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ECONOMICS OF PEPPER (*Capsicum species*) PRODUCTION IN AKWA IBOM STATE, NIGERIA

Ubokudom Etim Okon
Department of Agricultural Economics and Extension, Akwa Ibom State University, P.M.B. 1167, Uyo, Nigeria
Correspondence e-mail: ubokudomokon@aksu.edu.ng

Abstract
Pepper holds significant economic, nutritional, and medicinal value in Nigeria, contributing to food security, income generation, and export earnings. Despite its importance, pepper production in southern Nigeria, particularly in Akwa Ibom State, faces challenges such as low productivity, price fluctuations, and input constraints. This study examines the economics of pepper production in Akwa Ibom State, Nigeria. Using primary data collected from 90 pepper farmers through structured questionnaires. The results showed that pepper farming is predominantly undertaken by females (53.3%), married (33.6%) with a mean age of about 51 years, the majority (86.7%) had primary education and small household sizes. Despite a mean farming experience of 9.5 years, cooperative participation is low, limiting access to resources and information. The study found that pepper production is efficient in labour and material input utilization, with a profit margin percentage of 78.12%. The total costs were ₦177,557.11, with returns of ₦811,599.75, indicating profitability and viability. The cost of seedlings, cost of organic and inorganic fertilizer were significant factors influencing profitability of pepper production. However, challenges such as high input costs, particularly for labour and herbicides, influence profitability. Probit regression analysis cost of seedlings, cost of organic and inorganic fertilizer as significant factors influencing pepper profitability. Constraints faced by farmers include the high cost and scarcity of quality seeds, pests and diseases, high labour and irrigation costs, theft, storage problems, and market-related challenges. The research suggests that enhancing access to high-quality seeds, bolstering pest management strategies, fortifying market connections, and investing in infrastructure and farmer cooperatives are crucial steps to mitigate production challenges and bolster resilience.
Keywords: Profitability, pepper, costs, returns

Introduction

The role agriculture plays in the economic development of Nigeria cannot be overstated (Lawal *et al.,* 2021), in Nigeria, agriculture remains one of the dominant economic activities (Okon, Enete, & Amusa, 2012). Agriculture is one of the largest non-oil foreign exchange earner, the largest employer of labour and a key contributor to wealth creation and poverty alleviation in Nigeria (Lawal *et al.,* 2021) thus making the Nigerian agricultural sector a resilient sustainer of the economy in terms of food supply, employment creation, national income generation and industrialization (Okon *et al.*, 2016; Bonjoru *et al.,* 2019; Obot, 2021) and a significant portion of the agricultural production consists of fresh fruits and vegetables (Çinar and Semerci, 2022). Increase in agricultural productivity is subject to its marketability so as to improve its contributions to national economy (Ibitoye, Oyibo and Shaibu, 2019).

Vegetables holds great nutritional value and majorly comprise minerals, vitamins, proteins, carbohydrates, and fibres which form a major component in the human diet (Obot, 2021). Importantly, some common vegetables cultivated and marketed in Akwa Ibom State include fluted pumpkin leaf, waterleaf, Okra, Tomato and pepper (Akwa Ibom State Statistical Year Book, 2014; Okon *et al.*, 2023). They are produced and marketed in the wet and dry seasons of the year (Obot, 2021). These are important for human health due to provision of balanced nutrition, protein, minerals, carbohydrate and vitamins (Maurya *et al.,* 2015), which is important in meeting the micronutrient

deficiencies afflicting majority of the inhabitants of developing countries (Okon, Esheya and Udom, 2021).

Pepper (*Capsicum species*) is an important agricultural food crop, this is because of its economic value and importance and also due to the nutritional and medicinal values of its fruits, the contents, as well because of being a good and excellent source of natural colours and anti-oxidant compounds (Horward *et al*., 2000; Alabi, Oladele and Maharazu, 2022).. Pepper originated from Mexico in the Central America regions. It is one of the most widely used vegetables in the world, belonging to the Solanaceae family (Akpan *et al.,* 2023). The genus capsicum contains 30 species of pepper some of which include Tabasco pepper (*Capsicum frutescens*), Habaṅero pepper (*Capsicum chinense*), Cayenne pepper (*Capsicum annuum*), Rocoto pepper (*Capsicum pubescens*) and Thai pepper (*Capsicum frutescens*) (Grubben and Mohamed, 2004).

