



AN INVESTIGATION OF PROFIT EFFICIENCY OF DRY SEASON VEGETABLE FARMING BUSINESS ALONG RIVER BENUE BANK IN MAKURDI LOCAL GOVERNMENT AREA OF BENUE STATE, NIGERIA

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ABSTRACT

The study investigated the profit efficiency of dry season vegetable farming business along River Benue Bank in Makurdi Local Government Area of Benue State, Nigeria. The study described socioeconomic characteristics of the farmers and examined profit efficiency of dry season vegetable farming. Data were collected from 125 respondents that were selected using multistage sampling procedure. Descriptive and inferential statistics were used to analyse the data. The result showed that 64.80 % of the farmers were male with average age of 42.18 years and 84.00 % were married with average household size of about 7. Result of the Cobb-Douglas stochastic frontier profit model reveals an average profit efficiency of 0.49. The inefficiency model showed that age (-0.6509167) and education (-5.535188) have decreasing effects on profit inefficiency and household size (1.084588) has increasing effect on profit inefficiency. The study concludes the dry season vegetable farming profit efficiency is low and is significantly influenced by age, household size and level of education of the farmers. Also, dry season vegetable production in the study area is dominated by males who are still in their active age and married with household size that can supply family labour. The farmers can read and write. The study recommends that, there is need to encourage farmers to explore alternative marketing channels such as direct sales to consumers to increase profit margins; farmers should be advice to consider diversifying vegetable production to include high-value crops that can increase profitability; training and capacity building programmes should be provided to farmers through informal education using extension agents to improve production and marketing skills of the farmers; there is need to invest in infrastructure such as storage facilities and transportation networks to reduce spoilage and improve market access and policies such as provision of subsidies and credit facilities should be developed to support small-scale farmers.

Keywords: Profit, Efficiency, Vegetable, Dry Season, Irrigation.

INTRODUCTION

Agriculture sector is vital to the economy of Nigeria as it contributes significantly to gross domestic product (GDP), employment and food security of the country. Farming activities along the River Benue bank in Makurdi, Benue State, play a crucial role in supporting the livelihoods of local communities. The River Benue, one of Nigeria's major rivers, provides a reliable source of water for irrigation, making it an ideal location for dry season farming (Adebayo *et al.*, 2017). Dry season farming is an important aspect of agriculture, especially in regions with limited rainfall. Access to irrigation water from nearby water bodies plays a vital role in sustaining crop production during this period (Adewumi and Laniyan, 2020). Irrigation water management is essential for improving agricultural productivity and food security, especially in the face of climate change (IPCC, 2019).

Growing crops during the dry season enables farmers to tap into markets with higher demand and prices which enhances their profit efficiency (Adebayo *et al.*, 2020). This enables farming households to generate income throughout the year, improving their overall livelihoods (Olukosi *et al.*, 2019).

Consumption of vegetable has continued to witness a global expansion that is greater than any other plant group (Yakubu *et al.*, 2019). This is connected to their valued phytochemical contents and the diversity of plant species that can be exploited for their fruits, flowers, tubers or leaves as vegetables. Moreover, technological advancements have made their production more attractive due to



less disease incidence and pest attack. Vegetables are now considered as key contributors to the pursuit of sustainable development especially in third world countries like Nigeria where they are cheap sources of vital nutrients and energy as well as a means of improving income equality and employment.

Vegetable production play important role by providing essential nutrients in diets, improving livelihoods and contributing to food security (Adeyeye *et al.*, 2020). Vegetables are rich in vitamins, minerals and fiber making them a vital part of healthy diet (Oluwafemi *et al.*, 2019). Vegetable production increases food availability and accessibility especially in rural area where access to other sources of nutrients may be limited. Vegetables farming generates income for farmers, creates employment opportunities and contributes to national economy (Olukosi *et al.*, 2020). Vegetables have medicinal properties and can help prevent certain diseases (Afolabi *et al.*, 2018).

