Evaluation of the Production Efficiency and Profitability of Groundnut Production in Bwari and Gwagwalada Area Councils of Abuja, Nigeria

Funso Omolayo Alabuja[1]; Hauwa Bako[2]; Beatrice Itoya Oyediji[3]; Joseph Bamidele[4]; Sennuga, S. O.[5*]

[1]Department of Agricultural Economics, Faculty of Agriculture, University of Abuja, FCT, P.M.B. 117, Abuja, Nigeria
[2]Departments of Space Enterprises, National Space Research and Development Agency. Airport Road, P.M.B 437, Abuja, Nigeria.
[3]Department of Agricultural Extension and Rural Development, Faculty of Agriculture University of Ibadan, Nigeria
[4]Faculty of Business and Law, University of Northampton, Waterside Campus, University Drive, Northampton NN1 5PH, United Kingdom
[*5]Department of Agricultural Extension and Rural Sociology, Faculty of Agriculture, University of Abuja, FCT, P.M.B. 117, Abuja, Nigeria
*Corresponding Author

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Abstract**—** *This study assessed the production efficiency and profitability of groundnut farmers in Bwari and Gwagwalada Area Councils of Abuja, Nigeria. Using a multistage sampling technique, 200 respondents were surveyed through structured questionnaires. Descriptive statistics, stochastic frontier production function, and net farm income models were applied for analysis. Results showed that 55.0% of farmers were aged 31–50 years, while 57.55% had 5–15 years of farming experience, reflecting an active and knowledgeable farming population. Education was moderate, with 40.0% having secondary education, and household sizes were large, with 57.5% reporting 6 and above members. The stochastic frontier production function indicated that farm size (0.298, t = 4.14***), seed (0.215, t = 3.16***), and labour (0.176, t = 2.98**) significantly influenced economic efficiency, while fertilizer and capital were not significant. Inefficiency variables indicated that age (–0.112, t = –2.43**), farming experience (–0.158, t = –3.04***), education (–0.092, t = –2.42**), extension contact (–0.185, t = –2.98***), and cooperative membership (–0.132, t = –2.69***) significantly reduced inefficiency, while household size and access to credit were not significant. Profitability analysis confirmed viability, with a gross income of ₦145,500/ha, total cost of ₦52,790.00, and net farm income of ₦92,710.00. The return per naira invested (RNI) was 1.76. Key constraints included high input costs (81.0%), limited credit (74.0%), pest infestation (67.5%), and inadequate extension services (60.0%). Based on the findings, the study recommended the 81.0% of farmers identified high input costs as a major constraint, policies should focus on input subsidies, group purchasing schemes, or improved distribution systems to ensure farmers can access quality seeds, fertilizer, and agrochemicals at lower prices.*

Keywords—* *Groundnut production, Economic efficiency, Profitability, Inefficiency variables.

I. INTRODUCTION

Groundnut (*Arachis hypogaea L.*) is one of the most important leguminous crops in Nigeria, valued both for domestic consumption and its role in trade. Nigeria ranks among the leading producers of groundnut in Africa, with cultivation concentrated in states such as Kano, Kaduna, Katsina, Bauchi, and Jigawa. The crop provides edible oil, protein-rich food, and serves as a key raw material for confectionery, feed, and vegetable oil industries (FAO, 2021). For rural households, groundnut is a major source of livelihood, ensuring both food security and income generation (Amare *et al.,* 2019; Idu *et al.,* 2025).Beyond nutrition, its economic relevance is evident in its contribution to Nigeria's agricultural GDP and its role in rural employment. Historically, Nigeria was a dominant player in global groundnut exports during the 1960s, though this position weakened with the oil boom, policy neglect, and structural changes in agriculture (Okonkwo & Umeh, 2020; Yunus *et al.,* 2025).Even so, groundnut remains a crop of strategic importance for industrial growth and poverty reduction.Agronomically, it improves soil fertility through nitrogen fixation, making it crucial in sustaining productivity in semi-arid regions. This dual nutritional, economic, and ecological significance underscores why groundnut continues to receive attention in agricultural development and food security strategies in Nigeria (Adeyemi *et al.,* 2025).

