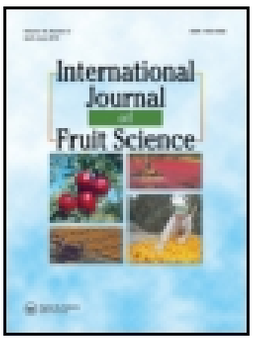

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Profitability and Technical Efficiency of Pineapple Production in Ogun State, Nigeria

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ABSTRACT

Nigeria pineapple production remains low when compared to other producing nations. The production output of the crop has been attributed to inefficient use of available inputs. This study focused on profitability and technical efficiency of pineapple production. Two Agricultural Development Project zones with three blocks each were randomly selected from the study area. The blocks consist of six cell-units each from which 101 pineapple farmers were selected. Data from interviews were analysed using descriptive statistics, cost and return and stochastic frontier production function. The result showed that the pineapple production business is profitable and returning more to the farmer than the original investment in terms of purchased inputs. The study showed that farms were operating inefficiently with efficiency score of 0.603. The study recommends policy that makes production inputs available to pineapple farmers in proportion they can afford.

KEYWORDS

Stochastic frontier; managerial skills; ADP zones; efficiency score; investment

Introduction

Pineapple (*Ananas comosus*) belongs to the family *Bromeliaceae*. Pineapple is the third most important tropical fruit in the world after banana and citrus (Esiobu et al., 2014). It is one of the most important commercial fruit crops in the world available throughout the year. Thailand is the largest producer of pineapple, accounting for 13% of global output. In Nigeria, pineapple production is a major source of income for some farmers. Nigeria pineapple production remains low when compared to other producing nations with productivity of 7.9 tons/ha (Adegbite and Adeoye, 2015). It accounted for 1.4 million metric tonne in 2011 (about 7% of the world production), which placed it in the seventh position (Food and Agriculture Organization, 2013). Pineapple production in Nigeria is primarily for fresh fruit markets and processing industry. It is a delicious fibre fruit with nice flavour and high nutritive value. Its contents make it a good raw material in confectionary industries for making

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sweet, fruit drinks and household food additives. The fruit also has medicinal value and a fragment consumption of pineapple juice immunes one against the malaria parasite (Amao et al., 2011). Majority of the pineapple produced came from small managed farms under mixed cropping systems (Kochhar, 2006).

Irrespective of the effort of various past governments on agriculture programmes, commercial value of pineapple production remains low in Nigeria when compared to other nations of the world in terms of land use for cultivation (Esiobu et al., 2014). For instance, more emphasis has been placed on enhancing the production of major crops by ignoring most of the horticultural crops, pineapple inclusive. Furthermore, research development and investment effort have also been focused primarily on production of other staple foods and vegetables while paying little attention on pineapple production, in spite of its nutritive advantage in vitamins and minerals (Omotoso and Akinrinde, 2013).

It is clear that the nation is not fully exploring her potential in pineapple production; hence, the inability to fully tap into the economic potentials of the crop might be a reflection of its inefficient nature in production which otherwise would have served as an important tool in achieving some of the objectives of the Nigerian Agricultural Government Transformation Agenda. Recently, the Federal Government of Nigeria, through the Federal Ministry of Agriculture and Rural Development (FMARD), Food Agricultural Organisation (FAO) and six states in the south-west geo-political zone initiated a youth's empowerment programme to sustainably bridge the gap between pineapple supplies and demand as well as created a massive job opportunity and increased income generation (Dabiri, 2015). Measuring efficiency is an important issue in the use of scarce resources in production. This is because it is a first step in a process that might lead to substantial resource savings. Studies (Conley and Udry, 2000; Saili et al., 2005; Keerthi, 2008) have investigated production inefficiency and profitability of farmers in developing countries (Nigeria inclusive) using different econometric tools. However, Keerthi (2008) studied the production and marketing of pineapple in the Shimoga District of India. The result of the stochastic frontier analysis of pineapple production showed that fertilizer and planting material were positive and significantly impacted on pineapple output. In another study, Saili et al. (2005) conducted a research into the factors affecting the performance of pineapple smallholders in Kampung Meranek. The result showed that the average income of pineapple farmers was increased per hectare per annum. This study employed stochastic frontier production function to estimate the technical efficiency of pineapple farmers in the study area.