Vegetable consumption in Nigeria is deemed to be lower than recommended daily intake with high costs and seasonality being major deterrents (Okoronkwo and Okoronkwo, 2020). This study provides empirical information on profit efficiency of dry season vegetable production along River Benue Bank within Makurdi Local Government Area of Benue State, Nigeria.

The persistent rise in prices of vegetables in Nigeria has significant consequences for households, including reduced food security, increased poverty, and decreased quality of life. The problem is further exacerbated by low output as a result inefficient production resource management and over dependence on rainfed seasonal production.

Dry season vegetable production along river banks is a vital agricultural activity that provides a source of income and food security for many farming households in Nigeria (Adeyeye *et al.*, 2020). The proximity to water sources enables farmers to cultivate crops year-round, taking advantage of favorable market conditions during the dry season (Olaniyi *et al.*, 2019).

Despite its potential, the profitability of this venture is often hindered by various factors that affect the efficiency and productivity of farmers. Dry season vegetable production along river banks may not be as profitable as it could be due to inefficient production practices, lack of access to markets, and inadequate pricing strategies (Adebayo *et al.*, 2020). This can lead to reduced income for farmers, making it difficult for them to sustain their livelihoods and invest in their farms (Olukosi *et al.*, 2020).

There is largely a limited understanding of the effects of climate change adaptation strategies on rice production efficiency especially in Benue State, Nigeria. As a result of the gap in quantitative assessments of efficiency of rice production under various climate change adaptation strategies and the inability to complement local practices with formal climate change adaptation strategies, there is need for more empirical research on the effects of climate change adaptation strategies on rice production efficiency.

Limited access to markets makes make it difficult for farmers to sell their produce, leading to reduced profitability. Farmers may have to rely on middlemen or traders, who may offer low prices for their produce. The high costs of inputs such as seeds, fertilizers, and pesticides can reduce the profitability of dry season vegetable production. Farmers may struggle to afford these inputs, leading to reduced yields and lower quality produce (Adeyemo *et al.*, 2019).

Therefore, it is essential to investigate the economics of dry season vegetable production along River Benue Bank in Makurdi Local Government area of Benue State, Nigeria. The study described the social economic characteristics of the respondents; investigated the profit efficiency of dry season vegetable production and identified the constraints to dry season vegetable production.

METHODOLOGY

Study Area

The study area is Makurdi Local Government Areas (LGA) of Benue State, Nigeria. Makurdi LGA is located in the Northwest agricultural zone of the state. The clayey soil drains the soil poorly thereby making Makurdi area marshy and liable to flooding. However, the soil supports the cultivation of wetland rice and sesame. The climate is typically tropical, with marked dry season from November to March and wet season from April to October. Annuals rainfalls of 1,300 to 1,500mm are



common. Average annual temperatures are high, fluctuating between 28°C and 32°C. Dry woodland savannah is naturally found in the Makurdi area. Common trees are locust beans, shea butter and gmelina. Alluvial soils containing a lot of organic matter are common (Dada, 2006).

The estimated population of Makurdi LGA in 2024 based on 2006 Census is 472,000. It is the second most populous LGA in Benue State after Gboko LGA. The densely populated areas of High Level, Modern Market and Wurukum are business districts. The indigenes of Makurdi LGA are the Mbagwen, Nyiev, Mbawa, Kyoodu Usha (a section of Masev) and Ugondo. These are politically structured into ten council wards. Farming and trading are the main economic activities in Makurdi area. The farmers produce livestock, vegetables, soy beans, millet and sesame. Trading in provisions, electronics and other consumer goods are also common. Fishing on the River Benue is also done on medium scale (Dada, 2006).

Sampling Procedure

The employed a multi-stage sampling procedure. The multi-stage sampling procedure involves the following steps: Foremost, River Benue has North and South Banks in Makurdi LGA. Data were collected from both banks of the river as dry season farming is carried out on both banks the river.

