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Profit Efficiency in Groundnut Oil Processing among Women within Zuru Emirate of Kebbi State, Nigeria

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Abstract

This study analyzed the profit efficiency of women groundnut oil processing in Zuru Emirate of Kebbi State, Nigeria, focusing on socio-economic characteristics, stochastic frontier profit efficiency, determinants of inefficiency, and constraints affecting processors. Primary data were collected from 153 women processors using a multi-stage sampling technique across four Local Government Areas: Zuru, Danko-Wasagu, Sakaba, and Fakai. Data were analyzed using descriptive statistics, Net Farm Income (NFI), and the Cobb–Douglas Stochastic Frontier Profit Function. The socio-economic results revealed that 82.3% of the processors were within the economically active age group of 21–50 years, while 62.1% were married. About 35% had 6–10 years of processing experience, and 49% had household sizes of 1–5 members, suggesting availability of family labour for processing activities. The cost and return analysis showed that variable costs accounted for 88.10%, 87.93%, and 87.05% of total cost during the peak, lean, and off seasons respectively. Groundnut seed constituted the largest proportion of production cost, representing 65.20%, 66.92%, and 69.15% across the three seasons. Net Farm Income was ₦7,099.50 during peak season, ₦5,537.92 during lean season, and ₦5,258.82 during off-season, indicating higher profitability during the peak season. The stochastic frontier results indicated that groundnut seed price was positive and highly significant ($p < 0.01$) with coefficients of 0.549, 0.685, and 0.631 across seasons, while labour cost also significantly influenced profit efficiency (0.211, 0.124, and 0.135). Cooperative membership (0.876; 9.645; 7.460) and credit access (0.002) significantly influenced inefficiency. Major constraints included difficulty accessing credit (83.2%), high seed cost (70%), input/output price fluctuation (60%), high machine cost (50%), high transportation cost (50%), and poor electricity supply (46%). The study concludes that improving credit access, processing technology, and rural infrastructure will enhance profit efficiency and livelihoods of women processors.

Keywords: Efficiency, Groundnut, Profitability, Processing, Oil, Women and Zuru.

1. Introduction

Processing of agricultural products is generally accepted as the efficient method of maintaining the shelf-life of produce. Such processed products provide local foods for consumption among the rural population [29]. Hence, the importance of crop processing industries especially in Nigeria cannot be over emphasized. Major crops processing include beans, sesame, cashew nuts, cassava, cocoa, groundnuts, gum arabic, kola nut, maize (corn), melon, millet, palm kernels, palm oil, plantains, rice, rubber, sorghum, soybeans and yams [22]. Out of these various crops, women are highly involved in production of some and processing of others (International Crops Research Institute for the Semi-Arid Tropics [17].

Groundnut (*Arachis hypogea L.)* otherwise called peanut, monkey nut, gobber pea and *Arachide* belongs to the family *Leguminosea*. It originated from South America, but is now widely cultivated throughout the tropical, sub-tropical and temperate countries, and in Africa, Asia, North and South America. Optimum mean daily temperature to good growth is 300^0C and growth ceases at 150^0C and cool temperature delay flowering [3].

Women make essential contributions to the agricultural and rural economies in all developing countries [28]. Their roles vary considerably between and within regions and are changing rapidly in many parts of the world, where economic and social forces are transforming the agricultural sector [28].

Rural women often manage complex households and pursue multiple livelihood strategies. Their activities typically include producing agricultural crops, tending animals, processing and preparing food, working for wages in agricultural or other rural enterprises, collecting fuel and water, engaging in trade and marketing, caring for family members and maintaining their homes [11]. Many of these activities are not defined as "economically active

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employment" in national accounts but they are essential to the well-being of rural households [10].

In Nigeria, the processing of groundnut into various products is done mostly by women either for home consumption or for commercial purposes [14]. The most common commercial products of groundnut are: groundnut oil, groundnut cake and fried peanuts which are sold at market places or hawked on the streets [21].

