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ECONOMIC ANALYSIS OF FLUTED PUMPKIN PRODUCTION IN KOLOKUMA/OPOKUMA LOCAL GOVERNMENT AREA OF BAYELSA STATE, NIGERIA

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ABSTRACT: *The study examines the economic analysis of fluted pumpkin production in Kolokuma/Opokuma Local Government Area of Bayelsa State, Nigeria. A structured questionnaire was used to obtain the required information from the fluted pumpkin farmers. Both descriptive and inferential statistics such as frequency, percentages, mean, stochastic frontier production and budgetary model were used***.** *The results indicate that married female farmers made up the majority of the 38.5% of farmers, with individuals between the ages of 31 and 40 on average. The variables that increased the fluted pumpkin technical efficiency were age, education level, and agricultural experience, according to the stochastic model. Age, farm experience, and transportation all had a significant impact on the production of fluted pumpkins at different probability levels. The total cost incurred was ₦703,453.07. The returns from the study amounted to ₦1,146,295.37, thereby, making the Net farm Income ₦442,841.64. The rate of return on investment (ROI) was 0.65. The return on investment of 0.65 indicates that every ₦ 1.00 naira invested returns ₦ 0.65 to the enterprise. This is an indication of a high return. The study identified that inadequate credit facilities, high rate of flooding, insufficient storage facilities, lack of labour/high cost of labour and little or no capital to start were the major problems of fluted pumpkin farmers. It was therefore recommended that the government provide farmers the mean of accessing reasonable price for farm input at the appropriate time.*

KEYWORDS: Technical efficiency, profitability, fluted pumpkin production, Kolokuma/Opokuma, Translog stochastic Production Model.

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INTRODUCTION

West Africans plant the tropical vine known as "fluted pumpkin" (Telfairia occidentalis) for its edible seeds and as a leaf vegetable. Southern Nigeria is home to the native fluted pumpkin, which belongs to the Cucurbitaceae family (Akoroda, 1990). Enabulele and Uavbarhe (2001) describe it as a leafy vegetable that bears fruit. The plant is widely recognized by common names such as fluted gourd, fluted pumpkin, ugu (Igbo language), and ogu (Ijaw). Fluted pumpkin production is still a major component of Nigerian agriculture and is consumed as a condiment there (Ibekwe and Adesope, 2010). One of Nigeria's most popular leafy vegetables is fluted pumpkin. Although production of fluted pumpkin is decreasing in many locations due to rising input costs and low yield, the fruit has enormous potential and is in high demand (IITA, 1984). Due to its nutritional value and widespread acceptance in Nigeria, fluted pumpkin holds a significant position in the diet of the populace amidst the various meals produced and consumed.

The crop is mostly produced by small-scale farmers who make their living from it with little agricultural inputs. It is primarily farmed and consumed in rural, urban, and peri-urban areas of Nigeria (Mercy, 2017). Farmers that cultivate fluted pumpkins have the potential to significantly impact the nation's food supply in areas with a thriving and growing market gardening sector. It turns into a defense against the reduction of health standards required for efficient production in a growing economy (Tyndal, 1998).

Up to 90% of Nigeria's agricultural output is produced by small-scale farmers, they believed to own 90% of the country's cultivated land (Onokerhoraye, 1995). The attempt of producing enough fluted pumpkin is becoming more and more difficult as a result of Nigeria's growing demand for vegetables. The output of fluted pumpkin has not been able to meet the increasing demand for human consumption, let alone cattle feed. It is necessary to establish an economically feasible technology that will help small-scale farmers' sustained fluted pumpkin production. Traditional agriculture is the main industry in the majority of the rural areas where this study is centered. Many farmers view farming as a way of life rather than a business, and many of them are unaware of modern management practices. They don't keep proper farm records and conduct much of their job with family labor. Among the difficulties the farmers experienced were attacks by pests and diseases, high expenses associated with agrochemicals, an unsatisfactory market structure, limited storage facilities, a lack of finance, high labor costs, and complications related to land title. The specific objectives of the study therefore are; ascertain profitability of fluted pumpkin farmers, determine technical efficiency, determine factors that influence technical efficiency and determine the constraints associated with fluted.