The second stage involved the selection Council Wards. Five Council wards - two from North Bank and three from South Bank were selected purposively based on proximity with River Benue Bank, predominance in vegetable farming business and accessibility.

Third stage involved the random selection of vegetable farmers. Twenty-five (25) vegetable farmers were selected from each of the selected Council wards. This procedure will generate a sample size of one hundred and twenty-five (125).

Method of Data Collection

Data for the study were collected from primary source. Structured questionnaires were used to collect data for the study. The questionnaire focused on socioeconomic characteristics, cost of inputs, revenue and constraints to vegetable production. Content validity was used to ascertain the adequacy of the items included in the questionnaire. To ensure reliability of the questionnaire: pre-test, pilot-test and test-retest were conducted. All information provided by participants were kept in confidence and used solely for the purpose of the study.

Analytical Techniques

The study used descriptive statistics such as mean, frequency and percentage to describe and identify the socioeconomic characteristics of the respondents and constraints to dry season farming along River Benue Bank.

Stochastic frontier profit function was used to estimate and investigate the profit efficiency of vegetable farmers. The data were fitted into the Cobb-Douglas profit functional form. The model is specified as:

$$\ln(\text{profit}) = \beta_0 + \beta_1 \ln(\text{rent}) + \beta_2 \ln(\text{seed cost}) + \beta_3 \ln(\text{wages}) + \beta_4 \ln(\text{fertilizer cost}) + \beta_5 \ln(\text{herbicide cost}) + \beta_6 \ln(\text{pesticide cost}) + \beta_7 \ln(\text{irrigation cost}) + v_i + \mu_i \dots\dots\dots(1)$$

Where:

Profit was measured in Naira.

Rent was measured in Naira.

Seed cost was measured in Naira.

Wages were measured in Naira.

Fertilizer was measured in Naira.

Herbicide cost was measured in Naira.

Pesticide cost was measured in Naira.

Irrigation cost was measured in Naira.

β_0 is intercept.

β_1 to β_7 are parameters to be estimated.

v_i are random error terms.



μ_i are inefficient effects.

$$\mu_i = \delta_0 + \delta_1(\text{age}) + \delta_2(\text{household size}) + \delta_3(\text{education}) + \delta_4(\text{off farm income}) + \delta_5(\text{farm size}) \dots (2)$$

Where:

Age of the household head was measured in years.

Household size was measured as number of persons living together in given home.

Education was measured in years spent in formal education.

Off farm income is annual off farm income was measured in Naira.

Farm size was measured in hectares.

RESULT AND DISCUSSION

Socioeconomic Characteristics

The findings revealed that 64.80 % of the respondents were male and 35.20 % were female. This means that vegetable farming in the study area is dominated by males. This might call for increase female involvement in vegetable farming in the study area for gender balance. This result agrees with findings of Kebede *et al.* (2024) that majority of the farmers who practice irrigation water management in Jimma Zone of Ethiopia are male.

The result of the study in Table 1 showed that 43.20 % of the respondents were within the age of 41-50 years of age, 32.20 % were within the of 31-40 years of age, 14.40 % of the respondents were at least 50 years of age and 11.20 % were at most 30 years of age. The result reveals also that the average age of the respondents was 42.18 years. This result might mean that the respondents are relatively young and still in the active age. This implies that production can move towards an increase. The result contradicts Onuk *et al.* (2017) who found that the average age of dry season vegetable women farmers in Makurdi Local Government Area of Benue State, Nigeria is 35.9 years.

The results showed that 84.00 % of the respondents were married, 11.20 % were single, 3.20 % were widowed and 1.60 % were divorced. This means that majority of the vegetable farmers in the study area were married. This implies that the respondents are responsible and will be able minimise cost of production to improve profit efficiency in the farming business. This result corroborates the result of Onuk *et al.* (2017) that majority of dry season vegetable women farmers in Makurdi Local Government Area of Benue State, Nigeria are married.