Despite the dominant and important role women play in agricultural activities in the country, they are hardly given any attention in the area of training and/or visitation by extension agents with improved technologies. Banks hardly grant them loans and they are hardly reached with improved seeds, fertilizer and other inputs [6]. In most societies, gender inequities on resources and market tend to limit women's ability to engage in agricultural trade to complement economic gains [21]. Despite the constraints to produce high quality products due to inefficient of technology inputs, resources, and information among women processors and marketers, the demand for traditionally processed raw material continues to predominate in most developing countries [13] Regardless of women's poor economic background, lack of skills to cope with the competing pressures from their domestic responsibilities, time constraints, fewer marketable skills, and domestic child care responsibilities that make women strive to small-scale economic spheres, mostly characterized by vicious cycle of low investment, low productivity, low incomes earning, and low contributing to social wellbeing and food security. Under certain circumstances, seasonal price variability may also translate into seasonal variation in (food) consumption [7].

The price of groundnut seed is not stable throughout the months of the year, peak season of groundnut start from the month of October that is the harvesting time to the month of January, post-harvest time where the groundnut seed is available and affordable in the market at low price, at this period more women engaged fully in to the groundnut processing venture [21]

In lean season the price of groundnut shoot up, that is the period from February to the month of May and at this period competition set in between the groundnut processors and the farmers who are willing to buy and plant for next production season, due to the increase in price of groundnut seed, participation of women groundnut processors reduces and many engaged in to other venture such as farming, animal rearing [1].

Off season of groundnut processing start from the month of June to the month of September, in this period, the price of groundnut seed rises thereby affecting the participation of women processors as they engaged themselves in one venture or the other. Though many studies has been conducted on profit efficiency which analyses the groundnut enterprise [16] study profitability analysis of Groundnut processing in Maiduguri Metropolitan Council of Borno State, Nigeria, [15] study an evaluation of Groundnut processing by women in a rural area of North Central Nigeria, [21] study Economic analysis of groundnut processing and it effect on poverty level of the processors in Zamfara State Nigeria, however, not much attempt has been made to analyze profit efficiency in groundnut oil processing among women within Zuru Emirate of Kebbi. It is against this background that this research was conducted to analyze the profit efficiency in groundnut oil processing among women within Zuru Emirate of Kebbi State, Nigeria.

In order to close this gap, this research focus on the profit efficiency in groundnut oil processing among women within Zuru Emirate of Kebbi State. Computing profit efficiency will constitute a more important source of information for policy marker than potential vision offer by analyzing profit efficiency [20].

Groundnut, an important oil seed crop, provides significant sources of cash through the sales of seed, cakes, oil and haulms. Groundnut plays an important role in the diets of rural populations. Groundnut processing is one of the major activities of the rural people within Zuru Emirate. of Kebbi State. Hence it is a source of livelihood for many women such as groundnut processors, groundnut farmers, marketers, transporters, etc. transformation of groundnut industry through processing would enhance the overall economic development through the income and employment generation in the rural economy of women within Zuru Emirate. Generating information on efficient method of groundnut processing helps in alleviating the problems encountered by the processors as well as improves their standard of living. Such data on groundnut processing provide information on the profitability and profit efficiency of the enterprise and guides the processors on whether or not to embark on groundnut processing investments.

The result of the study might provide essential information needed by agricultural development planners, government agencies, policy makers, and social platform on the potentials and problems involved in groundnut processing in the study area; the research also served as a reference material for further research work.

2. Methodology

2.1. Study Area

Zuru Emirate is located in South-eastern part of Kebbi State within longitude 5°14¹5.78 'E and latitude 11° 26¹6.79 'N [25] It has an area of 41,855 km^2 and a population of 3,238,628. It is bordered to Anka Local Government Area of Zamfara State to the North, to the South West by Rijau Local Government Area of Niger State and West by Koko - Besse Local Government Area. The climate lies within the tropical Sudan savannah, the minimum temperature of the area ranges from 15°- 24° C while the maximum ranges from 32°- 39°C, with the annual rainfall ranging from 560 - 1300mm. The first rain fall usually beings from April and last for five (5) to six (6) months [4].