Despite its significance, groundnut production in Nigeria faces persistent challenges that undermine efficiency and profitability. The majority of farmers operate on a small scale, using traditional methods with limited access to improved seeds, fertilizers, and mechanization (Abu *et al.,* 2021; Joel *et al.,* 2025).As a result, yields remain far below global averages. Pest and disease infestations, especially groundnut rosette virus, along with drought and erratic rainfall, further reduce output (Olorunfemi *et al.,* 2018).Weak infrastructure and poor access to storage and markets increase post-harvest losses, while financial and institutional barriers—such as inadequate credit and limited extension services—restrict adoption of modern technologies. Market volatility adds to these problems, as smallholders often lack bargaining power and must sell at unfavourable farm-gate prices (Ogunlela & Ogunlade, 2019; Maisule *et al.,* 2025).The combined effect of these constraints is a productivity–profitability gap: farmers struggle not only to maximize efficient resource use but also to earn sustainable returns. Groundnut's potential for supporting rural incomes and national agricultural growth therefore remains underutilized, and its full economic impact is not being realized.

Although there is growing interest in agricultural efficiency and profitability research in Nigeria, studies that integrate both dimensions for groundnut farming remain scarce. Much of the existing work examines profitability using gross margin or net income analysis, or efficiency using approaches such as Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). However, few combine the two to provide a complete picture of farm performance (Shehu *et al.,* 2020; Tanko & Jirgi, 2020). Profitability alone cannot explain how effectively resources are utilized, while efficiency measures without profitability do not reveal the actual economic sustainability of farming activities. Moreover, many studies are region-specific, limiting generalization across Nigeria's diverse agro-ecological zones. Important socio-economic factors such as education, household size, farm experience, and access to credit or extension services are often overlooked, even though they significantly influence both efficiency and profitability outcomes. Given Nigeria's persistent food security challenges and rural poverty, there is a pressing need for a comprehensive evaluation that integrates production efficiency with profitability analysis. By filling this gap, the present study contributes both to the academic literature and to practical discussions on Nigeria's agricultural economy (Olaitan. *et al.,* 2025; Oyediji *et al.,* 2025).

This study aims to evaluate the production efficiency and profitability of Groundnut production in Bwari and Gwagwalada Area Councils of Abuja, Nigeria. To accomplish this, the following objectives are put forward:

a) Describe the socio-economic characteristics of groundnut farmers in the study areas.

b) Estimate the economic efficiency of groundnut production.

c) Determine the determinants of efficiency in groundnut production.

d) Estimate the profitability of groundnut production.

e) Identify the major challenges associated with the production of groundnut in the study areas.

II. LITERATURE REVIEW

2.1 Theoretical Framework:

The theoretical framework of this study is anchored on production economics and efficiency theories, which provide the analytical foundation for examining how groundnut farmers in Nigeria utilize resources and derive profitability from their farming enterprises

One of the main theoretical lenses guiding this study is Farrell's (1957) efficiency theory, which decomposes efficiency into three critical components: technical efficiency, allocative efficiency, and economic efficiency. Technical efficiency refers to the ability of farmers to obtain the maximum possible output from a given set of inputs. Allocative efficiency deals with using inputs in optimal proportions given their prices and marginal productivities, while economic efficiency integrates both technical and allocative efficiency to reflect overall resource use performance. These concepts are particularly relevant in Nigeria, where most groundnut farmers are smallholders who operate under imperfect market conditions, face high transaction costs, and have limited access to extension services, credit, and improved technologies. The framework assumes that deviations from the production frontier represent inefficiencies caused by both farm-level and institutional constraints.

Additionally, the study draws from the profit maximization theory, which emphasizes that farm households aim to maximize net returns from agricultural enterprises (Olawunmi *et al.*, 2025). Within this framework, profitability is assessed by comparing total revenue with total production costs. In the case of groundnut farming, profitability is influenced by factors such as input prices (e.g., seed, fertilizer, labor), market prices of outputs, and the efficiency with which resources are utilized. The profitability framework aligns with studies such as Abubakar & Sule (2021) and Salisu *et al*. (2024), which underscore that while groundnut farming is generally profitable, inefficiencies in production often reduce the magnitude of realized gains. By linking efficiency theory with profitability analysis, this framework enables a comprehensive evaluation of how resource allocation patterns, socio-economic characteristics of farmers, and market dynamics collectively influence outcomes in groundnut production (Mato *et al.*, 2025; Oyotomhe *et al.*, 2025).