According to Matloub *et al.,* (1989) peppers are usually classified as sweet or hot pepper; these two types have many cultivars, which vary by fruit shape, flavor, pungency, and color. It can be used in diverse forms, such as culinary, pickling, grinding, roasting, drying, and freezing (ISU, 2009). It is both an annual and perennial crop that completes its life cycle within one year and has a regenerating ability (Ikeh *et al.,* 2012). It grows up to a height of 1.5m with several branches. It has a relatively extensive root system including a tap root which varies depending on available moisture and variety (Akpan *et al.,* 2023).

Pepper is recognized as the most widely and varied food for general populace in Africa and the entire world (Dipeolu and Akinbode, 2008). It is reported to be the world's most important fruit vegetable, which ranks second after tomatoes and constitutes about 40% of human vegetable consumption and it is the world's most commonly used spice (Adeoye *et al.,* 2014). Pepper provides essential minerals, vitamins and is the most widely produced type of spice flavouring and colouring for food (Werner, 2021). Peppers are rich in vitamins A, C and K. Vitamin A is reported to be good for eye sight, and vitamin C also prevents the common cold. All varieties are good and excellent sources of potassium, vitamins A and C, fibre, and folic acid (Alabi *et al.,* 2022). In many households, pepper provides countless needs such as enhancing diets intake, storing of grains and mild drugs (Ibitoye *et al.,* 2019). Pepper is used for flavouring, adding taste in food, colouring cosmetics and imparting heat to medicine by manufacturing industries. It is also used as ornamental plant and the red powdered pepper is used for colouring flamingos in the zoo (Ibitoye *et al.,* 2019).

Nigeria is reported to be the largest producer of pepper among the sub-Saharan African Countries (Akpan *et al.,* 2023), and is known to be one of the major producers of pepper in the world accounting for about 50% of the African production and the major area of production is Northern Nigeria (Ogunbo, 2015). In 2020, Nigeria produced 762,174 tonnes of green chilies and peppers, representing a slight 0.27% increase from 2019 (FAO, 2020). The average yield was 2 to 2.5 tonnes per hectare for green chilies and peppers, while dry chili production was 62,556 tonnes from a harvested area of 36,605 hectares with a yield of 17,089 hg/ha (FAO, 2020). Pepper is an important annual cash crop, possessing a lot of economic, health and medicinal uses in humans it works internally as a stimulant and a carminative and externally as a counter-irritant (Grubben and Mohamed, 2004; Akpan *et al.,* 2023). It is equally good as an additive in poultry bird feed formulation. In Akwa Ibom State pepper is cultivated in an open field or in screen houses (Akpan *et al.,* 2023).

Pepper consists of about 20% of the average daily vegetable consumption per person in Nigeria (Ogunbo, 2015). It is used extensively in food flavouring in the daily diet of over 120 million Nigerians, irrespective of their socio-economic status. It is used in the preparation of soups and stew, which are among the major essential compliments of staple based on cereals and root crops and also forms remedies for toothache and sore throat (Ogunbo, 2015).

Pepper is adapted to all of the agro-ecological zones of Nigeria where favorable conditions support cultivation in the traditional cropping systems and intercropping (Ayodele, Ajewole and Alabi, 2016). Some large-scale farms grow pepper under irrigation to support all season cultivation. Pepper has the ability to play a role in rural income generation, poverty alleviation, and food and nutrition security among producers (Adewoyin *et al.*, 2011; Okon *et al.*, 2023).

The productivity and growth of the pepper production are dependent on the economic potential of the individual farm enterprise, and this is determined by the producers' ability to balance adequately increased returns with possible increase in production cost which could arise from increase in production inputs. Moreover, policy recommendations on how to improve agricultural productivity require reliable estimates of the current level of farmer's profit. Therefore, profitability of the farm enterprise is a prerequisite for attaining higher productivity (Okon *et al.*, 2021).

The Food and Agriculture Organization (FAO) estimates that the world's production of *Capsicum* spp. will reach 38.5 million tonnes in 2021 from a harvested area of 2.2 million hectares, yielding 17.5 tonnes per hectare on average (FAO, 2021; Olutumise, 2022). However, there remains a significant yield disparity between developed and developing countries. According to recent FAO data, the average yield in developing countries is approximately 10-15 tonnes/ha compared to 25-30 tonnes/ha in developed countries. This disparity points to the untapped potential for yield improvements in developing countries, including Nigeria.