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METHODOLOGY

The Kolokuma/Opokuma Local Government Area in Bayelsa State, Nigeria, served as the study's area. A multi-stage sampling strategy was employed to gather data from one hundred and twenty fluted pumpkin farmers. In the first step, eight (8) villages were purposefully chosen since they were among the largest producers of fluted pumpkins. Secondly, a random selection of fifteen (15) fluted pumpkin farmers was made in each community. Primary data were collected using a well-structured questionnaire, which was administered to the respondents. A total number of 108 were retrieved for the analysis. The data for this study was analyzed using both descriptive and inferential statistics. The models are specified as follows; the budgeting technique employed was the net farm income. The difference between the gross revenue (GR) and total cost (TC) gives the net revenue (NR), Net farm income (NFI), Net returns on investment (NROI) is expressed as:

NFI = GR – TC

NROI = NFI / TC

Where:

NFI = Net Farm Income

NROI = Net returns on investment

TC = (TVC + TFC) = Px. X

GR = Py. Y

GR = Gross Return

Py= Unit Price of Output

Y = Quantity of Output

Px= Unit Price of Input

X = Quality of Input

TC = Total Cost (N)

TFC = Total Fixed Cost (N)

TVC = Total Variable Cost (N)

The Translog Stochastic Frontier Production Model (SFPM).

The explicit Cobb Douglas functional form for fluted pumpkin farmers in the study area is specified as;

$$\text{In } Yi = \beta0 + \beta_1 \text{In}X_1 + \beta_2 \text{In}X_2 + \beta_3 \text{In}X_3 + \beta_4 \text{In}X_4 + \beta_5 \text{In}X_5 \, (Vi + Ui) \quad \ldots\ldots\ldots\ldots (1)$$

Where,

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Yi: Output of fluted pumpkin in (tonnes/ha)

X_1 = Cost of transportation (₦)

X_2 = Cost of harvesting (kg)

X_3 = Cost of chemical (₦)

X_4 = Cost of planting material (₦)

X_5 = Hired Labor (Man-days)

The inefficiency model Ui is defined by

$U_{ij} = \delta 0 + \delta_1 Z_1 ij + \delta 2 Z_2 ij + \delta_3 Z_3 ij + \delta_4 Z_4 ij$ …….......... (2)

Where;

Z_1 = Age (years)

Z_2 = Farming experience (years)

Z_3 = Educational level (years of formal educational qualification)

Z_4 = Farm size (hectare)

RESULTS AND DISCUSSION

Table 1 indicated that 38.5% of farmers are between the ages of 31 and 40, with a mean age of 42. This suggests that the majority of farmers are young, active individuals who are in their active stages of life. The labour-intensive nature of producing fluted pumpkins, which calls for youthful and enthusiastic farmers, may be the reason why the majority of those involved are younger. The outcome is consistent with Mercy-Ebere's (2017) findings, which state that fluted pumpkin producers are 42 years old on average. Due to the fluted pumpkin's non-rigorous nature, 84% of the respondents were female and dominated the production of the vegetable in the study area. According to Sigot (1995), women in Africa are considered to be responsible for 70% of the continent's overall food production. Several studies suggest that women make up as much as 60% of the agricultural workforce in the continent.

The majority of farmers (77-8%) were married, 77.8% had families with four to eight members on average, and 87% had some form of schooling. Since education facilitates the uptake of innovation and the understanding of current concepts, it plays a critical role in eliminating technical inefficiencies. The results also indicate that 90% of the farmers in the research area had between six and ten years of experience, indicating that they have been in the farming business since they were young people and that adopting new innovations won't be a problem.

The result aligns with Olowa's (2016) findings, which showed a favourable correlation between technical efficiency and agricultural experience. Eighty-five per cent used both hired and family labour. Due to the heavy usage of labour, which necessitated the addition of hired

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labour, family labour—which primarily consisted of school-age children—was always needed. 69% of farmers used a monoculture system.

