MODELING PROFIT EFFICIENCY OF SMALL SCALE GROUNDNUT FARMS IN NIGER STATE, NIGERIA: A STOCHASTIC PROFIT FRONTIER APPROACH

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ABSTRACT
Revamping and reviving groundnut pyramids in Nigeria has been a topical issue of discuss in the current political dispensation due to global crash in oil prices which has adversely affected the revenue base of the country. The best and most effective pathway for the country to regain its lost lead position in terms of production and export of this commodity among the comity of nations is to improve productivity of this crop through efficient utilization of scarce resources. This research empirically measure profit efficiency on small-scale groundnut farms in Niger State of Nigeria using cross sectional data obtained from 120 active farmers drawn through a multi-stage sampling technique. Results showed an active working population with a sustainable household size which lack formal education (western) and have poor resource base which affect their productivity, thus, resulting in marginal profit. The empirical results revealed presence of profit inefficiency effects in groundnut production as indicated by the significant estimated gamma coefficient and the generalized likelihood ratio test results obtained from the data analysis. However, findings indicated that 27.4% of profit loss was due to conglomeration of technical, allocative and scale inefficiencies. Thus, opportunities still exist for these producers to increase their efficiencies by improving on the aforementioned combined efficiencies. The study recommends efficient allocation of farm resources; sustainable household size and literacy level enhancement which would not only reduce inefficiency, but also minimize profit loss incurred by groundnut producers in the studied area.

Keywords: Profit efficiency; SPF; Groundnut production; Small scale; Niger State; Nigeria

INTRODUCTION
In spite of Nigeria's fertile soils, large expanse of arable land as well as suitable climatic factors, all of which favours groundnut production, the nation's output has declined over the years, thereby losing its leading position to countries like China and the United States of America that have invested immensely in both institutional and market organizations that linked the farmers to markets. Also, these countries were able to meet the new strict sanitary and phytosanitary requirements, particularly for Aflatoxin, which is a serious food toxin (FMARD, 2011). In Nigeria groundnut is a rich source of protein which is an important diet in most homes today and unfortunately the domestic production of groundnut has not met the demand thereby affecting food security. The food problem in the country has been worsened by low level of resource productivity in recent time which leads to low profit efficiency. However, the gap between demand and supply of agricultural products in Nigeria has been on the increase since focus shifted away from agriculture to other sectors of the economy.

Taphee *et al*.,(2015) reported that groundnut production in Nigeria is dominated by small scale farmers cultivating between 1-3 hectares of farms often using traditional tools; and earning not appreciable incomes. Furthermore, he stated that due to limited capacities of these small scale farmers their outputs are usually low and their productivities have remained below optimum of 2 tonnes per hectare. This calls to question the efficiency of use of available technologies by groundnut farmers in the country. An underlying premise is that if farmers, most especially the small scale category, are not efficient in the use of existing technologies, then efforts designed to improve efficiency would be more effective than introducing new technologies as a way of improving output (Taphee *et al*., 2015). The increase in groundnut consumption as a good source of protein and its cultural and religious acceptability are an indication that groundnut farmers must live up to expectation of meeting the local demand. And to achieve this; efforts must be taken to investigate the productive efficiency of the groundnut farmers in the country, using profit efficiency that is based on perfect competitive market. Profit efficiency is a wider concept than cost efficiency since it takes into account the effect of the choice of a certain vector of production both on cost and on revenues, thus offering

complementary information useful for the analysis of groundnut farming efficiency.

In Niger State the crop is a principal commodity produced by majority of household, hence output increase is an important step towards achieving food self-sufficiency within the state. With the risen population in the state, there is need to match the gap given that groundnut is an important crop for realizing this dream due to its nutritional and industrial benefits. However, it appears that groundnut farmers in the state are not getting maximum return from the resources committed to the enterprise as a result of low yield which has led to low returns that accrued to them from marketed surplus. Furthermore, based on literatures there is little or no attention devoted to analyzing the profit efficiency of groundnut farmers even though prices of output and input are known, which if researched will enhance profit efficiency which will lead to greater benefits for groundnut farmers. With this trend, onus lies on researchers to investigate the factors that reduce profit from groundnut production in the state. Therefore, the aim of this paper is to contribute towards better understanding of small scale groundnut farmers' production efficiency in Niger State with a view of predicting profit efficiencies applying stochastic frontier profit function, giving that past studies adopted traditional response function [e.g Ani *et al.*(2013); Girei *et al.*(2013)] and the few which used Stochastic frontier exclusively focused on technical efficiency (Taphee *et al.* 2015). The broad objective was to investigate profit efficiency of small-scale groundnut production in Niger State of Nigeria. The specific objectives were to:

i. describe the socio-economic characteristics of groundnut farmers in the study area;
ii. evaluate income distribution among groundnut producers in the study area;
iii. estimate costs and returns for groundnut production in the study area;
iv. determine profit efficiency and attendant risks factors influencing profit efficiency in the study area; and,
v. identify the militating factors affecting the production of this crop in the study area.