Nigeria's soil and weather conditions are highly conducive to the cultivation of pepper, making it one of the largest producers globally, accounting for 50% of Africa's pepper production (Alabi and Anekwe, 2023). Despite this, the country contributes only about 5% to global pepper production (Nigerian Export Promotion Council, 2022).

Most Nigerian pepper farmers operate on a small scale and face resource constraints, relying on middlemen to market their produce (Adeoye et al., 2014). These smallholder farmers encounter significant production challenges, including poor agricultural practices, low soil fertility, diseases, unstable pepper prices, and a lack of adequate market infrastructure (Ogunbi, 2015; Baluk and Daniel, 2009). Additionally, storage issues, inadequate feeder roads, and limited market information exacerbate these challenges, making pepper production a less profitable venture for many farmers. Marketing inefficiencies further compound the difficulties faced by these farmers, as highlighted by Baluk and Daniel (2009).

While Nigeria's northern region dominates pepper production, southern states such as Akwa Ibom lag significantly behind due to the predominance of traditional farming methods and a lack of adoption of improved cultivation practices (Ayodele et al., 2016). This low level of technological adoption is coupled with price fluctuations and yield instability, which have hampered the vegetable supply chain's efficiency in Akwa Ibom State (Obot, 2021). Obot (2021) further emphasizes that vegetables, including pepper, have historically been viewed as minor crops in southern Nigeria, attracting limited attention compared to staple and cash crops.

Smallholder pepper farmers in Akwa Ibom State often face systemic constraints rooted in their socioeconomic status. Factors such as education level, farm size, access to inputs, and availability of credit play a pivotal role in shaping their productivity and profitability. The economic viability of pepper farming in Akwa Ibom hinges on a detailed analysis of its cost and returns. Previous studies have assessed profitability in other regions of Nigeria, for instance, Obayelu *et al.* (2021) found that the mean age of the farmers was 51.05, average household size was about 7 persons, mean farm size was 1.44ha. Furthermore, the study found the value of post-harvest loss to be $69.85 and total output to be 677.16kg with an average yield of 470.25kg/ha. The study found that gender reduced the likelihood of postharvest loss while distance and transportation cost increased it. Alabi *et al.* (2022) in Abuja reported a mean age

of 38.3 years, household size was 5 persons. The gross margin was ₦167, 741.60 per hectare, the rate of returns of investment in pepper production was 0.89, and the operating ratio was 0.49. The gross margin ratio (GMR) was calculated to be 0.48. Labour input, seed input, farm size were significant factors affecting output of smallholder pepper production. They further reported a mean technical efficiency of 0.79, and returns to scale of 1.2363. Lawal *et al.* (2021) in Kano State found that the majority of the chilli pepper marketers were male and 46.2% were between the ages of 30-39years, and the majority of the marketers had attended various level of education in the study area which means they can read and write. Their results showed that many of the marketers had less than 10 household members and less than 10 years of experience in pepper. Net margin was ₦2,520.74 per 30kg. Marketing of chilli pepper was found to be efficient in view of the high marketing efficiency obtained, with marketers facing constraints of lack of uniform measure, poor credit facilities, transportation, inadequate storage facilities and poor market infrastructures. Ilesanmi *et al.*(2023) in Ekiti State observed that farmers earned an average net income of ₦100,159 per hectare while the return on investment was estimated to be 1.3. The results of multiple regression revealed that labour, quantity of glove, seed and farm size influenced pepper production in the area. The estimates of resource-use efficiency showed that all the variables in the model were underutilized except variables such as cutlass and quantity of glove which are over utilized. Their results further revealed that pest and disease, lack of credit, inadequate storage facilities and inadequate water supply were the main constraints to the optimal productivity and profitability in the area. Limited research exists specific to Akwa Ibom. Numerous factors, including access to inputs, market dynamics, climatic conditions, and agricultural practices, influence pepper production's profitability. In Akwa Ibom, understanding these variables is essential for designing strategies to enhance profitability. For example, Obot (2021) noted that the agro-input market's inefficiency and price volatility hinder farmers from achieving optimal profitability. Production constraints in Akwa Ibom, ranging from poor soil fertility and disease outbreaks to inadequate infrastructure and market access, significantly reduce productivity. Ogunbi (2015) and Baluk and Daniel (2009) highlighted these issues in other parts of Nigeria, but their specific manifestation in Akwa Ibom remains underexplored.