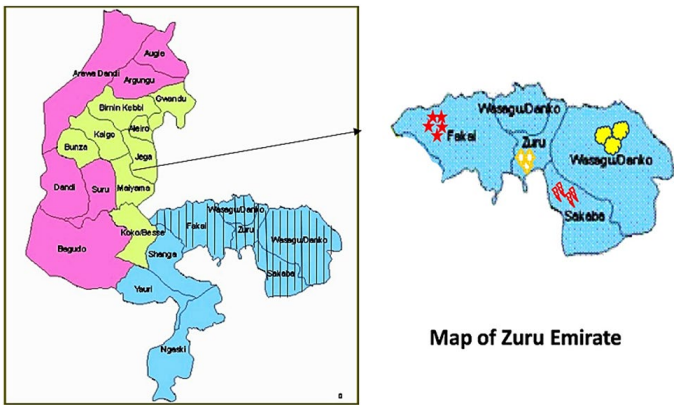

Fig 1: Map of Kebbi State showing Zuru Emirate

2.2. Sampling Technique and Sample Size

Multi – stage sampling technique was employ in the data collection within the four Local Governments of Kebbi State: namely; Zuru, Danko - Wasagu, Sakaba and Fakai Local Governments.

Sampling Plan

L.G.A.	District	Village	No. of women processors	Proposed Sample (20%)
Zuru	Senchi	Senchi	23	5
		Bahago	17	3
	Dabai	Dabai Dabai	149	30
		DabaiDoruwa	74	15
Danko – wasagu	Waje	Tungan gaya	23	5
		Waje	32	6
	Kanya	Rafin Gora Gommawa	23 32	5 6
Sakaba	Sakaba	Sakaba Wangachi	77 23	15 5
	Dirin Daji	Dirin Gari Mazamaz	93 37	19 7
Fakai	Bajida	penin Amana Penin Gaba	18 11	4 2
	Fakai	Mahuta Doro	83 44	17 9
Total	8	16	784	153

Source: *Field survey, 2025*

2.3. Data Collection

Both primary and secondary data were used which includes (Journal, text book, internet, conference proceedings and other publication) were used for the research. Primary data was collected through the use of structured questionnaires which were used to provide information on the socio-economic characteristic of women groundnut oil processors such as age, marital status, educational level, years of experience and household size. Other information sourced include prices of both inputs and output in groundnut oil processing at peak, off and lean season and problems encounter in groundnut oil processing were also identify.

2.4. Analytical Technique

The following analytical tools were used for the study, which include: Descriptive statistics, Net Farm Income and Stochastic Frontier Profit Function Model.

i). Descriptive Statistics

Descriptive Statistics such as Frequency, mean, standard deviation and Percentage was used to achieve objective (i) and (v)

ii). Net Farm Income Analysis (NFI)

The technique was used to analyze objective (ii). The budgeting analysis involves operations leading to estimation of gross revenue and total cost for the same production period.

iii). Stochastic Frontier Profit Function

The Cobb-Douglas stochastic frontier profit function was used to examine the profit efficiency and in analyzed the determinants of profit efficiency among women groundnut oil processors. The stochastic frontier profit function in the double log (Cobb- Doglass) is specified in explicitly as:

$\ln \pi = \beta_0 + \beta_1 \ln P_1 + \beta_2 \ln P_2 + \beta_3 \ln P_3 + \beta_4 \ln P_4 + \beta_5 \ln P_5 + \beta_6 \ln P_6 + \beta_7 \ln p_{7+} V_i + U_i$

Where;

$\ln\pi$ = Revenue (N)

$\ln P_1$= natural log price of groundnut (N)

$\ln P_2$= natural log for wage of labor (N)

$\ln P_3$= natural log for price of firewood (N)