RESEARCH METHODOLOGY

Niger state code named power state and famous for production of food crops in Nigeria, is the largest in terms of landmass in the country. The ecological location of the state is guinea savannah zone while the geographical location is North-central otherwise called middle belt, and stretches between latitudes 8°20'N and 11°30'N of equator and longitude 3°30'E and 7°20'E of the Greenwich Meridian. The state enjoys luxuriant vegetation with vast Northern Guinea savannah found in the North while the fringe around Mokwa in Southern Guinea savannah which favours cultivation of arable crops and livestock production. Primary occupation of the majority of the inhabitants is farming while secondary occupations are small agribusiness, petty traders, artisanal, civil servants and *ayuverda* medicine. The study adopted multi-stage sampling technique to collect cross sectional data on small-scale groundnut farms in the state. The first stage involved convenient selection of one out of the three Agricultural zones available in the state, namely, Kuta zone due to costs and time constraint of the researcher. The second stage involved purposive selection of two LGAs, namely, Shiroro and Chanchaga due to their comparative advantage in cultivation of groundnut. The third and last stage introduced random sampling techniques to select three villages from each LGA and twenty active producers from each selected village, respectively, thus, given a total sample size of 120 respondents. Instrument of data collection was structured questionnaire coupled with interview schedule keeping in view input-output data of the farmers defined within cost content. Both descriptive and inferential statistics were used to analyze the data collected. Objective i and v; ii; iii; and, iv were achieved using descriptive statistics, Gini coefficient in conjunction with Lorenz curve, cost concepts and income measures, and, stochastic frontier profit function, respectively.

Empirical model

1. **Gini Coefficient:** It is a statistical measure of dispersion developed by an Italian statistician named Corrado Gini and published in his paper "variability and Mutability" (Italian: *Variabilitae mutabilita*). The Gini index is defined as a ratio of the areas on the Lorenz curve. The formula is specified as follows:

G = A/0.5 = 2A=1-2B …….. (1)

2. **Cost concepts and Income measures**

Cost concepts and income measures are widely used because of their relevance in decision-making process. This means that these costs serve as a basis to expand the size of the farm, to buy the requisite capital assets in the long run and the requisite inputs in the short run. The researchers re-modified the cost concepts developed by Subba *et al.*,(2016) and Dr. Sen's committee report (1979), and are specified below:

a. **Cost Concepts**: Costs related to groundnut production are split up into various cost concepts such as A, B, C and D

Cost A_1: Total Variable costs (Explicit costs)
Cost A_2: Total Variable cost (Economic cost)
Cost A_3: Total cost (Explicit costs)
Cost A_4: Total cost (Economic cost)
Cost B_1: The following items are included in Cost B_1

Wages of hired labour

Wages of permanent labour
Market rate of fertilizer and manure
Market rate of seed
Imputed value of own seed
Imputed value of manure
Market value of pesticides and pesticides
Land revenue and other tax
Depreciation of farm implements/ equipment's
Miscellaneous expenses

Cost B_2: Cost B_1 + rent paid for leased in land
Cost C: Cost B_1 or B_2 + interest on fixed capital excluding land + rental value of owned land
Cost D: Cost C + imputed value of family labour

b. Income Measures

Farm business income = Gross income – Cost B_1/B_2
Family labour income = Gross income – Cost C
Net income = Gross income – Cost D
Farm investment income = farm business income – imputed value of family labour

3. Stochastic profit frontier model

Profit efficiency refers to profit gained from operating on the profit frontier, keeping in view farm-specific prices and factors i.e considering a farm that optimize profit subject to perfectly competitive input and output markets. Following Bidzakin *et al.*(2014); Sadiq (2015); and, Sadiq and Singh (2015) the Cobb-Douglas functional form used is specified below:

Implicit form

$\pi = f(q_i;Z)+(Vi-Ui)$……(2)
π = Normalized profit
f= Suitable Cobb-Douglass function
qi= Vector of variable input
Z= Fixed input
V_i= Error associated with uncertainty
$-U_i$= errors associated with risks

Explicit form

$Ln = \beta_0 + \beta_1 LnP_1 + \beta_2 LnP_2 + \beta_3 LnP_3 + \beta_4 LnP_4 + \beta_5 LnZ_1 + \beta_6 LnZ_2 + (Vi - Ui)$……(3)

Where;
Ln = Natural logarithm
π = Normalized profit
β_0 =Constant term or intercept
β_1-β_n= coefficients of parameters
P_1 = Cost of labour normalized by unit cost of output (₦)
P_2 = Cost of seeds normalized by unit cost of output (₦)
P_3 = Cost of fertilizer normalized by unit cost of output (₦)
P_4 = Cost of herbicides normalized by unit cost of output (₦)
Z_1 = Depreciation on capital input
Z_2 = Farm size (hectares)
V_i = represents symmetrical random error due to factors beyond the farmers' control.
$-U_i$ = Profit Inefficiency

The inefficiency model (U_i) is defined by:

$-U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 \ldots + \delta_n Z_n + \vartheta$ ..... (4)

Where:
Z_1 = Age of the farmer (Years)
Z_2 = Education (Years)
Z_3 = Household size (Number)
Z_4 = Farming experience (Years)
Z_5 = Extension contact (Yes=1, Otherwise =0)
Z_6 = Co-operative membership (Yes=1, Otherwise = 0)
ϑ = truncated random variable
$\delta_0, \delta_1 \ldots \delta_6$ are inefficiency parameters

These socio-economic variables are included in the model to indicate their possible influence on the profit efficiencies of the groundnut farmers.

Profit loss due to inefficiency was calculated as maximum profit at farm-specific prices, fixed factors multiplied by farm-specific profit inefficiency. Profit loss is defined as the amount loss due to inefficiency in production at given prices and fixed factor endowments, and calculated by multiplying maximum profit by (1-Pe). Maximum profit per hectare was computed by dividing the actual profit per hectare of individual farms by its efficiency score.

PL=maximum profit (1-PE)…….(5)

Where:
PL= profit loss
PE=profit efficiency

3.0 RESULTS AND DISCUSSION

3.1 Socio-economic characteristics of groundnut farmers

Results in Table 1 showed a mean age of 47±9.86, indicating that majority falls within the age bracket (17-49) recommended by FAO as productive and active in agricultural production; and majority had Quranic education due to their religious affiliation which mandates them to focus and have in-depth understanding of their religious knowledge when compared with western education, thus, hindering their responsive and receptive intuition towards new technological breakthrough. The mean household size of 6±3.64 indicates that most of the farmers had a sustainable household size recommended by FAO to be fair for a typical agricultural setting in sub-Saharan Africa. A male dominated enterprise which may be associated with the drudgery *viz.* land clearing, sowing, weeding, herbicides application, harvesting, drying, thrashing etc. Findings revealed that the mean years farming experience was 15±12.6 years, which is reasonable enough to enable them garner ample knowledge and skills involved in groundnut production; and majority acquired their lands *via.* inheritance, which in the long-run will be subject to dispute due to increase in household size which inturn would put pressure on acquired land as every adult member of the family would want to have a share of the land, thereby resulting in

fragmentation, thus, discouraging cultivation of cash crops and mechanization. Furthermore, it was observed that virtually almost all were married, indicating how marital status has become an important factor in agricultural production especially when economic capital is limited; majority have extension contact, a development that would encourage technological transfer and productivity enhancement except for those who decided to remain laggards; and, social participation of farmers through their involvement in farm organisations was found to be high, thus, enhancing diffusion of innovation, access to government assistance either in kind or cash, enhancement of market bargaining power for their outputs, pecuniary economic advantages for input purchases, and likely pre-disposal to adopt innovative technologies due to confidence in peers. These findings with respect to extension contacts, education and gender were contrary to findings reported by Taphee *et al.*(2015).