This dearth of studies focusing on the southern regions, particularly Akwa Ibom State, necessitates the need to fill this gap by examining the economics of pepper production in Akwa Ibom State. Pepper is an important vegetable that features significantly in the many food varieties of Nigeria, with important culinary, medicinal and cosmetic values. It is also a major source of revenue as an export crop. Although the production of pepper is spread across Nigeria, the output of pepper in the southern part of Nigeria is much lower compared to her northern counterpart, hence, this study will provide a much-needed insight into the profitability of pepper production in Akwa Ibom, identifying the challenges faced in production, by addressing the research questions outlined below.

1. What are the socioeconomic characteristics of pepper farmers in the study area?
2. What is the cost and returns of pepper production in the study area?
3. What are the factors that influence the profitability of pepper production in the study area?
4. What are the constraints encountered in pepper production by farmers in the study area?

Research Methodology

Study Area

This study was conducted in Akwa Ibom State, Nigeria. Akwa Ibom State is located in the South-South region of Nigeria. It has an estimated population of 5,482,177 (National Population Commission, 2016) and a land area of 6,900 sq Km. It lies between latitudes $4^0$32'N and$5^0$33'N and longitudes $7^0$25'E and $8^0$25'E. It is situated within the tropical region with significant rainfall most months, with a short dry season. The average annual temperature is 25.7

°C or 78.3 °F. The rainfall here is around 3033 mm or 119.4 inches per year (Climate Data, 2021). It is bordered on the east by Cross River State, west by Rivers State and Abia State and on the south by the Atlantic Ocean. It is currently the highest oil-producing State in Nigeria. The vegetation is characterized by three easily distinguishable types namely, the saline water swamp forest, the freshwater swamp and the rainforest (Wikipedia, 2020). Agriculture is the dominant economic activity and the various agricultural products available in the State includes palm oil, cassava, yam, cocoyam, plantain, cucumber, tomatoes, pepper, maize, rice, rubber, sea foods such as varieties of fish, shrimps, crayfish, oysters etc, poultry eggs and meats, pork and, snails among others.

Sampling Technique and Sample Size

The study was carried out in Akwa Ibom State, Nigeria. The State has six Agricultural zones, namely: Abak, Eket, Etinan, Ikot Ekpene, Uyo and Oron. Multistage sampling procedure ws used in selecting the respondents. In the first stage, three out of the six agricultural zones were purposively selected due to the predominance of pepper farmers; they are Abak, Ikot Ekpene and Uyo. In the second stage, one Local Government Area was randomly selected from each of the selected agricultural zone, namely Abak, Ikot Ekpene and Uyo. In the third stage, 30 farmers were randomly selected from each of the selected Local Government Areas, giving a total of ninety (90) respondents for the study.

Method of Data Collection

Primary data was used for the study. The primary data was collected using a structured questionnaire that was administered to the selected pepper farmers.

Method of Data Analysis

Data were analyzed using descriptive statistics in the form of frequencies, percentages and tables. Also, the gross margin, net margin and rate of return of investment was used to measure the profitability of pepper production, and cost-benefit analysis was used to estimate the costs and returns which will determine the profitability index of the farmer.

Gross margin (GM) = Total Revenue (TR) – Total Variable Cost (TVC)

Net Profit (π) = Total Revenue (TR) – Total Cost (TC)

Rate of Returns (ROR) = TR/TC

Rate of Returns to Investment (RORI) = π/TC

The Ordinary Least Square (OLS) regression model was used to analyze factors that influence the gross margin of the pepper farmers in the study area. The modelis explicitly expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + u$$

Where,

Y = Gross margin
X_1 = labour cost (₦)
X_2 = Seed cost (₦)
X_3 = Inorganic fertilizer cost (₦)
X_4 = Organic manure cost (₦)
X_5 = Herbicide cost (₦)
X_6 = Depreciation cost of capital assets (₦)
X_7 = Farm size (ha)
β_0 = Constant
β_{1-7} = Coefficients of estimates
u = Error term

A 3-point Likert-type scale rating was used to analyze the constraints to pepper production in the study area. The rating was weighted as "3 = very serious, 2 = serious, 1 = not serious." A mean weight was obtained for the rating to be 2.0. Scores equal or above the mean weight is adjudged as a "constraint", while scores below the mean weight is adjudged as "not a constraint". The responses were discussed using descriptive statistics such as frequency and percentages.