2.2 Conceptual Framework:

The conceptual framework for this study, exploring the relationship between the independent variables and the dependent variables (production efficiency and profitability indicators of Gross margin and Net farm income) being mediated by the intervening variables. The independent variables in this study are the core factors hypothesized to influence both the production efficiency and profitability of groundnut farming, and these include socio-economic characteristics of age, education level, household size, farming experience, gender, access to extension services, access to credit as well as farm resource use of quantity of seed, fertilizer, pesticides/herbicides, labour (family and hired), and capital invested.

The intervening variables are contextual factors that can mediate influence of independent variables on production outcomes. They include access to climatic factors, pest and disease pressure, policy environment and technology adoption.

III. MATERIALS AND METHODS

3.1 Study Area:

This study was conducted in Bwari and Gwagwalada Area Councils of the Federal Capital Territory (FCT), Abuja, Nigeria. Bwari Area Council lies in the northwestern part of Abuja, covering about 914 km². It shares boundaries with Kaduna and Niger States. The area has a tropical climate with a rainy season from April to October and a dry season from November to March. Annual rainfall ranges between 1,100 mm and 1,600 mm, while average temperatures vary between 21°C and 32°C, creating favourable conditions for legume crops such as groundnut. The soils are predominantly sandy-loam and ferruginous, which support crop cultivation (Adewumi & Omotesho, 2019).

Gwagwalada Area Council is located in the southwestern part of Abuja and spans approximately 1,043 km². Positioned along the Abuja–Lokoja highway, the council enjoys strong market linkages that facilitate the distribution of agricultural produce. It experiences similar climatic conditions to Bwari, with rainfall between 1,200 mm and 1,700 mm annually and temperatures averaging 23°C to 34°C. The soil profile, dominated by sandy-loam, is highly suitable for groundnut production (Oladimeji & Abdulsalam, 2020).

Both councils are predominantly rural, and farming is the main source of livelihood. Farmers cultivate groundnut alongside maize, yam, cassava, and cowpea, with livestock rearing also contributing to household income. Groundnut production is particularly important as a cash crop for local consumption, small-scale oil milling, and animal feed. Proximity to Abuja city provides unique market opportunities, yet farmers face challenges including limited access to modern inputs, fluctuating prices, and pest infestations (Salisu *et al.*, 2024).The selection of Bwari and Gwagwalada is justified by their agricultural relevance, prevalence of smallholder groundnut farmers, and strategic location within the FCT. Their blend of rural agricultural activity and urban market access makes them ideal for evaluating production efficiency and profitability under smallholder conditions (Yusuf *et al.*, 2019).

3.2 Population of the Study and Research Design:

The population of this study comprises groundnut farmers in Bwari and Gwagwalada Area Councils of the Federal Capital Territory (FCT), Abuja. These farmers are largely smallholders who cultivate groundnut alongside other staples such as maize, yam, and cassava, relying on both family and hired labour. They were selected because of the councils' prominence in smallholder farming and the importance of groundnut as a cash and food crop in the area (FCT-ADP, 2021).The study employs a descriptive and analytical survey research design. Primary data was collected through structured questionnaires and interviews covering socio-economic characteristics, input use, and returns. Production efficiency was estimated using stochastic frontier analysis (SFA), while profitability will be assessed through gross margin and net farm income. This approach ensures a comprehensive evaluation of both efficiency and profitability of groundnut production in the study area.

3.3 Sample Size and Sampling Techniques:

A **multistage sampling technique** was adopted for this study to ensure representativeness and minimize bias in the selection of respondents. In the first stage, two Area Councils were purposively selected from the six councils of the Federal Capital Territory (Abuja Municipal, Bwari, Gwagwalada, Kuje, Kwali, and Abaji). Bwari and Gwagwalada were chosen because of their high concentration of smallholder farmers actively involved in groundnut production, as documented by the Federal Capital Territory Agricultural Development Programme (FCT-ADP, 2021).

In the second stage, wards were randomly selected from each of the councils. From Bwari, five wards including Bwari Central, Igu, Ushafa, Kuduru, and Shere were chosen, while in Gwagwalada, five wards such as Dobi, Zuba, Gwako, Paiko, and Ikwa were selected. This stage was critical in ensuring adequate geographic coverage across the study area.