Table 1: Socio-economic profiles of groundnut producers in the study area

Characteristics	Freq.	%	X ± SD
Age			
≤ 29	6	5	
30-39	18	15	
40-49	45	37.5	
50-59	38	31.7	
≥60	13	10.8	
Total	**120**	**100**	**47±9.86**
Education			
Quranic	62	51.7	
Primary	17	14.2	
Secondary	35	29.2	
Tertiary	6	5	
Total	**120**	**100**	
Household size			
≤ 3	18	15	
4-6	51	42.5	
7-9	34	28.3	
≥ 10	17	14.2	
Total	**120**	**100**	**6±3.64**
Gender			
Male	102	85	
Female	18	15	
Total	**120**	**100**	
Experience			
1-3	16	13.3	
4-6	22	18.3	
7-9	6	5	
10-12	76	63.3	
Total	**120**	**100**	**15±12.6**
Land acquisition			
Inheritance	101	84.2	
Borrowing	19	15.8	
Total	**120**	**100**	
Marital status			
Married	1	0.8	
Single	119	99.2	
Total	**120**	**100**	
Extension contact			
Yes	77	35.8	
No	43	64.2	
Total	**120**	**100**	
Co-operative membership			
Yes	70	41.7	
No	50	58.3	
Total	**120**	**100**	

Source: Field survey, 2016

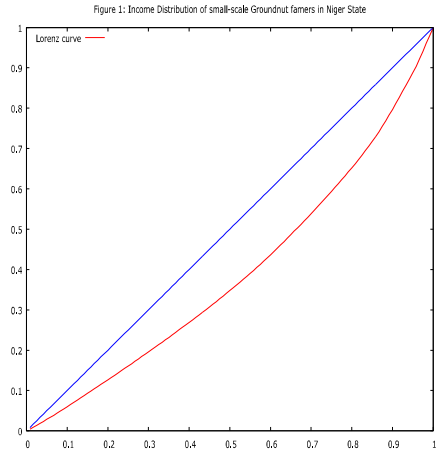
3.2 Evaluation of income distribution among groundnut producers

The perusal of Table 2 showed the estimated Gini coefficient index of 0.22, indicating equality in income distribution among groundnut producers in the study area. This was justified diagrammatically by Lorenz curve which was not farther from the line of equality (Figure 1). Therefore, it can be inferred that groundnut production in the study area was mainly dominated by farmers who belong to low income category. Also, the current producers of groundnut in the study area are fulltime farmers with poor resource base. Therefore, based on this finding study recommend that any intervention package by government or private sectors to boast commercial groundnut production should explicitly focused on this target group rather than the political or temporarily farmers.

Table 2: Income distribution of groundnut producers in the study area

Index	Estimate
Gini coefficient	0.219
Population value index	0.220

Source: Field survey, 2016



3.3 Costs and returns for groundnut production

Results in Table 3 showed that the estimated cost of cultivation incurred was ₦27518.43, with total variable cost being ₦15465.93and total fixed cost ₦12052.43. However, the total variable cost contributed 56.20% while fixed cost contributed 43.80% to the total cost incurred in groundnut production per hectare. On the basis of cost component analysis, labour costs which includes family labour calculated at opportunity cost principle and hired labour recorded the highest cost incurred (26.88%) followed by manure (17.3%), while fertilizer (0.18%) recorded least costs incurred per hectare. This means that labour is an important variable cost item that determines groundnut productivity and profitability in the studied area. Furthermore, the estimated accrue total revenue to groundnut production per hectare was ₦57989.10, while the gross margin (cash), gross margin, net cash income and net income were ₦49071.57, ₦42523.17, ₦30479.07 and ₦30471.67, respectively. Also, the ROI (accounting) was 5.50, implying that for every ₦1 invested, ₦5.50 was return, while ROI (economic) was 2.75, indicating that for every ₦1 invested, ₦2.75kobo was return. The RORCI which is the ratio of profit to total cost of production indicates what a business earns through capital outlay. The results revealed that the RORCI (accounting profit) (111%) and RORCI (economic profit)(241%) were greater than the prevailing banking rate of 8%, thus, implying that groundnut farming in the study area is a profitable venture. Therefore based on this cost concepts and income measures, it is worthwhile to invest in groundnut production in the study considering the profit margin and cost of cultivation which ascertained that the venture is reasonably profitable.