$\ln P_4$= natural log for price of grinding (N)

$\ln P_5$ = natural log for price of transportation (N)

$\ln P_6$ = natural log for prices of ingredients (N)

$\ln P_7$ = natural log for depreciation on equipment's (N)

lnZ = natural log for depreciated charges on processing equipment's (years)

Ej error term defined as $v_i + u_i$ …….. (2)

V_i = are random variables which are assumed to be independent of U_i, identical and normally distributed with zero mean and constant V variance N $(0, \sigma^2 v))$]

U_i = which are non-negative random variables which are assumed to account for profit inefficiency in processing and are often assumed to be independent of V_i such that U_i is the non - negative truncated (at zero).

U_i is defined as:

$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_{5+} \delta_6 Z_{6+} \delta_7 Z_7$

Where:

U_i = Profit Inefficiency

Z_1 = Age (years)

Z_2= Marital status (dummy variable: married= 1, single = 2 Divorce= 3 and widowed = 4)

Z_3= Education (years)

Z_4 = Experience in groundnut oil processing (Years)

Z_5 = House hold size (Number)

Z_6 = Years of membership (Dummy variable; 0 for non-member, 1 for member)

Z_7 = Credit worth (N)

$\delta_0 - \delta_7$ = Parameters to be estimated

***A-priori* Expectation on Model Variables**

P_1 = Cost of groundnut (N): This is expected to have both positive and negative impact on profit efficiency. If the cost is high profit efficiency will be negatively affected and if the cost is low profit efficiency will be positively affected.

P_2 = Cost of labor (N): This involved both family and hired labor. It is assumed to have a negative impact on profit efficiency, too much labor affect profit.

P_3 = Cost of firewood (N): This is assumed to have both positive and negative influence on profit efficiency. If the cost is high it will have a negative impact on profit efficiency and

if the cost is low, it is expected to have a positive impact on profit efficiency.

P_4 = Cost of grinding (N): It is expected to influence profit efficiency negatively.

P_5 = Cost of transportation (N): This is assumed to have a negative effect on profit efficiency. If the cost is high, profit efficiency will be affected negatively.

P_6 = Cost of spices: It is assumed to have a negative impact on profit efficiency.

P_7 = Depreciation on equipment's: This involve depreciation on frying pan, mortar and pistil, gallons, drums, bottle, basin and processing machine. It is expected to have a negative influence on profit efficiency.

Z_1 = Age: This is the age of the respondents. It is expected to have a negative influence on inefficiency like in old age.

Z_2 = marital status: This is expected to play a significant role on inefficiency on profit efficiency.

Z_3 = Education: This is the number of years spent on western education. It is assumed to have a negative impact on inefficiency.

Z_4 = Experience: This is the year spent on groundnut oil processing. It relate positively to inefficiency.

Z_5 = House hold size: It refers to the number of person in the family and it is expected to have a positive impact on profit efficiency.

Z_6 = Years of membership: It is expected to relate positively to inefficiency.

Z_7 = Credit worth (N): It is expected to relate positively to inefficiency. Those that are credit accessed are assumed to perform better than those that are not credit accessed

3. Results and Discussion

The socio-economic characteristics of the respondents and distribution, on the basis of age, marital status, household size, educational level and years of experience were presented in Table 1.0. 82.3% of the women groundnut oil processors are within 21-50 years which account for the majority of women ground nut oil processors in the Zuru emirate, 62.1% of women groundnut oil processors were married, while 12.4 and 7.2% were divorce and widowed respectively.