Results and Discussion

The socioeconomic characteristics of pepper farmers in the study are presented in Tables 1. The results showed that the majority of the respondents (53.3%) were female. This implies that the pepper farming in the study area is female-dominated, with a mean age of about 51 years. Suggesting that, the farmers were aging. Older farmers often possess extensive experience and knowledge accumulated over decades of farming. Their expertise can

contribute to maintaining traditional agricultural practices, preserving local agricultural knowledge, and providing mentorship to younger farmers. However, there may be challenges in adopting new technologies and modern farming practices due to entrenched habits and resistance to change. This is in line with the findings of Obayelu *et al.,* (2021), who had a mean age of 51.05 years, while Alabi *et al.,* (2022) reported a mean age of 38.3 years.
Most (35.6%) of pepper farmers were married, with about 10 years of farming experience and a mean household size of 5 persons. Bigger households sizes may be usefully employed as family labour on the farm Okon *et al.,* (2012), Lawal *et al.,* (2021) and Alabi *et al.,* (2022) had similar findings. Also, the majority (78.9%) of the respondents were not members of cooperative societies. Among other things, social organisations give farmers access to pertinent data and information to update their current production, management, and resource use. This implies that most of the farmers in the study area may not have access to information, capital, and other resources and technologies that could improve their productivity.

Education enhances farmers' ability to access and utilise agricultural information, market intelligence, and extension services. The majority (86.7%) of the respondents reports having attended primary education, but on average educational careers last for 6.8 years only. Educated farmers are better equipped to navigate agricultural markets, negotiate prices, and access financial services such as credit and insurance. They are also more likely to leverage technology, agricultural inputs, and mechanisation to optimise farm operations and maximise returns.

In a typical African society, mode of land acquisition could influence the farming systems as well as productivity. The mode of land acquisition showed that 28.9% of the respondents purchased the land used for farming, 26.7% of the respondents utilised communal lands for pepper production, 16.7% of the respondents acquired their lands by inheritance and contract, respectively, and 11.1% of the respondents acquired their land by lease. Farmers who acquired their lands through inheritance or outright purchase may be able to utilise them as security to obtain loans from financial institutions.

The distribution of the respondents according to farm size indicates that 86.6% of the respondents had less than 1ha of farmland, 7.8% of the respondents had between 1 to 2ha of farmland, and 5.6% of the respondents had farmland ranging from 3 to 5ha for pepper production. The mean farm size of the respondents stood at 0.8ha. This implies that the majority of the respondents were smallholder farmers, with a farm size of less than 1ha. This corroborates with the findings of Obayelu *et al.,* (2021), who reported an average farm size of 1.4ha.

The source of labour showed that 45.6% of the respondents hired farm labour for their production activities, 22.2% made use of family labour, and 32.2% of the respondents combined both family and hired labour for their production activities. The result implies that the use of hired labour was predominant in the study area. Also, water sources for pepper production indicated that the majority (53.3%) of the respondents practiced both rainfed and irrigation agriculture, while 22.2% and 24.4% of the respondents utilised rainfall and irrigation farming, respectively, for their pepper production. This implies that many of the respondents relied on irrigation and rainfall to provide water for pepper production and, hence, may be able to cultivate all year round for improved household income.

Table 1: Socioeconomic Characteristics of Respondents in the Study Area (n = 90)

Variable	Frequency	Percentage
Gender		
Female	48	53.3
Male	42	46.7
Age ($\bar{x}$= 50.9)		
20 – 29	7	7.8
30 – 39	15	16.7
40 – 49	17	18.8
50 – 59	19	21.1
60 – 69	27	30.0
>70	5	5.6
Marital Status		
Single	20	22.2
Married	32	35.6
Divorced	20	22.2
Widowed	18	20.0
Farm Experience ($\bar{x}$= 9.5)		
1 – 5	14	15.6
6 – 10	45	50.0
11 – 15	27	30.0
16 – 20	4	4.4
Social Organization		
No	71	78.9
Yes	19	21.1
Education		
No formal	7	7.8
Primary	78	86.6
Secondary	5	5.6
Household Size ($\bar{x}$= 5)		
1 – 5	56	62.2
6 – 10	34	37.8
Land Acquisition		
Inheritance	15	16.7
Leased	10	11.1
Contract	15	16.7
Purchase	26	28.8
Communal	24	26.7
Farm Size (ha) ($\bar{x}$= 0.7)		
< 1	78	86.6
1 – 2	7	7.8
3 – 5	5	5.6
Labour Source		
Family	20	22.2
Hired	41	45.6
Both	29	32.2
Water Source		
Rainfed	20	22.2
Irrigation	22	24.4
Both	48	53.4

Source: Field Survey, 2024.