Table 3: Costs and returns estimates of groundnut production per hectare

Items	Quantity	Unit price (₦)	Cost (₦)	%
Input cost				
Variable cost				
Family labour	7.78 manday	750	5835	21.2
Hired labour	2.15 manday	750	1612.50	5.86
Seed	4.55 kg	318.75	1450.31	5.27
Fertilizer	0.87 kg	56	48.72	0.18
Manure	953.40 kg	5	4767	17.32
Herbicides	1 litre	1039	1039.00	3.78
Imputed interest on working capital	(8% of ₦8917.53)		713.40	2.59
TVC			15465.93	56.20
Fixed cost				
Rent			5000	18.2
Imputed rental value			5000	18.2
Depreciation			2052.50	7.5
TFC			12052.50	43.80
Total cost			27518.43	100
Cost concepts				
Cost A1			8917.53	
Cost A2			15465.93	
Cost A3			15970.03	
Cost A4			27518.43	
Cost B1			4964.65	
Cost B2			16683.43	
Cost C			21683.43	
Cost D			27518.43	
Return				
G/N pod				
Qty gifted	20.86 kg	78	1627.08	
Qty consumed	19.14 kg	78	1492.92	
Qty sold	638.45 kg	78	49799.10	
Total	678.45 kg	78	52919.10	
Bale				
Qty gifted	0.18 bag	1000	180	
Qty consumed	0.24 bag	1000	240	
Qty sold	4.65 bags	1000	4650	
Total	5.07 bags	1000	5070	
Total revenue			57989.10	
Farm business income			41305.67	
Family labour income			36305.67	
Gross margin (cash)			49071.57	
Gross margin			42523.17	
Net cash income			38479.07	
Net income			30471.67	
ROI (accounting)			5.50	
ROI (economic)			2.75	
RORCI (accounting)			2.41	
RORCI(economic)			1.11	

Source: Field survey, 2016

3.4.1 Maximum Likelihood Estimation of profit frontier

The results of the maximum likelihood estimates of the parameters of stochastic frontier profit function are given in Table 4a. The predict variable was restricted profit from an output of one season. All the estimated coefficients carried the expected signs and were significant at 1 percent probability level with the exception of labour cost which was non-significant, indicating that these variables were significantly different from zero, thus, important in profit gained in groundnut production. The non-significance of labour cost may be due to the free and excess family labour which renders labour cost low. The elasticities of all the significant cost variables were negative, meaning that an increase in the cost of seeds, cost of fertilizer, cost of herbicides and depreciation would decreases the profit gained. Also, for farm size which is the only non-monetary term included in the model positively influenced profit gained. In otherwords, a ₦1 increase in cost of seeds will decrease profit by 66kobo; a ₦1 increase in the cost of fertilizer will decrease profit by 36kobo; a ₦1increase in the cost of herbicide will decrease profit by 51kobo; ₦1 increase in depreciation per annum will decrease profit by 17kobo; a ₦1 increase in the cost of labour will decrease profit by 13kobo though non-significant, while 1 hectare increase will increase the profit by 33.1 percent. For diagnostic statistics, the estimated sigma squared (σ^2) was 3.157 and was significant at 1 percent probability level, implying correctness and fitness of the distribution assumption of the composite error term, while the gamma (γ) was 0.99 and was significant at 1 percent probability level, indicating that 99.2% of deviation of the actual profit from the maximum profit (frontier) is attributed to differences in farmers' practices rather than error.

Furthermore, the results of the estimated coefficient of predictor variables included in the inefficiency model showed four out of the six variables included in the model to be significant at different probability levels. The significant variables are age, education, household size and extension services, while the non-significant variables are farming experience and co-operative membership. The coefficient of age and extension services carried negative sign and are significant at 10% and 1%, respectively, implying direct relationships with profit efficiency. This means that the more the age of the farmer the more profit efficient he become; and farmers with access to extension services are more profit efficient when compared to their counterparts who have no access to extension contact because they will significantly perform better in operating at optimum efficient level. This is expected because as the farmer's age increase coupled with increase level of experience; his or her productivity will increase given that they tend to be more efficient in production. Also, this conforms to the assumption that extension services enhance good living condition of farmers; strength farmers' capacity to develop *viz.* access to agricultural information and contribute improvement in agricultural development. Furthermore, the coefficients of education and household size carried positive signs and are significant at 1% and 5% respectively, indicating an inverse relation with profit efficiency i.e reduction in profit efficiency. The higher the educational level of the farmer the more likelihood he or her will venture into white collar jobs or off farm activities thereby affecting his profit efficiency, and farmers with large house hold size are likely to incur more expenditures on house hold consumption thereby affecting profit gained from groundnut production. This agreed with the findings of Simonyan *et al.*, (2011) who opined that large household size will leads to 0.36 and 0.55 decrease in efficiency of both credit and non-credit users respectively. However the coefficient of farming experience and cooperative membership carried negative and positive signs, respectively, but were non-significant; as such need no further discussion. The diagnostic test for the inefficiency model using the generalized likelihood ratio showed that the chi-square (χ^2) calculated is greater than chi-square (χ^2) tabulated, indicating the fitness of the specified inefficiency model, and that the estimated coefficients which explained profit efficiency are different from zero, hence, the traditional response function (OLS) is not an appropriate representation of the data (Table 4b).