Table 1: Socio-economic Characteristics of Groundnut Oil Processors in the Study Area

Age	Frequency	Percentage
11-20	14	9.20
21-30	39	25.50
31-40	49	32.00
41-50	38	24.80
51-60	9	5.90
61-70	4	2.60
Marital Status		
Single	28	18.30
Married	95	62.10
Divorced	19	12.40
Widowed	11	7.20
Educational Level		
Quranic	40	26.10
Primary	24	16,00
Secondary	34	22.20
Adult education	21	8.00
Tertiary education	12	14.00
Years of Experience		
1-5	29	19.00
6-10	53	35.00
11-15	25	16.00
16-20	22	14.00
21-25	10	7.00
26-30	4	9.00
Household Size		
1-5	75	49.00
6-10	67	44.00
11-15	9	6.00
16-20	2	1.00
Total	153	100.00

Source: *Field Survey, 2026*

This study examined the seasonal variation in costs and returns in groundnut oil processing across peak, lean, and off seasons. The findings provide insight into input cost structure, revenue fluctuations, and profitability dynamics within small-scale agro-processing enterprises.

Table 2: Average cost and returns analysis in groundnut oil processing across season

Variable Cost	Peak			Lean				Off	
	Average	Total	Percentage	Average	Total	Percentage	Average	Total	Percentage
Ground seed	888.16	13591.25	65.20	9022.88	138050	66.92	10349.15	1543420	69.15
Labor	1263.86	193370.00	9.30	1263.86	193370	9.37	126.86	193370	8.66
Fire wood	497.17	76070	3.65	400.33	6125	2.97	314.64	481.40	2.16
Grinding	951.21	145541	7.00	767.10	117366	5.69	631.69	96648	4.33
Transport	147.03	22495	1.08	147.03	22495	1.09	147.03	22495	1.01
Ingredient	254.38	38920	1.87	254.38	38920	1.89	254.38	38920	1.74
TVC	11996.87	183552	88.10	11855.56	1813901	87.93	12960.74	1982993	87.05
Fixed cost									
Gallon	199.20	30481	1.46	199.20	30481	1.46	199.20	30481	1.46
Jerry can	230.70	35059	1.68	230.70	35059	1.68	230.70	35059	1.68
Basin	224.60	34685	1.65	224.60	34361	1.65	224.60	34685	1.65
Frying pan	201.00	30685	1.65	201.00	30685	1.47	201.00	30685	1.47
Mortal and pistle	81.10	12406	0.60	81.10	12406	0.60	81.10	12406	0.60
Frying machine	58.00	8871	0.43	58.00	8871	0.43	58.00	8871	0.43
Oil separating machine	82.90	12678	0.60	82.90	12678	0.60	82.90	12678	0.60
Perforating spoon	119.90	18340	0.88	119.90	18340	0.88	119.90	18340	0.88
Colander	56.50	8640	0.40	56.50	86.40	0.40	56.50	8640	0.40
Turning stick	44.20	6760	0.30	44.20	6763	0.30	44.20	6760	0.30
Grinding machine	161.40	24700	1.20	161.40	24700	1.20	161.40	24700	1.20
Bowel	85.00	1300	0.60	56.50	8640	0.40	85.00	1300	0.60
Chooping board	9.80	3030	0.15	9.80	3030	0.15	9.80	3030	0.15
Knife	65.40	10006	0.48	65.40	10006	0.48	65.40	10006	0.48
TFC	1627.56	249017	11.90	1627.56	249017	12.07	1627.56	249017	12.95
TC= TVC+TFC	13624.43	2084538	100.00	13483.12	2062918	100.00	14588.30	2232010	100
Revenue									
Yi	11483.99	175705	55.41	10254.54	1568950	53.91	9939.87	1520800	50.08
Yii	9240.00	1413720	44.59	8766.47	1341270	46.09	9907.12	1515810	49.92
GR = Yi +Yii	20723.99	317077	100.00	19021.21	2910220	100	19847.12	3036610	
NFI = GR-TC	7099.50	1086232		5537.92	847302		5258.82	804600	

Source: *Field Survey, 2026*

Table 3: Maximum likelihood of Cubb-Douglas Stochastic Frontier Profit Function across season