Results in Table 1 indicated that 50 % of the respondents had household size of 6-10 persons while 36.80 %, 11.20 % and 1.60 % had household size of 6 persons or less, 11-15 and 16 persons and above respectively with an average household size 7 persons. This result means that the farmers have large household size and family labour could be readily available. This result is similar with the findings of Shuaibu *et al.* (2020) who reported an average household size of 8 among fluted pumpkin farmers in Sabon Gari Local Government Area of Kaduna State, Nigeria.

The results of this study as presented in Table 1 showed that 36.80 % of the respondents had tertiary education, 33.60 % of the respondents had secondary education, 24.00 % had no formal education and 5.60 % had primary education. This result means that most of the respondents had at least primary education or its equivalent and this implies that the farmers can read and write. This result contradicts the result of Dam (2012) who found that majority of dry season vegetables farmers in Floodplains of River Katsina-Ala in Katsina-Ala Town of Benue State, Nigeria had no formal education.

The results of the study presented in Table 1 revealed that 52.80 % of the respondents earn at most ₦100,000 from off farm employment annually, 27.20 % earn ₦100,001-₦200,000, 12.00 % earn ₦200,001-₦300,000 and 8.00 % earn at least ₦300,001 annually from off farm employment. The average annual off farm income of the vegetable farmers in the study area is ₦147,784. This might be used to support farming business in order improve economics of scale or scope.



Table 1: Distribution of Respondents according to Socioeconomic Characteristics

Variables	Frequency	Percentage	Mean
Sex			
Female	44	35.20	
Male	81	64.80	
Age			42.176
≤30	14	11.20	
31-40	39	31.20	
41-50	54	43.20	
≥51	18	14.40	
Marital status			
Single	14	11.20	
Married	105	84.00	
Divorced	2	1.60	
Widowed	4	3.20	
Household size			7.136
≤5	46	36.80	
6-10	63	50.40	
11-15	14	11.20	
≥16	2	1.60	
Education level			
No education	30	24.00	
Primary	7	5.60	
Secondary	42	33.60	
Tertiary	46	36.80	
Off-farm income			147,784
≤100000	66	52.80	
100001-200000	34	27.20	
200001-300000	15	12.00	
≥300000	10	8.00	

Source: Field survey, 2025

Profit Efficiency of Dry Season Vegetable Farming

The result of the Cobb-Douglas stochastic frontier profit model shows that there was variation in profit efficiency among the dry season vegetable farmers in the study area. Table 2 show that 44.20 % of the farmers had profit efficiency of 0.31-0.60, 27.40 % of the respondents had profit efficiency of 0.30 or less 18.60 % had 0.61-0.91 profit efficiency and 9.80 % of the farmers had profit efficiency of 0.90 or more. The average profit efficiency varied from 0.11 to 0.99 with an average profit efficiency of about 0.49.

The Cobb-Douglas stochastic frontier profit model with inefficiency effects was used in this study as it best fit the data for the study. The Maximum Likelihood Estimates for the parameters were presented in Table 3. Rent for land (0.5626725), cost of planting material (0.3587662), wages for labour (0.0434469), cost of fertilizer (0.043465), cost of pesticide (-0.1515658), cost of herbicides (0.0481057) and irrigation cost (-0.0111802) were highly significant ($P < 0.01$). The estimated value for the gamma (1.0000) and sigma square (27.96615) were all significant ($P < 0.01$) level of probability and this indicates that the profit inefficiency is significant for dry season vegetable production in the study area. The gamma parameter shows the relative magnitude of the variance in profit associated with profit inefficiency. The derived coefficients from the Maximum Likelihood Estimates represent the percentage change in the explained variable as a result of the percentage change in the explanatory variables. The significance of the gamma (at 1% level of probability) implies that the variables included in the inefficiency effects as well as the cost of production resources significantly influenced profit efficiency of dry season vegetable farming business. The independent variables included in the inefficiency effects model are; age, household size, years of education, off farm income and farm size.