Results in Table 4c explained the profit loss in key variables due to profit inefficiency. Interestingly, findings reported in Table 4a are uniform to the results presented in Table 4c which showed that aged farmers recorded less profit loss compared to their counterpart; farmers with extension contact recorded less profit loss when compared to their counterparts with no access; while educated farmers and farmers with large household size recorded high profit loss.

Table 4a: Maximum likelihood estimates of stochastic profit frontier function

Variable	Parameter	Coefficient	t-ratio
General model			
Intercept	β_0	4.035	5.214***
Cost of labour (₦)	β_1	-0.133	1.166^{NS}
Cost of seed (₦)	β_2	-0.663	5.227***
Cost of fertilizer	β_3	-0.363	2.626***

Variable	Parameter	Coefficient	t-ratio
(₦)			
Cost of herbicides (₦)	β_4	-0.514	2.838***
Depreciation (₦)	β_5	-0.166	2.917***
Farm size	β_6	0.3908	5.267***
Inefficiency model			
Intercept	δ_0	-7.643	2.285**
Age	δ_1	-0.068	1.662*
Education	δ_2	0.5030	2.661***
Household size	δ_3	0.2922	2.517**
Farming experience	δ_4	-0.0338	1.493^{NS}
Extension contact	δ_5	-6.301	2.632***
Co-operative membership	δ_6	0.4405	1.108^{NS}
Diagnostic statistics			
Sigma squared	σ^2	3.157	2.530***
Gamma	γ	0.992	276.558***
Log likelihood function		-41.57	

Source: Frontier 4.1 computer print-out

Table 4b: Generalized likelihood test of hypothesis of parameters in inefficiency model

H_0	χ^2-cal	χ^2-tab	Decision
H_0: γ =0	81.89		Reject H_0

Source: Frontier 4.1 computer print-out

Table 4c: Key factors explaining profit inefficiency and profit loss per hectare

Characteristics	Freq.	Profit efficiency score	Actual profit	Profit loss
Age				
≤ 29	6	0.47	6694.00	3547.82
30-39	18	0.72	10314.00	1547.10
40-49	45	0.89	13057.33	1436.31
50-59	38	0.91	13384.00	1204.61
≥60	13	0.42	7492.00	4345.36
Education				
Quranic	62	0.86	12150.67	1701.09
Primary	17	0.79	10106.67	2122.40
Secondary	35	0.71	9201.00	2668.29
Tertiary	6	0.65	8664.00	3032.40
Household size				
≤ 3	18	0.84	13888.00	2222.08
4-6	51	0.79	12660.00	2658.60
7-9	34	0.57	12564.00	5402.52
≥ 10	17	0.49	10990.00	5604.90
Extension contact				
Yes	77	0.92	14056.00	1124.48
No	43	0.57	8879.33	3818.11