	Peak			Lean			Off		
Variable	**Coefficient**	**Standard error**	**t-ratio**	**Coefficient**	**Standard Error**	**t-ratio**	**Coefficient**	**Standard Error**	**t-ratio**
P0	2.111***	0.423	4.993	1.181***	0.394	4.614	1.964***	0.438	4.485
P1	0.549***	0.105	5.211	0.685***	0.062	11.136	0.631***	0.057	11.050
P2	0.211***	0.029	7.220	0.124***	0.043	2.902	0.135***	0.044	3.046
P3	0.134**	0.054	2.494	0.068	0.047	1.447	0.032	0.049	0.653
P4	0.019	0.038	0.504	-0.055	0.047	-1.170	0.115**	0.052	2.219
P5	0.022	0.074	0.269	0.034	0.046	0.740	-0.009	0.048	-0.188
P6	0.041	0.053	0.769	0.011	0.006	0.302	-0.005	0.034	-0.147
P7	0.014	0.058	0.241	0.100*	0.053	1,900	0.049	0.050	0.980
$\delta 2$	0.063***	0.007	9.530	0.286***	0.059	4.849	0.066***	0.018	3.756
γ	0.011	0.355	0.031	0.837	0.055	15.209	0.188	0.204	0.920
Log likelihood	-5.002			-14.164			7.468		

Source: *Computer from MLE result ** and *** denote significance at p> 0.05 and p > 0.01 level respectively.*

The estimated inefficiency effects of groundnut oil processing across peak, lean, and off seasons demonstrate seasonal heterogeneity in technical inefficiency drivers, consistent with broader agricultural literature showing that efficiency is sensitive to production environment and constraints (e.g., input availability, climate variability, and technology adoption)

Table 4: Inefficiency effect in groundnut oil processing across season

	Peak			Lean			Off		
Variable	**Coefficient**	**Standard Error**	**t-ratio**	**Coefficient**	**Standard Error**	**t-ratio**	**Coefficient**	**Standard Error**	**t-ratio**
Z0	0.181**	0.089	2.032	-0.028	0.651	-0.043	0.220	0.236	0.932
Z1	-0.009	0.100	-0.868	-0.051	0.040	-1.288	-0.025	0.023	-1.111
Z2	0.007	0.162	0.457	-0.096	0.095	-1.007	0.047	0.037	1.288
Z3	0.008	0.190	0.415	-0.095*	0.054	1.745	0.032	0.026	1.217
Z4	0.120	0.147	0.823	-0.019	-0.013	-1.496	-0.322	0.511	-0.630
Z5	0.568	4.177	0.136	-0.025	-0.058	-0.429	-0.025	0.025	-0.989
Z6	0.876***	0.099	8.840	9.645***	2.410	4.004	7.460***	2.139	3.487
Z7	0.000	0.000	1.000	0.002***	0.005	3.475	0.002***	0.000006	3.333

Source: *Computer from MLE result ** and *** denote significance at p> 0.05 and p > 0.01 level respectively*

The distribution of constraints among women groundnut oil processors reveals that financial and market-related barriers dominate the processing value chain, with strong seasonal implications for production efficiency and income stability.

Table 5: Distribution of constraint encountered among the women groundnut oil processors across season in the study area.

Constraint	Frequency	Percentage
Difficulties in credit worth	127	83.20
High cost of seed	107	70,00
Fluctuation of price of input and output	92	60,00
High cost of processing machine	77	50,00
High cost of transportation	77	50,00
Poor electricity supply	10	46.00

4. Discussion

The predominance of processors within the economically active group (21–50 years) aligns with research showing that middle-aged adults dominate value-adding agricultural enterprises due to a combination of labour capacity and accumulated experience [19, 5] However, unlike some studies that emphasize age as a stable predictor of enterprise performance, our efficiency analysis shows that age alone does not neutralize seasonal inefficiencies, underscoring that demographic variables interact with market conditions in shaping outcomes.