The third stage involved the selection of farming communities within the sampled wards. Two farming communities were randomly chosen in each ward to capture variations in farming practices. For example, in Dobi ward of Gwagwalada, Dobi and Paikon-Kore communities were included, while in Igu ward of Bwari, Igu and Barangoni communities were selected. This provided a spread across different agricultural zones within each council.

Finally, in the fourth stage, the respondents were selected. Lists of registered groundnut farmers were obtained from farmer cooperatives, extension agents, and ADP offices. From these lists, respondents were randomly drawn using simple random sampling. To ensure balance, 100 farmers were selected from Bwari and 100 from Gwagwalada, making a total of 200 respondents. This sample size was considered adequate to capture variations in socio-economic characteristics, production practices, and outcomes among groundnut farmers in the study area.

3.4 Data Collection:

The primary instrument for data collection in this study was a structured questionnaire designed to obtain comprehensive information from groundnut farmers in Bwari and Gwagwalada Area Councils. The questionnaire covered socio-economic characteristics, input use, output levels, production costs, and marketing practices relevant to evaluating efficiency and profitability. To ensure validity and reliability, the instrument was pre-tested through a pilot study involving a small group of groundnut farmers outside the main sample. This exercise helped identify ambiguities and refine the structure and wording of questions, enhancing clarity and relevance to the study objectives. Each questionnaire session lasted about one hour, giving respondents adequate time to provide accurate responses. Trained enumerators administered the questionnaires to guide farmers in understanding the questions and to minimize response errors. This process ensured that the final instrument was well-suited to generating reliable primary data for analyzing groundnut production efficiency and profitability in the study area.

3.5 Data Analysis:

The data collected for this study were analyzed using both descriptive and inferential statistical techniques in line with the stated objectives. Descriptive statistics such as frequencies, percentages, and means were applied to address objective (i), which profiled the socio-economic characteristics of groundnut farmers, and objective (v), which identified major production constraints. For objectives (ii) and (iii), the stochastic frontier production function (SFA) was employed to estimate economic efficiency and identify its determinants among groundnut farmers. For objective (iv), the net farm income (NFI) approach was used to estimate costs, returns, and profitability in groundnut production. All analyses were conducted using the Statistical Package for the Social Sciences (SPSS v.24) and Frontier 4.1 software, which provided a robust platform for both descriptive and frontier efficiency analysis.

3.6 Model Specification:

3.6.1 Net Farm Income (NFI) Model:

Profitability was estimated using the net farm income (NFI) approach:

$$NFI = TR - TC \tag{1}$$

Where:

- NFI = Net farm income (₦)
- TR = Total revenue (₦)
- TC = Total cost of production (₦)

Depreciation of fixed assets was computed using the straight-line method:

$$D = \frac{P-S}{N} \quad (2)$$

Where:

- D = Depreciation (₦)
- P = Purchase value of asset (₦)
- S = Salvage value (₦)
- N = Useful life of asset (years)

The return per naira invested (RNI) was obtained as:

$$RNI = \frac{NFI}{TC} \quad (3)$$

3.6.2 Stochastic Frontier Production Function (SFA):

The SFA was used to analyze objectives (ii). The Cobb-Douglas frontier model is specified as:

$$\text{In}Y = \beta_0 + \beta_1 \text{ In}X_1 + \beta_2 \text{ In}X_2 + \beta_3 \text{ In}X_3 + ... + \beta_4 \text{ In}X_4 + (V_i - U_i) \quad (4)$$

Where:

- Y = Groundnut output (kg)
- β_0 = Constant term
- $\mathbf{X_1}$ = Farm size (ha)
- $\mathbf{X_2}$ = Quantity of seed (kg)
- $\mathbf{X_3}$ = Labour used (man-days)
- $\mathbf{X_4}$ = Quantity of agrochemicals (litres)
- **Vi** = Random error outside the farmer's control
- **Ui** = Non-negative inefficiency term

IV. RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of Groundnut Farmers:

The results in Table 1 show that 55% of farmers were aged 31–50 years, 25% were above 50, while 20% were 30 years or below. This indicates that most groundnut farmers are within their productive years, which enhances their ability to supply labour and adopt innovations. Rahman and Umar (2019) emphasized that middle-aged farmers are typically more productive, while younger farmers secure generational continuity in agricultural production.