Profitability of Pepper Production in the Study Area

Table 2: Cost and Benefit Analysis of Pepper Production

Variable	Quantity	Unit price(₦)	Amount (₦)
Revenue	**270.53kg**	**3000/kg**	**811599.75**
Variable Costs			
Cost of Land clearing	6.23mandays	1,200/manday	7,471.16
Cost of Field preparation	6mandays	1,200/manday	7,251.51
Cost of planting	3mandays	2,000/manday	6,143.27
Cost of transplanting	2mandays	2,600/manday	5,291.40
Cost of Fertilizer/manure application	2.64mandays	2,200/manday	4,460.06
Cost of Weeding/herbicide	3.12mandays	2,200/manday	6,678.64
Pesticide application	2.6mandays	2,400/manday	4,931.60
Irrigation Cost	2.08mandays	2,200/manday	4,580.32
Cost of Harvesting	2mandays	2,500/manday	5,454.71
Total Labour Cost			**52,262.66**
Cost of seedlings	6.53 kg	5,000/kg	32,644.44
Cost of pesticides	2.44ltrs	6,000/ltr	14,646.67
Cost of stakes	72.73 pcs	150/pcs	10,908.89
Cost of fuel for irrigation	8.84ltrs	1,125/ltr	9,943.33
Cost of inorganic fertilizer	0.18 kg	64,000/kg	11,343.33
Cost of organic manure	8.65 bags	1,300/bag	11,238.89
Cost of herbicides	1.94ltrs	6,500/ltr	12,581.11
Transportation cost			5,765.56
Total Input Cost			**109,072.22**
Total Variable Cost			**161,334.89**
Fixed cost			**16,222.22**
Total Cost			**177,557.11**
Total Revenue			**811,599.75**
Gross margin			650,264.86
Net profit			634,042.64
Profit margin			78.12%
Rate of Return			4.57
Return on Investment			3.57
Resource Productivity			
Labour productivity			0.32
Material Productivity			0.68

Source: Field survey, 2023.

The costs and returns analysis of pepper production is presented in Table 2. The result shows the estimated costs and return of pepper farmers in the study area were ₦177,557.11 and ₦811,599.75 per farmer per annum, respectively. Among the cost components, cost of material input had the largest share of the total cost (68%), followed by labour inputs (32%). The gross margin and net farm income on the average for pepper farmers was ₦650,264.86and ₦634,042.64 respectively. The profit margin percentage was 78.12%, while

return per naira outlay was 4.57, implying that for every ₦1 invested in pepper production enterprise there is a return of ₦4.57 to the enterprise. These measures of performances indicate that pepper production in the study area is viable and profitable. Alabi *et al.* (2022) reported a gross margin of ₦167,741.6/ha, with a rate of returns on investment 0.89, and gross margin ratio of 0.48. Lawal *et al.* (2021) reported a net margin of ₦2,520.74 per 30kg of chilli pepper, while Ilesanmi *et al.* (2023) reported a net income of ₦100,159, with the return on investment of 1.3.

The result further shows that the cost of labour input and material input was ₦52,262.66 and ₦109,072.22 respectively. Labour productivity of the farmers was 0.32. This shows that output earning per ₦1 expenditure on labour was ₦0.32, implying that labour was well utilized. Material productivity of the farmers was 0.68. This also shows that for every ₦1 spent on material input yielded an earning of ₦0.68, implying that material input was well utilized.

Factors Influencing the Profitability of Pepper Production in the Study Area

Table 3: Factors Influencing the Profitability of Pepper Production

Variable	Coefficient	Std. Error	z-value
Constant	292551	50358.3	5.809***
Labour Cost	−0.704	0.515	-1.368
Cost of seedling	6.240	1.426	4.375***
Inorganic Fertilizer Cost	−10.130	4.384	-2.310**
Organic Manure Cost	-8.987	3.055	-2.942***
Herbicide Cost	−0.592	1.072	-0.552
Capital Depreciation	0.155	0.611	0.253
Farm Size	-19261.2	32627.1	-0.590
Diagnostics			
Mean dependent var	226343.2	S.D. dependent var	225115.3
R-squared	0.739	Adjusted R-squared	0.642
F(6, 83)	7.373***	Log-Likelihood	-1227.795
Normality (Chi-square)	16.4936***	Hannan-Quinn	85.492

Source: Computed using Gretl Software, 2023.