The finding that 62.1% of respondents are married supports existing work linking marital status to enhanced access to family labour and income stability [22, 2] This supports the Sustainable Livelihood Framework's assertion that household structure functions as a social asset [24]. However, our evidence diverges from some studies that report a uniformly positive effect of larger households. While family labour can reduce wage costs, it may also increase dependency burdens, suggesting that larger households can have both productive and liability effects, depending on intra-household resource use and consumption patterns.

Education levels also present a nuanced picture. In line with Human Capital Theory, education is expected to enhance managerial capacity and technology adoption. While our results modestly agree with [26] and [23] that education benefits entrepreneurial performance, the persistence of inefficiency during lean and off seasons suggests that education alone cannot offset structural market constraints. This divergence underscores that structural rather than purely human-capital limitations—such as access to finance, infrastructure, and technology—are more binding in determining seasonal efficiency.

The cost composition, where variable costs constitute over 87% of total cost, supports [12] and [27] findings of labour and input dominance in small-scale agro-processing. The heavy dependence on groundnut seed costs, rising to nearly 70% in off season, agrees with broader agrifood systems research on commodity price volatility and its impact on profitability [5]

Seasonal net farm income declines also concur with [19] who emphasize how limited storage and working capital amplify seasonal profit instability. Thus, this study agrees with classical production cost theory showing that enterprises with high variable cost dependence are especially vulnerable to input price fluctuations.

During peak season, profit efficiency approaches 99%, implying minimal allocative or technical inefficiency under favourable market conditions. This finding contrasts with some studies that document persistent inefficiency even at peak output (e.g., processing studies in other African food sectors), suggesting that conditional efficiency may arise when supply and demand align. Lean season efficiency (62%) reflects substantial inefficiency, consistent with agribusiness studies reporting underutilized capacity and fixed cost burdens during low-output periods [8]. This supports the view that structural inefficiencies intensify when production and market demand are low. Off season moderate efficiency reflects the coexistence of structural constraints and cost pressures.

The significant role of structural inefficiency echoes recent empirical research in groundnut processing. A recent study on adoption of improved processing technology among rural women in Kebbi State, Nigeria, highlights that credit access, technology cost, and market constraints strongly influence the uptake of mechanized processing methods [9]. This supports our finding that structural limitations—rather than individual managerial capacity are core drivers of inefficiency.

While this study agrees with recent literature on the importance of household labour and cost structure influences [27, 12], it also highlights seasonal variability in efficiency that many empirical studies have not explicitly documented. Most prior research examines efficiency as a static phenomenon, but our data demonstrate that capacity utilization and profitability fluctuate significantly across seasons, with structural constraints exhibiting stronger effects during lean periods.

Moreover, while studies like those in Ghana and Kebbi State confirm the positive effects of processing infrastructure and technology adoption, our results extend this by linking these structural factors directly to seasonal profit efficiency not just productivity or income.

Therefore, the findings do not merely replicate existing knowledge; they critically contribute to understanding how

temporal market conditions and structural barriers interact to shape efficiency outcomes among women groundnut oil processors. This offers a more dynamic interpretation than studies that examine constraints in isolation or without consideration of seasonal performance metrics.

5. Conclusion

The results underscore the need for interventions that address structural inefficiencies such as improved access to affordable credit, mechanization, storage facilities, and rural infrastructure particularly during lean seasons. Seasonal targeting of policies may yield better efficiency outcomes than static interventions that ignore temporal variations in market conditions and enterprise performance.

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Abbreviations

FAO: Food and Agriculture Organization of the United Nation
GR: Gross Rvenue
NFI: Net Farm Income
TFC: Total Fixed Cost
TVC: Total Variable Cost
%: Percentage
N: Naira

Author Contributions

Ishaya, Rahila 1: Conceptualization, Resources, Data curration, formal analysis, methodology writing original draft
Yushau Hassan: Validation, writing review and editing
Ngaski Abubakar Abdullahi: Supervision, validation writing and editing
Gona Ayuba: Data curration, investigation, writing review and editing

Conflicts of Interest:

The Authors declare no conflicts of interest

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