Materials and methods

The study was conducted in Ogun State, Nigeria. The state has 20 local government areas, and the economic activities of most of the people in the state are

farming. This region is known to have concentration of pineapple farms that produce fresh fruits for the metropolitan city like Lagos. Multistage sampling technique was used to select pineapple farmers for this study. The first stage involved random selection of two Agricultural Development Project (ADP) zones out of four existing ADP zones in the state. In the second stage, three blocks were randomly selected out of six from each of these ADPs (Abeokuta and Ijebu Ode), respectively. The next stage was a purposive selection of four cell-units in each of the selected six blocks where there was prevalence of pineapple farmers. The last stage involved random selection of five pineapple farmers from each of the cell-units, making a total of 120 selected pineapple farmers. The selection of five farmers per cell across board was based on the fact that little difference exists between populations of farmers in each of the cell. Data on socio-economic characteristics, pineapple production activities (such as input and output costs) and other farm specific variables were collected from the farmers. Data were analysed using descriptive statistics, cost and return and stochastic frontier model. Descriptive statistics included frequencies, means and percentages for socio-economic characteristic of pineapple farmers and their production activities. Cost and return was used to estimate the profitability of the pineapple farmers in the study area, while stochastic frontier production function developed by Aigner et al (1977) as adopted by Tadesse and Krishnamoorthy (1977) and Taylor and Shinkwiler (1986) was used to estimate technical efficiency of pineapple farmers.

The stochastic frontier model developed by Aigner et al (1977) as adopted by Tadesse and Krishnamoorthy (1997) and Taylor and Shinkwiler (1986). In the analysis of farmer's efficiency/inefficiency, it is not the average of the observed relationship between the farmers' inputs and output that is of interest but the maximum possible output that is obtained from a given combination of inputs. The statement implies that not all producers are able to utilize the minimum quantity of required inputs in order to produce the desired quantity of output given the available technology. From a theoretical point of view, producers do not always optimize their production functions. Producers operating on the production frontier are considered technically efficient, while those who operate under the frontier production curve are denoted technically inefficient.

Results and discussion

The pineapple farmer's socio-economic characteristics are summarized in Table 1. Most arable food farmers were young and active (Salau, 2013). Majority of the pineapple farmers were males and below 50 years of age. This implies that the production of pineapple is dominated by farmers who were still active in age. The implication is that these farmers are more likely to adopt new innovative measures in pineapple production faster than the

Table 1. Socio-economic characteristics of the pineapple farmers.

Variables	Frequency	Percentage (%)	
Sex			
Female	23	22.8	
Male	78	77.2	
Total	101	100.0	
Age (years)			
21–30	8	7.9	
31–40	32	31.7	
41–50	27	26.8	
51–60	29	28.8	
Greater than 60	5	4.8	Mean = 44.2, SD = 5.8
Total	101	100.0	
Farming experience (years)			
1–10	22	21.8	
11–20	58	57.4	
21–30	16	15.9	
31–40	5	4.9	
Total	101	100.0	
Household size			
1–5	28	27.6	Mean = 7.0, SD = 2.2
6–10	69	68.4	
Greater than 10	4	4.0	
	101		
Family type			
Polygamous	62	61.4	
Monogamous	39	38.6	
Total	101		
Membership of association			
Yes	6	5.9	
No	95	94.1	
	101	100.0	
Educational status			
No formal	26	25.7	
Primary	33	32.8	
Secondary	32	31.6	
Tertiary	10	9.9	
Total	101	100.0	
Marital status			
Married	88	87.1	
Otherwise	13	22.9	
Total	101	100.0	
Contact with extension agent			
Yes	37	36.6	
No	64	63.4	
Total	101	100.0	
Improved sucker variety			
Local variety	83	82.2	
Improved variety	18	17.8	
Total	101	100.0	

Source: Field Survey, 2015.