Table 1. Socio-economic characteristics of respondents

Variables	Frequency	Percentage%
Age (Years)		
Less than 20	0	0
21-30	10	9.26
31-40	42	38.89
41-50	37	34.26
Above 50	19	17.59
Total	108	100
Sex		
Male	17	15.74
Female	91	84.26
Total	108	100
Education level		
No formal education	14	13.0
Primary education	23	21.3
Secondary education	56	51.85
Tertiary education	15	13.89
Total	108	100
Marital status		
Single	19	17.59
Married	75	69.44
Divorced	1	0.93
Widowed	13	12.04
Total	108	100
Household size		
Less than or equal to 4	11	10.19
5-8	84	77.78
9-12	11	10.19
Above 12	2	1.85
Total	108	100
Farming experience		
1-5	11	10.19
6-10	29	26.85
11-15	28	25.93
16-20	40	37.04
Total	108	100
Labour type		
Family labour	16	14.81
Hired labour	1	0.93
Both	91	84.26
Total	108	100

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Profitability of Fluted Pumpkin Farmers

Costs and returns associated with farming fluted pumpkins in the research area are displayed in Table 2. In the production of fluted pumpkins, the fixed cost items used were rent (₦600,885.00), hoes and cutlasses, which came to ₦21,604.74; the total fixed costs incurred was ₦622,489.74. The variable cost items included planting material (₦11,819.91), labour cost (₦17,842.59), transportation (₦6,607.00), harvesting (₦6,944.44), chemicals (₦33,188.89), and water (₦5,560.48), with chemicals accounting for the highest amounts due to their high cost. In all, ₦80,963.31 was spent on variable costs. ₦703,453.07 was the total amount invested. The majority of farmers either sold their food at the farm gate or in the closest marketplaces, but some sometimes transported it to cities where it could fetch better prices. The study's return resulted in ₦1,146,295.37, which indicates that the net farm income was ₦442,841.64. The results of Mercy (2017) and Akanni-John, Shaib-Rahim, Eniola, and Elesho (2020) further support this, showing that farmers are driven to produce fluted pumpkins due to their noticeable profitability, despite the high cost of production. This demonstrated that the production of pumpkins is profitable in the study area, suggesting that it might be a valuable source of employment for the teeming population and our young school dropouts. The ROI (return on investment) average was 0.65 in the table as well. The agro enterprise receives a return of N0.65, meaning that for every N1 invested by farmers in fluted pumpkins, they receive N0.65.

Table 2. Budgetary Analysis for Fluted Pumpkin Production

Variable	Total cost of the Production period (₦)	Percentage
A. Returns		
Revenue	1,146,295.37	
B. Variable cost		
Planting material	11,819.91	1.68
Cost of labour	17,842.59	2.54
Transportation	6,607.00	0.94
Harvesting	6,944.44	0.99
Manure/ Chemicals	33,188.89	4.72
Water	4,560.48	0.65
Total Variable Cost (TVC)	**80,963.31**	
C. Fixed cost		
Rent	600,885.00	85.42
Equipment (Hoes and Cutlass)	21,604.74	3.06
Total Fixed Cost (TFC)	**622,489.74**	
Total Cost(TVC+TFC)	**703,453.07**	**100**
Net Farm Income	**442,841.64**	
Return on Investment	**0.65**	

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Technical Efficiency in Fluted Pumpkin Production

The technical efficiency of the sampled farmers is less than (1.00), as Table 3 demonstrates. This suggests that farmers producing fluted pumpkins in the research area are not reaching the maximal output on the frontier. Based on the technical efficiency range, the most efficient farmer has an efficiency of 0.80, or 80%, while the least efficient farmers have an efficiency of 0.36, or 36%, and a mean efficiency of 0.61, or 61%. The farmers were able to produce around 61% of the maximum amount possible with a specific combination of inputs and technology, according to the mean technical efficiency of 61%. An average farm's technical efficiency can be considered reasonable, as indicated by the mean TE of 61%. Although the fluted pumpkin farmers' observed output is 20% below the maximum, the results additionally demonstrate their inefficiency. So, without incurring any additional costs, better resource allocation can raise the output of the fluted pumpkin farmers by 20%. With respect to the distribution of technical efficiency among farmers, it was found that approximately 13.89% of them had technical efficiency between 31 and 50%, and 86.21% had technical efficiency of 50% or more. Although this mean is much lower than the 79% reported by Kolawole and Ojo (2007), it is comparable to the mean estimate of 66% obtained in Ali (2014).