Findings in Table 1 revealed that 57.5% of farmers had 5–15 years of experience, 25% had over 15 years, and 17.5% had less than 5 years. This shows that most farmers possess adequate practical knowledge, enhancing decision-making and risk management. Amaza et al. (2019) noted that farming experience is a crucial determinant of efficiency, as it promotes better input utilization and adaptation to local production challenges, ultimately improving farm productivity.The study revealed that 40% of respondents had secondary education, 27.5% primary, 20% tertiary, while 12.5% had no formal education. This demonstrates that a majority possess at least basic education, which is vital for adopting modern practices. Education enhances farmers' ability to process agricultural information and participate in training programs. Ojo and Jibowo (2018) argued that education directly influences productivity by shaping farmers' responsiveness to new technologies and extension interventions.

Results indicate that 42.5% of respondents had 1–5 members, 37.5% had 6–10, while 20% had more than 10. Household size affects labour supply and dependency ratios, with moderately large households providing farm labour and reducing hired labour costs. Idrisa *et al.* (2022) emphasized that family size plays a significant role in smallholder farming systems, particularly where mechanization is minimal, although very large households may increase consumption burdens.The analysis shows that

45% of farmers received 1–3 extension visits per season, 25% had four or more, while 30% had no contact. Agwu et al. (2018) emphasized that extension interactions help farmers enhance input use efficiency and market awareness. Limited contact among some farmers suggests institutional gaps in service delivery that could affect adoption of improved groundnut practices.

About 42.5% of respondents had cooperative membership of 5–10 years, 35% below 5 years, and 22.5% above 10 years. Bernard and Spielman (2019) found that cooperatives play a central role in reducing transaction costs and enabling smallholders to compete effectively. The prevalence of medium-term membership suggests cooperatives are important, though long-term loyalty remains relatively low in the study area.The results show that 30% of farmers accessed ₦50,000–₦100,000, 27.5% less than ₦50,000, 15% above ₦100,000, while 27.5% had no access. Credit availability is critical for investment in inputs and farm expansion, but access remains limited. Nwaru *et al.* (2021) noted that formal credit is constrained by collateral and high interest rates, compelling many smallholders to depend on informal sources, which often restricts capital availability and limits potential profitability in groundnut farming.

TABLE 1
SOCIO-ECONOMIC CHARACTERISTICS OF GROUNDNUT FARMERS (n = 200)

Variable	Freq (n = 200)	Percent
Educational level		
No formal education	25	12.5
Primary school	55	27.5
Secondary school	80	40
Tertiary education	40	20
Age		
≤ 30 years	40	20
31–50 years	110	55
> 50 years	50	25
Years of farming Experience		
< 5	35	17.5
5–15	115	57.5
> 15	50	25
Household Size		
1–5 persons	85	42.5
6–10 persons	75	37.5
> 10 persons	40	20
Cooperative Membership (years)		
< 5	70	35
5–10	85	42.5
> 10	45	22.5
Amount of Credit Received (₦)		
< ₦50,000	55	27.5
₦50,000 – ₦100,000	60	30
> ₦100,000	30	15
No Credit Access	55	27.5
Extension Visits per Season		
None	60	30
1–3	90	45
≥ 4	50	25

Source: Field Survey, 2025

4.2 Economic Efficiency and Determinants of Efficiency in Groundnut Production:

The results of the stochastic frontier production function for groundnut production in Table 2 highlight both the productive inputs that significantly influence economic efficiency and the socio-economic variables that either improve or hinder technical performance. The model is divided into three components: production function parameters, inefficiency variables, and diagnostic statistics, each of which provides valuable insights into the determinants of groundnut production efficiency.

4.3 Production Function:

The production function results highlight the critical role of land, seed, and labour in driving groundnut output. The constant term ($\beta_0 = 0.842$, $p < 0.01$) was significant, indicating a baseline productivity level. Farm size ($\beta_1 = 0.298$, $p < 0.01$) emerged as a major determinant, confirming that larger cultivated areas enhance output. This finding supports Ogundari and Ojo (2018) and aligns with evidence from Shehu *et al.* (2020), who found landholding size to be a strong determinant of efficiency among Nigerian farmers. Seed input ($\beta_2 = 0.215$, $p < 0.01$) was also significant, demonstrating that improved or sufficient seed use raises productivity, consistent with Amaza and Maurice (2019) and Abdulrahman *et al.* (2023), who emphasized seed quality as a driver of yield growth. Labour ($\beta_3 = 0.176$, $p < 0.01$) showed a positive effect, reflecting the labour-intensive nature of groundnut farming, in line with findings by Amos (2019) and Alabi *et al*. (2018).

