (2015) who observed that lack of credit facilities, poor road network, and high cost of transportation were some of the constraints to pineapple production in Edo State, Nigeria. In addition Esiobu and Onubuogu 2014 observed lack of extension services to disseminate relevant information to the farmers as a major constraint to pineapple farmers.

Table 3: Constraints associated with pineapple production in the study area

Constraints	Frequency (n=210)	Percentage (%)	Ranking
Lack of credit facilities	75	35.71	1
Poor road network	60	28.57	2
Lack of extension services	32	15.23	3
High cost of transportation	30	14.29	4
High cost of land	13	6.20	5

Source: Field Survey, 2015

In the study are, lack of credit facility (35.71) was identified as the major constraint in pineapple production. Access to agricultural credit has been positively linked to agricultural productivity in several studies according to Nwaru *et al* (2004). Yet this credit facility opportunity has eluded small-holder farmers in Nigeria. The farmers find it difficult to acquire loans due to the issues of collateral and high interest rates. Poor road network ranked as the next most severe constraints; this limits the access to purchased inputs, credit and output markets and thereby reducing the transmission of market signals.

About 15.23% of the farmers complained of not having access to extension services. This is in consonance with the findings of Esiobu and Onubuogu 2014 that there is inadequate information to farmers from extension agents in Edo State, Nigeria. The implication of this is that the farmer will be aware of modern technique for pineapple production as well as market situation for pineapple production in the study area. From **Table 3** 6.20% identified the high cost of land as a constraint to pineapple production in Delta State. This would affect the farmers' ability to increase the size of his farm and carry out several methods of practice in pineapple production.

Cost, Returns and Profitability Analysis of Pineapple Production in Delta State

Table 4 indicates that 46.26% of the total variable cost was recorded for the acquisition of suckers. Land preparation which is a pre-planting operation recorded 11.12%; fertilizer and transportation recorded 16.31% and 3.34% respectively. Planting operation, weeding operation and harvesting operation has 11.12%, 7.41% and 4.44% respectively. The total amount incurred as variable cost ₦134, 900.00 was higher than the fixed cost for the pineapple enterprise. The Table II also shows the Total Revenue (TR) of ₦911, 537.20, Gross Margin (GM) of ₦657, 772.12 and Net Farm Income (NFI) of ₦717, 207.12. The Profitability Index (PI) was found to be 3.27. This findings suggest that pineapple production in Delta State is a profitable Agribusiness and would yield more output and increase the farmers income when investment is carried out in large scale. This implied that pineapple production is efficient, effective and thus, investment be increased upon and managed properly and farmers encouraged investing in the venture.

Table 4: Estimated costs, Return and Profitability Analysis of Pineapple Production in Delta State (₦)

Value of Output (₦)	Average Cost (₦)	Number Used	Total Cost (₦)	Percentage
A. Total Revenue	911,537.20			
B. Variable Cost				
Land preparation	3000.00	5 man hour	15,000/00	11.12
Number of suckers	120.00	5200 suckers	62,400.00	46.26
Fertilizer	5500.00	4 bags	22,222.00	16.31
Transportation	1500.00	3.0km	4500.00	3.34
Planting operation	3000.00	5 man hour	15,000.00	11.12
Weeding operation	2000.00	5 man hour	10,000.00	7.41
Harvesting operation	1200.00	5 man hour	6,000.00	4.44
			134,900.00	100.00
C. Fixed Costs				
Equipment depreciation			59,430.00	
Total Fixed Costs			59,430.00	
Net Farm Income (NFI) [A – (B – C)]	717,207.12			
D. Gross Margin (GM)	657.772.12			
Profitability Index	3.27			

Source: Field Survey, 2015.

Determinants of Pineapple Farmers Output/Income

Table 5 shows a multiple regression analysis result of estimation of pineapple output. Three functional forms was tested (linear, semi-log and double-log), based on the statistical significance of the coefficients, goodness of fit and the economic model that supports production concept, the linear function was chosen as the lead equation. This was so because its R^2 value was 0.919, F-Ratio (41.017) and has four significant variables. The R^2 shows that the joint variation in pineapple farmers' output was explained by the explanatory variables; while approximately 8.1% was not accounted for due to error term (μ).