Table 3: Technical efficiency of Fluted Pumpkin production

Efficiency level	Frequency	Percentage
0.31 – 0.50	15	13.9
0.51 – 0.70	79	73.2
0.71 – 0.90	14	13.0
Above 0.9	0	0.00
Total	**108**	**100.00**
Minimum	**0.36**	
Maximum	**0.80**	
Mean	**0.61**	

Factors Influencing Technical Efficiency of Fluted Pumpkin Farmers

The result of the stochastic frontier for fluted pumpkin production in Kolokuma/Opokuma Local Government Area is presented in Table 4 as the maximum likelihood estimates. At various probabilities, each of the five (5) inputs that the model uses is statistically significant. Transportation, harvesting, manure/chemicals, planting materials, and labour constitute the factors. The variance parameters of the production function of the stochastic frontier are denoted by δ2 and γ. At the 1% probability level, the sigma square (0.13) has statistical significance. The estimation coefficient of 0.43 indicates that planting material is the most significant component in the production of fluted pumpkin, meaning that a 10% increase in planting material quantity would result in a 4.3% increase in fluted pumpkin output. According to Mercy's (2017) research, planting material plays a crucial role in the establishment of fluted pumpkins. Statistically significant at the 1% probability level, manure/chemical is the second most important component in the production of fluted pumpkins, with a positive estimated coefficient of 0.2. This suggests that the output of fluted pumpkin would increase by 2.0% for every 10% increase in manure/chemical invested.

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Production of fluted pumpkins also requires a substantial amount of labour. Adegeye and Dittoh's (1985) premise that labour is one of the key inputs of production is corroborated by the results obtained. The indicators of inefficiency that have been established are related to the distinct socio-economic characteristics associated with farmers, which seem to have a noteworthy function in ascertaining their extent of technical efficiency. There was a positive estimated coefficient of age for the farmers. This suggests that an older population of fluted pumpkin farmers is probably less technically efficient than a younger population. In contrast, Onuche, Ayodele, and Audu's (2014) findings support the opposite. Younger farmers are more open to new ideas than older ones, which may have something to do with the association between age and inefficiency observed in this study.

At the 1% probability level, the coefficient of farm experience was determined to be negative and statistically significant. This suggests that, in comparison to less experienced farmers, fluted pumpkin farmers are likely to become more technically proficient as they gain expertise. This conclusion is consistent with the findings of Ajibefun and Abdulkadir (2004) and Onoja and Achike (2011), which found that agricultural expertise had a significant impact on farmers' efficiency levels. The statistical significance of the computed coefficient of schooling at the 10% probability level was determined to be negative. This suggests that substantial but detrimental effects of schooling have been observed in technological efficiency. Education may reduce technical inefficiencies, according to this. Education makes it easier to understand new concepts; according to Adejoh, Onuche, and Edoka (2010), which claim that this helps innovations be adopted as well. According to Shahid Ali (2014), Onuche et al. (2014), Nosiru et al. (2014) indicates that education improves agricultural production efficiency. This finding supports that theory.