In contrast, agrochemical use ($\beta_4 = 0.047$, $t = 1.15$) was not significant, suggesting limited or ineffective application, likely due to cost or lack of knowledge. This result echoes Olarinde (2019) and supports the view of Oyekale and Idjesa (2023) that smallholders often face financial or technical barriers in chemical use.

4.4 Inefficiency Variables (Determinants of Efficiency in Groundnut Production):

The inefficiency model reveals socio-economic factors influencing farmer performance. The significant constant term ($Z_0 = 0.564$, $p < 0.01$) confirmed the presence of inefficiency effects. Age ($Z_1 = -0.112$, $p < 0.05$) and farming experience ($Z_2 = -0.158$, $p < 0.01$) reduced inefficiency, suggesting that accumulated knowledge improves resource use, as also observed by Idiong (2020) and Rahman and Umar (2009). Education ($Z_3 = -0.092$, $p < 0.05$) improved efficiency, consistent with Bravo-Ureta and Pinheiro (2019), who reported that human capital enhances adoption of improved practices.Household size ($Z_4 = 0.025$, $t = 0.93$) was not significant, implying that larger households do not necessarily translate into effective farm labour, similar to findings by Binam et al. (2004). However, extension contacts ($Z_5 = -0.185$, $p < 0.01$) and cooperative membership ($Z_6 = -0.132$, $p < 0.01$) significantly reduced inefficiency, emphasizing the role of technical support and collective action, as highlighted by Ajibefun and Daramola (2003) and Uaiene *et al.* (2019). Credit access ($Z_7 = -0.038$, $t = -0.93$) was not significant, likely due to inadequate loan sizes or diversion of funds, consistent with Adeyemo *et al.* (2020) and Okoye *et al.* (2023).

4.5 Diagnostic Statistics:

The diagnostic statistics validate the robustness of the model. The variance parameter ($\sigma^2 = 0.084$, $p < 0.01$) confirmed its adequacy, while gamma ($\gamma = 0.743$, $p < 0.01$) showed that 74.3% of output variation was due to inefficiency rather than random noise. This finding aligns with Battese and Coelli (2019) and is consistent with Abdulai and Huffman (2018), who noted that inefficiency strongly explains productivity differences among smallholders. With a mean efficiency score of 0.71 across 200 farmers, the study indicates that producers operate at 71% of potential output, leaving 29% of productivity lost to inefficiencies, echoing similar findings by Kolawole (2024).

TABLE 2
MAXIMUM LIKELIHOOD ESTIMATES RESULTS OF STOCHASTIC FRONTIER PRODUCTION FUNCTION (ECONOMIC EFFICIENCY AND DETERMINANTS) OF GROUNDNUT PRODUCTION

Variable	Parameters	Coefficient	Standard-error	t-ratio
Production function				
Constant	β_0	0.842	0.21	4.01***
Farm size	β_1	0.298	0.072	4.14***
Seed	β_2	0.215	0.068	3.16***
Labour	β_3	0.176	0.059	2.98***
Agrochemical	β_4	0.047	0.041	1.15 ns
Inefficiency variables				
Constant	Z_0	0.564	0.187	3.01***
Age	Z_1	-0.112	0.046	-2.43**
Farming experience	Z_2	-0.158	0.052	-3.04***
Education	Z_3	-0.092	0.038	-2.42**
Household size	Z_4	0.025	0.027	0.93 ns
Extension contacts	Z_5	-0.185	0.062	-2.98***
Cooperative society	Z_6	-0.132	0.049	-2.69***
Amount of credit	Z_7	-0.038	0.041	-0.93 ns
Diagnostic statistics				
Sigma-squared	(σ^2)	0.084	0.11984	1.807***
Gamma	(γ)	0.743	0.00015	200.39***
Log likelihood function	(L/f)	-112.456	-	-
LR test		21.37	-	-
Total number of observation		200	-	-
Mean efficiency		0.71	-	-

Note: *** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level; ns = Not significant. ***Source: Field Survey, 2025***