Table 5: Estimation of Pineapple Output in Delta State

Explanatory variables	Linear	Semi-log	Double-log
Constant	-9.78130.9	387366	- 0.6929
	-(2.8655)**	(8.8527)***	-(17.9748)
Farm size P_1	479194.90	-141920	0.007
	(8.0831)**	-(1.6071)	(0.9501)
Cost of planting materials P_2	-1.7766	-114281.1	-0.0011
	-(1.2217)***	-(0.7246)	-0.8449
Cost of labour P_3	1.8121	-323331.2	0.0003
	(1.1276)**	-(2.8903)**	(0.3861)
Cost of fertilizer P_4	-15.7799	-179415.1	0.009
	-(3.0021)*	-(1.9503)*	(1.2129)
Cost of equipment P_5	-1.9272	12545470	3.3451
	-(0.6699)	-(0.8107)	(16.4972)**
R^2	0.919	0.836	0.632
Adjusted R^2	0.893	0.7560	0.5250
F – Ratio	41.017	38.128	33.110

Source: Field Survey, 2015: Values in Parenthesis are t-ratios. *Significant at 10%; **Significant at 5% and ***Significant at 1%

Farm size **(P_1):** The farm size was found to be positive in relation to output of pineapple farmers in the study area. This in accordance with the findings of Adeyemo (2009), who reported that large farm size increases productivity, their technical, allocative and resource-use efficiency. This relationship was significant at 5% level of probability.

Cost of planting materials **(P_2):** The coefficient of cost of planting material was found to be negative and at 1% level of probability. This implied that the farmers spent more on purchasing planting materials and this will in turn affect their income negatively.

Cost of labour **(P_3):** this was positively significant to output of pineapple farmers in Delta State. This could be due to the fact that majority of the farmers made use of family labour and hired few hands to work in their farms. The relationship was significant at 5% level of probability.

Cost of fertilizer **(P_4):** the cost of fertilizer had a negative coefficient and was significant at 10% level of probability, implying that as cost increases, the farmers will purchase below the recommended quantities for their farms. This reduces output of pineapple farmers in the study area.

Resource-use Efficiency

Table 6 shows the resource-use efficiency of farmers in the study area, P_1 (farm size = 1.2) was under utilised as the efficiency index was greater than 1. Cost of planting materials, cost of labour, cost of fertilizer and cost of equipment were over-utilized as their indices were lesser than 1. For an optimum level to be achieved by the farmers, the quantities of over utilised resources should be reduced, to the point when marginal value product equals the marginal factor cost of the resources, so that profit can be maximized.

Table 6: Resource-Use Efficiency

Resources	MPP	MVP	MFC	Efficiency	Decision
Farm Size (P_7)	47914.90	11979.88	₦10,000.00 per Ha	1.2	Under utilisation
Cost of planting materials (P_8)	-1,7766	-0.004	₦120.00 per sucker	-0.004	Over utilisation
Cost of labour (P_9)	1.8121	0.054	₦3000.00md	0.000	Over utilisation
Cost of fertilizer (P_{10})	-15.7799	-0.394	₦5500.00 per 25kg	-0.000	Over utilisation
Cost of equipment (P_{11})	-1.9272	-0.12	₦1981.95 per year	-0.000	Over utilisation

Source: Field Survey, 2015

CONCLUSION

The Gross Margin (GM) was found to be ₦657,772.12, Net Farm Income ₦717,207.12, with a Profitability Index (PI) found to be 3.27 (Viable) and Resource-Use Efficiency (RE) <1(over utilised). The variables from the regression results showed that cost of planting materials and cost of fertilizer were negatively significant and farm size, cost of labour and cost of fertilizer were all positively significant. The F-Ratio was 41.017, showing the overall significance of the regression. Farmers complained of lack of credit facility, poor road network, lack of extension services, high cost of transportation and high cost of acquiring land.

RECOMMENDATIONS

Based on the research findings, the following recommendations were made

1. The farmers are encouraged to form cooperative societies to enable them obtain credits from the government and other financial institutions such as Bank of Agriculture.
2. There is need for the government to construct and maintain access roads leading the rural communities for the ease of transporting Agricultural produce to urban areas.
3. There is need for more training and recruiting of extension agents by the government and to adequately equip them to carry out their functions to the farmers thereby increasing their output with minimum inputs.
4. Government should subsidize agricultural inputs required in pineapple production in the study area, and help to commercialize pineapple production to meet up with the increasing population in Nigeria.

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