Table 4. Maximum likelihood estimation (MLE) of stochastic frontier production function for fluted Pumpkin farmers in Kolokuma/Opokuma LGA

Variables	Parameter	Coefficient	Standard error	t-ratio
Constant	β_0	8.61	0.58	14.76***
Transportation (X_1)	β_1	-0.02	0.01	-2.27**
Harvesting (X_2)	β_2	0.01	0.01	1.71*
Manure/chemical (X_3)	β_3	0.02	0.01	2.54**
Planting materials (X_4)	β_4	0.43	0.04	12.17***
Labour (X_5)	β_5	0.02	0.01	2.07**
Inefficiency Model				
Constant	δ_0	0.29	0.53	0.55
Age (Z_1)	δ_1	0.22	0.13	1.75*
Experience (Z_2)	δ_2	-0.07	0.04	-1.59
Education (Z_3)	δ_3	-0.03	0.02	-1.78*
Variance Parameters				
Sigma square	δ^2	0.13	0.02	6.88***
Gamma	Γ	0.25	0.43	0.58
Log Likelihood Ratio (LR)		14.6		

Source: *Field Survey, 2023*

Note: ***, **, * = Significant at 1%, 5%, and 10% respectively.

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Constraints Associated With Fluted Pumpkin Production

Table 5 highlighted farmers of fluted pumpkins categorized by issues they encountered while cultivating. According to the farmers which farm fluted pumpkins, the main issues include low or nonexistent capital to get started, high rates of floods, poor credit facilities, low storage facilities, low labour supply or high labour costs. This supports Mercy-Ebere's (2017) findings, which showed that the main issues with fluted pumpkin production were a lack of finance facilities and storage space. The most disturbing constraints were inadequate credit facilities to venture into fluted pumpkin production as a commercial business as most farmers are in it for consumption purposes. Another serious problem was the high rate of flooding as their farms were close to the river and when the river water rose it affected their farms and they tend to lose their produce. The third serious problem was lack of labour/high cost of labour as most of the farmers complained that the cost of hiring someone to work in their farms was expensive and they could not afford it. Inadequate market knowledge was the least of the obstacles identified considering there were always customers for their produce. The absence of quality planting seeds came next, even though the majority of farmers claimed to have quality planting seeds. Farmers also frequently faced additional challenges such as the high expense of transportation to markets, the rapid spread of pests and illnesses, and a shortage or scarcity of land.

Table 5. Distribution of respondents based on constraints associated with fluted pumpkin production in Kolokuma/Opokuma

S/N	Constraints	Frequency	Percentage%	Rank**
1	Inadequate credit facilities	33	16.6	1st
2	High rate of flooding	32	16.4	2nd
3	Lack of labour/ high cost of labour	29	14.8	3rd
4	Inadequate storage facilities	27	13.6	4th
5	Little or no start-up capital	25	12.6	5th
6	High cost of transportation to markets	17	8.6	6th
7	Lack of land/insufficient land	13	6.8	7th
8	High spread of pests and diseases	12	6.6	8th
9	Lack of good planting seed	7	3.4	9th
10	Inadequate market information	1	0.4	10th
	Total	**196***	**100**	

Source: Field Survey, 2023

** rank in descending order

* multiple response

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CONCLUSION AND RECOMMENDATIONS

The development of an economically feasible method is necessary to support small-scale farmers' sustainable and profitable production of fluted pumpkins, as these farmers have the potential to significantly impact the nation's food supply. Age, sex, and farming experience were the characteristics that increased technical efficiency considering farmers were not entirely efficient. Based on the study, the main issues associated with fluted pumpkin producers were low financing facilities, frequent flooding, limited storage facilities, low labour costs, and little to no initial capital. The socioeconomic traits of farmers and the production output of fluted pumpkins were significantly correlated. The firm receives 65 kobo for every N 1 invested, as indicated by the return on investment of 0.65. The study's conclusions lead to the following suggestions being put into practice:

1. The government need to supply farmers with affordable, readily available farm inputs and tools at the appropriate time. The government ought to establish a strategy that subsidises input prices and ensures timely delivery to farmers, enabling them to increase production efficiency.

2. The distribution of improved seeds and the encouragement of extension agents to instruct farmers in more efficient agricultural practices that minimise waste and maximise the use of available resources.

3. To help farmers overcome their capital and financial limits, the government ought to prioritise providing credit and financing options. Improving infrastructure will also benefit farmers' economic status. Farmers constitute the product's producers, and the government should help them financially and with other incentives to keep them operating. It is also important to create an atmosphere that is favorable for dealers by offering sufficient storage space and ready marketplaces both domestically and maybe internationally.

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