4.6 Profitability of Groundnut Production:

The results from the cost and return analysis in Table 3 reveal that groundnut production in the study area is profitable, with a gross income of ₦145,500 per hectare. When compared with the total production cost of ₦52,040.92, the net farm income stood at ₦93,459.08, confirming that farmers generate a significant surplus from groundnut cultivation. The return per naira invested (RNI) of 1.80 implies that for every ₦1 spent on production, farmers earned ₦1.80 in return, underscoring the economic viability of the enterprise. These findings are consistent with prior studies which documented that groundnut production in Nigeria yields substantial net returns for smallholder farmers (Audu *et al.*, 2019; Yusuf *et al.*, 2020).

In terms of input distribution, labour accounted for the largest proportion of costs (66.77%), highlighting the labour-intensive nature of groundnut farming due to manual land preparation, planting, weeding, and harvesting (Alabi & Ajayi, 2019). Seed and fertilizer contributed 11.32% and 10.22% respectively, reflecting their importance in determining crop yield and quality. Agrochemicals accounted for just 4.67%, suggesting limited application compared to other crops, while the cost of land rental (6.99%) remained moderate, influenced by land tenure conditions in the area (Eze *et al.*, 2019).Overall, the profitability results reinforce groundnut's role as a viable cash crop for rural households, offering both income and livelihood security. The balance of input costs further illustrates the dominance of labour and the relatively lower financial burden of other inputs, in line with existing research on legume production systems in Nigeria (Etim et al., 2020).

TABLE 3
COSTS AND RETURNS PER HECTARE OF GROUNDNUT PRODUCTION

Variable	Average Quantity/ hectare	Value (₦)/hectare	Percentage to total cost
Gross Income (GI)		145,500.00	
Variable Inputs			
Labour	12.5	34,750.00	65.79
Seed	6.2	5,890.00	11.15
Agro-chemical	2.1	2,430.00	4.6
Fertilizer	3.4	5,320.00	10.07
Total Variable Cost (TVC)		48,390.00	91.61
Fixed Inputs			
Cost of renting land	-	3,650.00	6.91
Depreciation of tools (hoes, cutlasses, and other equipments)	-	750	1.42
Total Fixed Cost (TFC)		4,400.00	8.39
Total Cost (TVC+TFC)		52,790.00	100
Net Farm Income (NFI) = (GI – TC)		92,710.00	
Return per Naira Invested (RNI) = (NFI/TC)		1.76	

Source: Field Survey, 2025

4.7 Constraints Associated with Groundnut Production:

The results in Table 4 indicate that the most critical challenge to groundnut farmers is the high cost of inputs such as seeds and fertilizer (81%). Rising input prices significantly increase production costs and reduce profitability, while simultaneously discouraging the use of improved inputs, which limits yields and efficiency (Yusuf *et al.*, 2019). Limited access to credit (74%) further compounds this issue, as farmers lack the financial capacity to purchase modern technologies or expand operations, leading to persistent inefficiency in resource allocation (Abubakar & Sule, 2021).

Pest and disease infestation (67.5%) was another major constraint, consistent with findings by Salisu, Oseni, Luqman, and Baba (2024), who reported that pest outbreaks reduce yields and erode farmer incomes. Inadequate extension services (60%) exacerbate this problem by limiting farmers' access to improved knowledge on pest control, input use, and best practices, all of which are essential for achieving efficiency (Amaza & Maurice, 2020). Poor market prices (57.5%) also reduce profitability, as farmers often receive low returns despite high production costs, discouraging reinvestment in groundnut farming (Salisu *et al.*, 2024; Akomolafe *et al.*, 2025).

Unreliable rainfall and climate variability (51%) remain pressing challenges for rain-fed systems, reducing productivity and making groundnut farming highly risky (Yusuf *et al.*, 2019). Post-harvest challenges, such as lack of storage facilities (47.5%), lead to significant losses and force farmers into distress sales, limiting profitability. High labour costs (42.5%) also strain production budgets, particularly as groundnut farming is labour-intensive. Structural issues, such as land tenure insecurity (31.5%) and poor road infrastructure (29.5%), further constrain efficiency by limiting farm expansion, timely access to markets, and input distribution (Abubakar & Sule, 2021; Oyediji *et al.*, 2025b).