The result OLS regression model for the factors influencing pepper production in the study area is presented in Table 3. The R-squared statistic yields a value of 0.739. This indicates that the model explains approximately 73.9% of the variation in the dependent variable. This indicates that the model exhibits strong explanatory power in the variability of pepper profitability. The F-cal ratio was 7.373 significant at 1% level of probability. This suggests that the model's inclusion of predictor variables significantly improves its ability to explain the dependent variable's variability, indicating explanatory power beyond chance and warranting further investigation into the specific effects of these predictor variables. The normality test reveals a value of 16.494 significant at 1% probability level. This means that the distribution of the variance of error term assume a normal curve. It implies that an increase or reduction in the sample size will result to an exact or similar change in the value of the estimation variables.

The results of the OLS regression analysis presented in Table 4.3 indicates that the intercept term was positive and significant at 1% level of probability indicating that there exists a baseline probability of achieving profitability in pepper farming, irrespective of the specific input costs considered in the model. This baseline profitability indicates the inherent economic viability of pepper cultivation within the study area.

Among the input costs examined, the coefficient of seedling costwas statistically significant and

positive (6.240, p<0.01). This means that a unit increase in the quantity of seedlings bought will yield a 6.24 increase in the gross margin of the farmer. This positive relationship could indicate that higher seedling costs can be associated with improved seed quality, and increased germination rate, which can increase the yield and consequently, the profitability. This corroborates the findings of Alabi *et al.* (2022), and Ilesanmi *et al.* (2023).

The result further reveals that the coefficients of the cost of inorganic fertilizer and organic manure were had a negative and significant relationship (-10.13, p<0.05), and (8.987, p<0.01), respectively with the gross margin of pepper farmers in the study area. This implies that a unit increase in the quantity of inorganic fertilizer and organic manure purchased for production will lead to a decrease of 10.13 and 8.987, respectively in the gross margin of pepper farmers in the study area. This inverse relationship indicates that increased quantities of soil amendments purchased will lead to an increment in the variable cost of production, hence, decreasing the gross margin. Illesanmi *et al.* (2023) had similar findings.

Constraints to Pepper Production by Farmers in the Study Area

Table 4.4: Constraints to Pepper Production in the Study Area

Variable	Very Serious (%)	Serious (%)	Not Serious (%)	Mean	Rank
Lack of irrigation facilities	75.56	20.00	4.44	2.71	1
High cost of labour	66.67	30.00	3.33	2.63	2
Scarcity of quality seeds	66.67	24.44	8.89	2.58	3
Pests and Diseases	62.22	32.22	5.56	2.57	4
High Cost of seeds	62.22	25.56	12.22	2.50	5
Insufficient labour	58.89	30.00	11.11	2.48	6
Theft	57.78	27.78	14.44	2.43	7
High cost of transportation	55.56	32.22	12.22	2.43	7
Poor market demands	56.67	26.67	16.67	2.40	9
Low soil fertility	43.33	42.22	14.44	2.29	10
Land fragmentation	56.67	15.56	27.78	2.29	10
High cost of manure/fertilizer	42.22	40.00	17.78	2.24	12
Storage problems	27.78	67.78	4.44	2.23	13
Destruction of crops by cattle	30.00	56.67	13.33	2.17	14
Poor yield	38.89	35.56	25.56	2.13	15
Soil erosion	25.56	40.00	34.44	1.91	16
Low product prices	11.11	60.00	28.89	1.82	17
Unhealthy competition	16.67	43.33	40.00	1.77	18

Source: Field Survey, 2023.

The lack of irrigation facilities, with a mean score of 2.71, was the most severe constraint faced by the farmers. This indicates a heavy reliance on rainfall, which is often irregular and insufficient, especially during dry seasons. Without adequate irrigation systems, pepper farmers face reduced yields and limited capacity to cultivate crops year-round. The absence of irrigation also exposes crops to water stress, which can significantly reduce their growth and fruiting potential. Ilesanmi (2023) reported inadequate water supply as a major constraint to pepper production. Scarcity of quality seeds ranked second, with a mean score of 2.58. Access to high-yielding and disease-resistant seed varieties is crucial for improving

productivity. However, limited availability of such seeds forces many farmers to rely on low-quality seeds, resulting in poor germination rates and low yields. This constraint not only reduces farm income but also discourages adoption of modern farming practices.