Source: Frontier 4.1 computer print-out

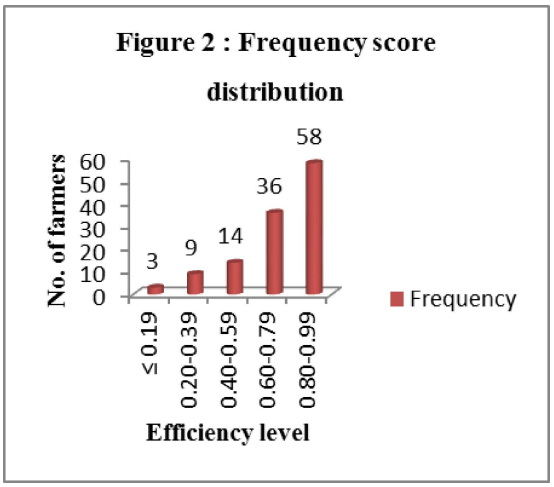
3.5 Profit efficiency score estimates

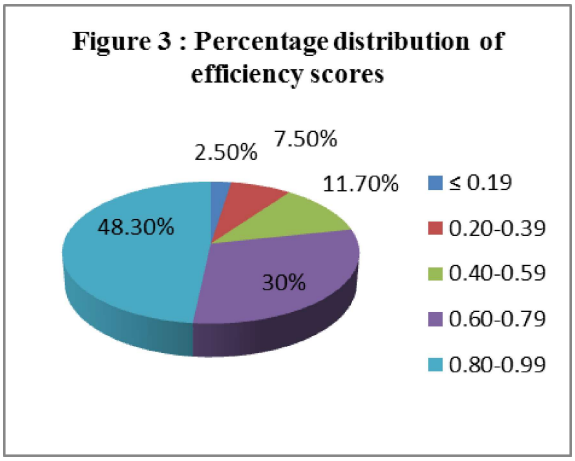
Results in the Table 5 show frequency distribution of efficiency scores of groundnut farmers in Niger State of Nigeria. The efficiency scores distribution of all the respondents are less than one (less than 100%), indicating that all the sampled groundnut farmers in the study area are below the profit frontier surface. Estimated mean profit efficiency of the farmers was 0.726, meaning that farmer who achieved an average profit efficiency score could increase profit gain by 27.4%. But this is achievable if the farmer's improved their technical, allocative and scale efficiencies. In otherwords, with given level of available resources the average farmer with efficiency score of 0.726 has the potential to increase his profit gain by 27.4%; the worst profit inefficient famer has the potential to increase his profit gain by 85.1%; and, the best profit inefficient farmer has the potential to increase his profit gain by 5.4%. Observed profit efficiency scores range was wide as evidenced from 0.149 to 0.946, however, this wide range is not only peculiar to Nigeria as similar research by Chikobola (2016) reported a wide range profit efficiency scores of 0.0950-0.9238 for groundnut production in Zambia. Also, based on the average efficiency score, approximately 64.17% were more than 72.6% profit efficient. In summary based on the mean profit efficiency score, it can be inferred that groundnut farmers in Niger state of Nigeria are relatively profit efficient, but it is clear that opportunities still exist to increase their efficiency viz. improvement in their technical, allocative and scale efficiencies. Also, there is room for improvement for the least profit efficient farmers to attain maximum efficiency if inefficiency determinants are minimized. The results are depicted in Figure 2 and 3.

Table 5: Deciles frequency distribution of profit efficiencies of groundnut farmers

Efficiency level	Frequency	Percentage
≤ 0.19	3	2.5
0.20-0.39	9	7.5
0.40-0.59	14	11.7
0.60-0.79	36	30
0.80-0.99	58	48.3
Total	**120**	**100**
Mean	**0.726**	
Mode	**0.895**	
Maximum	**0.946**	
Minimum	**0.149**	
Standard deviation	**0.197**	