older ones. The result showed that more than half of the pineapple farmers had farming experience which ranges from 10 to 20 years with average of 16.7 years. This indicates that most of the farmers have been in pineapple production business for long and have gathered enough experience to enable

them manage their farms well. Most of the pineapple farmers had a household size of 6–10 members, and family type was polygamous in nature. Large household size is a pointer to a potential of readily available labour for farm work; and availability reduces labour constraints faced during the peak of the farming season. This result agrees with Onaiwu (2011) that large household size reduces the cost of labour in the rural farming households. Furthermore, majority of the pineapple farmers were not members of farmer's association. The implication is that it will be very difficult for them to benefit from gains of social network which it presents. Educationally, farmers were knowledgeably endowed and this enables them to farm intelligently, accurately and efficiently, leading to increased yield, productivity and farm income. It also increases the ability and rate of information dissemination among farmers and significantly impact on productivities, income earning opportunities and ability to effectively adopt better management practices. The result showed that three-quarters of the pineapple farmers were literate to tertiary level. The result supports Ajibefun (2002) that young and educated people are more receptive to agricultural innovation than the old and illiterate farmers. Less than one-quarter of the pineapple farmers were married. The reason might be that there is a high tendency for farmers that are married to be more involved in sustainable and efficient farm production than their single counterparts. Most of the farmers did not have contact with extension agent and those that had contact with extension agent were less than half of the sampled farmers, meaning lower government involvement in pineapple production. Local pineapple varieties were more prominent among pineapple farmers than improved varieties. This shows that the farmers in the study are were conservatives, and the impact of research is yet to reach them.

Table 2 shows the cost and return to pineapple production on 1 hectare farm land. The result showed that labour contributed the largest percentage (23.2%) of the total cost of pineapple production, while cost of transportation and sucker accounted for 21.4% and 20.0%, respectively. However, the land rent and cost of farm implements used in pineapple farm represented about 5.6% and 18.7% of the total cost. The returns to variable costs from pineapple production were 3.32, indicating that for every dollar invested in production, about 3.3 was returned. Gross and operating ratios were 0.21 and 0.25, respectively, meaning that pineapple farming is a profitable business.

Table 3 shows the distribution of the efficiency scores of pineapple farmers. The result shows that majority of the farmers had efficiency score of 60.3%. The result indicated that there is efficiency gap in pineapple production and with present scope improvement is possible.

Table 4 shows the result of the maximum likelihood estimate of stochastic frontier production function. The sigma square (σ^2) value of 0.0061 which was positive and also significant at $P < 0.01$ level indicated a good fit and the correctness

Table 2. Cost and return to pineapple production on 1 hectare of farm land.

Item	Quantity	Price/unit	Value (Naira)	Percentage (%)
Variable cost (VC)				
Labour	36 man-days	N800.0	29247.0	23.2
Pineapple suckers	1011	N25.0	25257.0	20.0
Fertilizer	2 bags (50 kg)	N5500.0	11000.0	8.7
Herbicide	2 bottles (15.0 l)	N1650.0	3300.0	2.6
Transportation			27061.0	21.4
Total (VC)			95 865.0	
Total fixed cost (TFC)				
Land rent		N7041.0	7041.0	5.6
Farm implements		N23307.0	23307.0	18.7
Fixed cost (FC)			30 348.0	
Total cost (TC)			126213.0	100.0
Total revenue (4816 kg output at N 86/kg)			414 176.0	
Gross margin (GM) Naira			TR-TVC = 318311.0	

Source: Field Survey, 2015.

Table 3. Distribution of technical efficiency scores among pineapple farmers.

Technical efficiency range	Frequency	Percentage (%)
0.31–0.40	2	2.0
0.41–0.80	48	47.5
0.81–1.00	51	50.5
Total	101	100.0
Mean efficiency = 0.603		
Maximum = 0.994		
Minimum = 0.100		

Source: Field Survey Data, 2015.

Table 4. Maximum likelihood estimates of stochastic frontier model for pineapple farmers.

Variable	Parameter	Coefficient	T-ratio
Intercept	β_0	1.3225***	6.0355
Farm size (ha)	β_1	0.0170	0.2682
Hired labour (man-day)	β_2	0.0605*	1.6961
Fertilizer used in (kg)	β_3	0.1119**	2.0816
Suckers planted in (kg)	β_4	0.1607***	4.7757
Quantity of herbicide used in (l)	β_5	0.1780***	4.4854
Sigma squared	σ^2	0.0061***	6.5679
Gamma	γ	0.0001	0.0159
Log likelihood function		114.3369	
LR-statistic		38.5002	

Source: Field Survey, 2015.
Notes: ***Significant at $P < 0.01$, ** significant at $P < 0.05$, * significant at $P < 0.10$.