TABLE 4
CONSTRAINTS ASSOCIATED WITH GROUNDNUT PRODUCTION

Constraints	Frequency	Percentage (%)
High cost of inputs (seeds, fertilizer)	162	81
Limited access to credit	148	74
Pest and disease infestation	135	67.5
Inadequate extension services	120	60
Poor market prices	115	57.5
Unreliable rainfall/Climate variability	102	51
Lack of storage facilities	95	47.5
High labour costs	85	42.5
Land tenure issues	63	31.5
Poor road/transport infrastructure	59	29.5

Multiple Responses
Source: Field Survey, 2025

V. CONCLUSION AND RECOMMENDATIONS

This study examined the production efficiency and profitability of groundnut farmers in the study area, using socio-economic characteristics, stochastic frontier analysis, profitability estimates, and constraints assessment. The socio-economic profile of the 200 respondents showed that 55.0% were aged 31–50 years, reflecting an active farming population, while 57.5% had 5–15 years of farming experience, indicating accumulated knowledge of groundnut cultivation. Education levels were modest, with 40.0% having secondary education and 27.5% primary education, both enhancing adoption of improved practices. Household sizes were large, as 42.5% reported 1-5 members, ensuring limited access to family labour. Institutional support was weak, with only 45.0% having regular extension contact, and 57.5% accessing credit within ₦50,000–₦100,000.

The stochastic frontier production function showed varying levels of efficiency among farmers. Significant production factors were farm size (0.298, t = 4.14***), seed (0.215, t = 3.16***), and labour (0.176, t = 2.98**), while fertilizer and capital were not significant. Diagnostic statistics revealed a gamma (γ) of 0.82, showing that inefficiency explained 82% of output variation. The mean efficiency score of 0.71 indicated that farmers achieved 71% of potential output, leaving a 29% gap that could be closed through better resource use.The inefficiency model revealed that age (–0.112, t = –2.43**), farming experience (–0.158, t = –3.04***), education (–0.092, t = –2.42**), extension contacts (–0.185, t = –2.98***), and cooperative membership (–0.132, t = –2.69***) significantly reduced inefficiency, emphasizing the importance of demographic and institutional factors. However, household size (0.025, t = 0.93ns) and access to credit (–0.038, t = –0.93ns) were not significant, suggesting that these did not strongly influence efficiency differences among farmers.

Profitability analysis confirmed the economic viability of groundnut production. Farmers earned a gross income of ₦145,500 per hectare against a total production cost of ₦52,040.92, generating a net farm income of ₦93,459.08. The return per naira invested (RNI) was 1.80, showing that every ₦1 invested yielded ₦1.80 in returns. Labour dominated production costs (66.77%), followed by seed (11.32%) and fertilizer (10.22%), highlighting the labour-intensive nature of groundnut farming.Despite profitability, constraints remained. High input costs (81.0%), limited credit access (74.0%), pest and disease infestation (67.5%), and inadequate extension services (60.0%) were the most severe, while other challenges included poor market prices (57.5%), climate variability (51.0%), lack of storage (47.5%), high labour costs (42.5%), land tenure issues (31.5%), and weak road infrastructure (29.5%).

Based on the findings of the study, here are recommendations, derived from the data and analysis:

1. Since 81.0% of farmers identified high input costs as a major constraint, policies should focus on input subsidies, group purchasing schemes, or improved distribution systems to ensure farmers can access quality seeds, fertilizer, and agrochemicals at lower prices.

2. With 74.0% of respondents citing limited credit as a barrier, there is a clear need for farmer-friendly credit schemes with flexible repayment plans. Targeted microfinance tailored to smallholder groundnut farmers could enable timely purchase of inputs and adoption of efficiency-enhancing technologies.
3. Inadequate extension contact (60.0%) significantly influenced inefficiency. Investment in extension networks, training programs, and ICT-driven platfos will provide farmers with timely knowledge on modern production practices, pest management, and resource use.
4. Cooperative participation was shown to significantly reduce inefficiency. Encouraging farmers to join or form groundnut cooperatives can improve bargaining power, facilitate bulk input purchases, and enhance access to markets and credit.

Labour accounted for 65.79% of production costs, and 42.5% of farmers reported high labour expenses as a constraint. Mechanization support through affordable tools or farmer cooperatives can reduce labour intensity and enhance efficiency in groundnut farming.

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