Source: Frontier 4.1 computer print-out





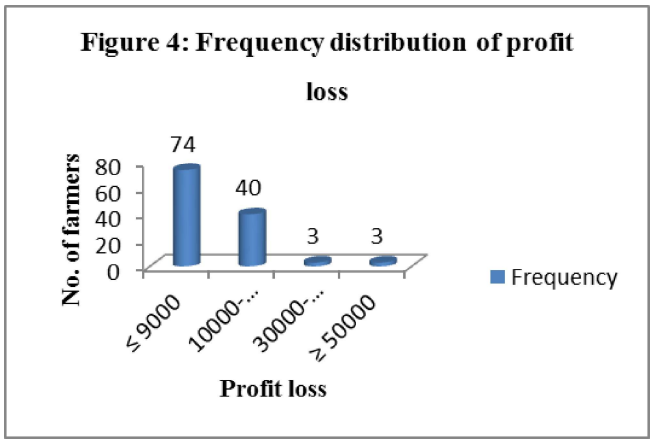
3.6 Profit loss in groundnut production

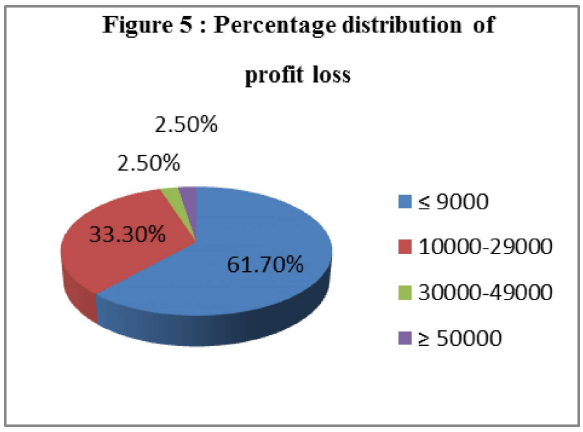
Table 6 showed the frequency distribution of translated profit loss as a result of inefficiency. Rahman (2003) as cited by Galawat and Yabe (2010) defined profit loss as the amount of loss due to inefficiency in production at given prices and fixed factor endowment. Findings showed the average profit loss among the farmers to be ₦12019.84k and could be minimized by improving technical, allocative and scale efficiencies. The large standard deviation (₦16278.11k) implies that there exist wide variations in profit loss among the producers. However, findings revealed wide range of profit loss, with largest farm-specific profit loss been ₦100944.48k and the least profit loss been ₦676.02k, thus, indicating the existence of opportunities to increase profit levels of the producers in the study area, at their given available technology, prices and level of fixed factors. Furthermore, findings revealed that 61% of the producers recorded profit loss of less or equal to ₦9999, an indication that the farmers tried to minimize their profit loss; approximately 33.3% recorded profit loss of between ₦10000 to ₦29999 while 5% recorded profit loss of equal or greater than ₦30000. Figure 4 and 5 shows the results diagrammatically.

Table 6: Frequency distribution of profit loss

Loss	Frequency	Percentage
≤ 9000	74	61.7
10000-29000	40	33.3
30000-49000	3	2.5
≥ 50000	3	2.5
Total	**120**	**100**
Mean	**12019.84**	
Maximum	**100944.48**	
Minimum	**676.02**	
Standard deviation	**16278.11**	

Source: Frontier 4.1 computer print-out





3.7 Perceived constraints in groundnut production

The major constraints faced by the sampled farmers on various fronts such as high-input costs, price fluctuation, inadequate extension contact, credit paucity, incidence of pests and diseases etc are presented in Table 7. These problems were ranked in ascending order from the most severe problem to the less severe problem. Among the identified constraints, high-input costs, price fluctuation and inadequate extension contact were the major

prioritized problems, while flood-drought problems and land tenureship problems were the less severe problems affecting groundnut producers in the study area. Based on these findings, study suggests measures to lessen these perceived constraints viz. necessary policy instruments so as to increase the production and productivity of groundnut in the state.

Table 7: Perceived constraints faced by groundnut producers

Constraint	Frequency	Percentage	Rank
High input cost	107	21.32	1
Price fluctuation	106	21.12	2
Inadequate extension services	104	20.72	3
Paucity of credit	74	14.74	4
Pest and diseases	66	13.15	5
Weather vagaries	26	5.18	6
Land tenure ship problem	19	3.79	7
Total	**502**	**100**	

Source: Field survey, 2016
Note: *Multiple choices

CONCLUSION

Stochastic profit frontier approach was used to investigate profit efficiency on small scale groundnut farms in Niger State of Nigeria using cross sectional data elicited from 120 active farmers' selected *viz.* multi-stage sampling technique. The study showed that despite an active working population made up young able bodied people most of them have no formal knowledge which would invariable affect their productivity thus narrowing their profit margin. Also, it was found that this product is mainly produced by low income earners with poor resource base, which invariably would jeopardize government effort towards revamping this export sector if mechanisms to look inward are not developed and put into action by policy makers. Furthermore, despite that the groundnut farmers in the study area are relatively profit efficient judging from the mean efficiency score, clear opportunities still exit for them to increase their profit efficiencies by approximately 27.4% viz. improving their technical, allocative and scale efficiencies. Also, the average profit loss among groundnut farmers in study area was ₦12019.84k per hectare which could be minimized by improving technical, allocative and scale efficiencies. The policy implication is that encouraging efficient resource allocation, enhancing farmer's literacy, sustainable house hold size and making farm business attractive for educated ones who mostly ought for white collar jobs would not only reduce inefficiency, but also minimize profit loss incurred by groundnut producers in the study area. Based on these findings the following recommendations are made:

- Government should invest more in the agricultural sector to ensure off season production through irrigation practices to tackle the seasonal price fluctuation of produce that serve as precursor/raw materials to milling industries.
- Policies made by government to enhance groundnut production should be implemented by all the agencies concerned in groundnut production in order to improve productivity.
- The groundnut farmers should be willing and ready to take risk by adopting new innovative technologies that can increase their production efficiency.
- The farmers should be advised to form or join an existing cooperative societies in order to harness their resources to improve their finances for a better production

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