of independent variables specified. The gamma (γ) which measures the effect of technical inefficiency on the observed output gave a value of 0.1×10^{-5}. This implies that 0.0001% of the variation in the output of pineapple was attributed to technical inefficiency. All the estimated parameters are less than one, indicating that input allocation is in stage 2 of the production function. The result shows that labour, quantity of fertilizer used, quantity of herbicide used and quantities of

sucker used significantly determined technical efficiency of pineapple farmers. This suggests that the more the use of these inputs by farmers, the more the output of pineapple produced. The significance of these parameters could be attributed to their importance in crop production in the sense that a shortage would have direct negative effect on production and cause inefficiency. Labour with positive coefficient indicates that the available labour is efficiently managed along with other inputs to avoid redundancy and diminishing return to labour. The quantity of fertilizer applied was directly related to the output of pineapple. The reason is that agronomic evidence has shown that pineapple yields are responsive to fertilizer application (Spironello et al., 2004). The coefficient of suckers was estimated to be positive and significantly related to output. This could probably be attributed to improper spacing of pineapple suckers during planting (as a management practice for free movement and easy weeding). Quantity of herbicide used was significant and increased the pineapple output.

The result of technical inefficiency of pineapple farmers indicated that years of farming experience, extension contact and household size significantly explained inefficiency in pineapple production (Table 5). The years of farming experience of the farmers has negative coefficient and is statistically significant. This means that farmers new in pineapple production business are less efficient compared to their counterparts with more years of experience. The contact with extension agents showed that farmers that had contact with extension agents tend to be less inefficient than their counterpart with no contact. Extension contact is a channel to transmit appropriate knowledge and technology to farmers. The implication is that a farmer with more contact with extension agents is better positioned to appreciate new agricultural techniques and carry out effectively than those with less.

The result agrees with Haq (2013) that agricultural extension services can provide farmers opportunities of productive works. In the case of household size, the coefficient is positive and statistically significant. This implies that household size contributed to technical inefficiency of pineapple production because of the young generation's perception of farming activities as poor men job and their unwillingness to take it as a means of

Table 5. Determinants of technical inefficiency.

Variable	Parameter	Coefficient	T-ratio
Intercept	δ_0	−0.4029***	−3.0292
Age of farmer (year)	δ_1	0.0020	1.4316
Years of education (year)	δ_2	0.0016	0.8278
Farming experience (year)	δ_3	−0.0336**	−2.2712
Contact with extension agents	δ_4	−0.0444**	−2.4053
Association membership	δ_5	_0.0167	−0.7725
Access to credit	δ_6	−0.0015	−0.5833
Household size	δ_7	0.03624***	2.8312

Source: Field Survey, 2015.

Notes: ***Significant at $P < 0.01$, **significant at $P < 0.05$, *significant at $P < 0.10$.

livelihood. This is consistent with the findings of Parikh et al. (1995) and Dolisca and Jolly (2008) that family size has a positive and significant relationship with technical efficiency.

Conclusion and recommendations

Pineapple is one the few fruits with abundant vitamins and high productivity in Nigeria. Efficiency in its production is critical to food security, poverty alleviation and improved vitamin-related deficiency among the populace (especially children) in the country. This study examined profitability and technical efficiency in pineapple production in Ogun State, Nigeria. The gross margin and profitability ratio (return to variable cost, gross ratio and operating ratio) indicated that pineapple production is a profitable business. It is thus recommended that awareness of business opportunities in production of pineapple should be highlighted by government.

The study revealed that pineapple farmers had an average efficiency score of 0.603, an indication that all pineapple farms in the study area were operating inefficiently. The low efficiency scores observed in the study is a reflection of inefficiency that characterizes small-scale agriculture. Result also showed that extension contact is a significant variable for pineapple farmers' efficiency. Therefore, if optimum production is to be achieved in pineapple enterprise, the scope and coverage of extension services must be increased. Also, the technical skills of the extension agents should be improved upon through regular training to enable them carry out their responsibilities more efficiently. The study has shown that farm inputs such as hired labour, quantity of fertilizer used, quantity of herbicide used and quantity of suckers are important determinants of pineapple's output in the study area. The study recommends that production inputs must be made available to pineapple farmers at the right time, in right quantity and in affordable prices.

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