Furthermore, the high cost of labour, with a mean score of 2.63, reflects the financial strain faced by farmers in hiring workers for planting, weeding, and harvesting activities. Labour-intensive operations, coupled with rising wage demands, make pepper farming less economically viable. This challenge is exacerbated by the increasing scarcity of rural labour ($\bar{x}$ = 2.48) due to urban migration. Pests and diseases were also identified as a severe constraint, with a mean score of 2.57. Pest and disease infestations can devastate pepper crops, leading to substantial yield losses and decline in quality of the produce. Lack of access to affordable and effective pest control measures further compounds the issue. The implications include reduced marketable produce, financial losses, and increased vulnerability to food insecurity.

Theft and high cost of transportation respectively had a mean score of 2.43 indicating that they were perceived as constraint to pepper production in the study area. Incidences of theft can result in crop losses, financial setbacks, and heightened security concerns, undermining farmers' confidence and investment in pepper cultivation. Transportation challenges further compound farmers' woes, as poor road networks and high fuel prices inflate the cost of moving produce to markets. The high cost of transportation can considerably affect the gross margin of the farmers. Lawal *et al.,* (2021) reported transportation cost as a major constraint to chilli pepper production. This is followed by poor market demand ($\bar{x}$ = 2.4), low soil fertility and land fragmentation ($\bar{x}$ =2.29) respectively. Poor market demand may force farmers to sell the produce at less than cost prices, which can reduce the gross margin. This stresses the vulnerability of pepper producers to fluctuations in market forces, highlighting the need for enhanced market intelligence, value chain integration, and market diversification strategies.

The problem of land fragmentation diminishes the chance of farmers to benefit from economies of scale while incidentally increasing production costs. Also, continuous cultivation of land results to reduced soil fertility which can increase the cost of production in terms of soil fertility amendment and consequently reduce the gross margin of farmers. The problem of low soil fertility is further compounded by the high cost of manure and fertilizer ($\bar{x}$ = 2.24) which is critical in areas of over cultivated lands with low soil fertility if substantial yield is expected.

Furthermore, storage problems ($\bar{x}$ = 2.23) destruction of crops by cattle ($\bar{x}$ = 2.17), and poor yield ($\bar{x}$ = 2.13) were considered as constraints by the farmers. Inadequate storage facilities can compromise post-harvest handling, leading to spoilage, quality deterioration, and marketability issues, particularly during periods of surplus production. Uncontrolled grazing activities can damage pepper crops, disrupt field operations, and escalate conflicts between farmers and pastoral communities.

Lawal *et al.* (2021) reported that lack of uniform measure, poor credit facilities, transportation, inadequate storage facilities and poor market infrastructures were the major constraints faced by chilli pepper. This was also corroborated with the findings of Obayelu *et al.* (2021).

Conclusion

Pepper production in Akwa Ibom demonstrates considerable economic potential but is hindered by structural and operational challenges. The high profitability metrics, including a profit margin of 51.88% emphasizes the viability of pepper farming as a livelihood source. However, the reliance on small-scale production, aging farmer demographics, and low cooperative participation restrict productivity improvements. Significant barriers such as irrigation deficits, labour-intensive operations, and high herbicide costs threaten sustainable production.

Recommendations

- Efforts should be made to improve access to quality seeds at affordable prices, possibly through government subsidies or support programs.

- Investment in affordable and efficient irrigation systems should be prioritized to enable year-round production and reduce dependence on erratic rainfall patterns.
- Interventions aimed at pest and disease management, irrigation infrastructure development, and labour availability should be prioritized to mitigate production risks and enhance productivity.
- Initiatives to improve market linkages, value addition, and storage facilities are crucial for stabilizing prices, reducing post-harvest losses, and increasing farmers' bargaining power.
- Strengthening farmer organizations and cooperatives can also facilitate collective action, resource pooling, and knowledge sharing, thereby enhancing farmers' resilience and negotiating power in the market.
- Addressing constraints related to theft, crop damage by cattle, and storage problems requires a multi-stakeholder approach involving collaboration between farmers, government agencies, community leaders, and private sector actors. Investments in physical infrastructure, such as fencing, storage facilities, and market infrastructure, coupled with policy support for risk management and extension services, can contribute to overcoming these challenges and fostering a conducive environment for sustainable pepper production.
- Addressing the identified constraints and implementing targeted interventions tailored to the specific needs and circumstances of pepper farmers in the study area are essential for unlocking the full potential of pepper production, improving livelihoods, and promoting food security and economic development in the region.

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