The coefficient for age (-0.6509167) was negative and significant ($P < 0.01$). This means that age had decreasing effect on profit inefficiency of dry season vegetable farming in the study area during. This implies that an increase in age will result in an increase in profit efficiency of dry season vegetable production in the study area. This result disagrees with the result of Ajapnwa *et al.* (2017) who found a negative relationship between efficiency of vegetable production and age of the producers in the humid tropics of Cameroon.

The estimated coefficient for household size (1.084588) was positive and significant ($P < 0.05$). This result means that, an increase in household size will lead to increase in profit inefficiency. This result implies that profit efficiency of dry season vegetable production in the study area decreases with increase in household size. This result corroborates the findings of Mbanasor and Kalu (2008) who found a negative relationship between household size and economic efficiency of commercial vegetable production.

The study shows that, education has negative coefficient (-5.535188) and was statistically significant ($P < 0.01$). This means that education decreased profit inefficiency and increased profit efficiency of dry season vegetable farmers in the study area during. This result contradicts the result of Mbanasor and Kalu (2008) who found a negative relationship between economic efficiency and education level of commercial vegetable producers in Akwa Ibom State, Nigeria.

Table 2: Distribution of the Respondents based on Profit Efficiency

Profit efficiency	Frequency	Percentage
≤ 0.30	69	27.40
0.31-0.60	111	44.20
0.61-0.90	47	18.60
≥ 0.91	24	9.80
Maximum	0.99	
Minimum	0.11	
Mean	0.49	

Source: Field survey, 2025

Table 3: Maximum Likelihood Estimates (MLE) of the Stochastic Frontier Profit Model

Variables	Coefficient	St. Err.	t-value	p-value	Sig.
Rent for land	0.5626725	0.000138	4.13	0.000	***
Cost of seed	0.3587662	0.000389	9.24	0.000	***
Wages of labour	0.0434469	0.000279	16.98	0.000	***
Cost of fertilizer	0.043465	0.000292	15.11	0.000	***
Cost of pesticide	-0.1515658	0.000113	-13.98	0.000	***
Cost of herbicide	0.0481057	0.000900	5.32	0.000	***
Cost of irrigation	-0.0111802	0.000649	-17.43	0.000	***
Constant	4.728646	0.000012	3.19	0.000	***
Inefficiency effects					
Age	-0.6509167	0.185599	-3.51	0.000	***
Household size	1.084588	0.535738	2.02	0.043	**
Education level	-5.535188	1.342825	-4.12	0.000	***
Off-farm income	0.000539	0.000014	0.39	0.695	
Farm size	2.205026	1.7816135	1.23	0.217	
Constant	2.577625	7.738687	0.33	0.739	
Diagnostic parameters					
Sigma squared	27.96615	0.029703	31.13	0.000	***
Gamma	1.000000	0.000021	3.85	0.000	***

Source: Field survey, 2025

CONCLUSION AND RECOMMENDATION

The study concludes the dry season vegetable farming profit efficiency is low and is significantly influenced by age, household size and level of education of the farmers. Also, dry season



vegetable production in the study area is dominated by males who are still in their active age and married with household size that can supply family labour. The farmers can read and write.

Based on the finding of the study, the following recommendations are made:

- i. There is need to encourage farmers to explore alternative marketing channels such as direct sales to consumers to increase profit margins.
- ii. Farmers should be advice to consider diversifying vegetable production to include high-value crops that can increase profitability.
- iii. Training and capacity building programmes should be provided to farmers through informal education using extension agents to improve production and marketing skills of the farmers.
- iv. There is need to invest in infrastructure such as storage facilities and transportation networks to reduce spoilage and improve market access.
- v. Policies such as provision of subsidies and credit facilities should be developed to support small-scale farmers.

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