Cost efficiency status of rice farmers participating in IFAD-VCD programme in Niger state of Nigeria

Sanusi Mohammed SADIQ[1]*, Invinder Paul SINGH[2], Mohammad Makarfi AHMAD[3]

[1] Department of Agricultural Economics and Extension, FUD, Dutse, Nigeria

[2] Department of Agricultural Economics, SKRAU, Bikaner, India

[3] Department of Agricultural Economics, BUK, Kano, Nigeria

* Corresponding author sadiqsanusi30@gmail.com

Received 27/10/2020
Accepted 25/11/2020

Abstract

This research empirically determined the cost efficiency of the farmers that participated in the IFAD/VCD programme in Niger State of Nigeria. The study elicited cross-sectional data of 2018 cropping season from a structured questionnaire complemented with interview schedule from a sample size of 110 respondents selected through a multi-stage sampling technique. The sampled data were analyzed using the stochastic cost frontier model. The empirical evidence showed that none of the farmers were on the cost frontier surface i.e. inability to attain optimal minimum cost in the cultivation of rice in the studied area. The identified significant idiosyncratic variables militating against cost efficiency were poor health status of the farm family, which led to extra cost incurred in labor substitution and diseconomies of scale due to their small-scale mode of operation. Therefore, the study recommends that the policy makers should sensitize the farmers on the importance of health preventive measures and should endeavor to improve on the existing basic health centers in both human capital and logistics. In addition, the farmers should be encouraged to explore co-operative marketing so as to take advantage of bulk discount in input purchase and have bargaining power in marketing of their output, thus tackling the problem of diseconomies of scale in their farm operations.

Keywords: Cost efficiency, Stochastic, Frontier, IFAD, Rice, Nigeria

INTRODUCTION

Farming in Nigeria has been on the subsistence scale given that the bulk of the producers are resource-poor. The most viable chance of breaking the vicious cycle of poverty affecting these farmers is to transit them to a sustainable farming system. The imperfection in the markets has made it difficult for these resource-poor farmers to keep-up with the going concern of their firm enterprises, thus worsening their livelihood and food security of the studied area in particular and the country in general.

The essence of the IFAD-VCD programme is to secure the livelihood of the rural populace particularly the weaker section so that they can break the vicious cycle of poverty. The feasibility of Nigeria's economic growth and development depends largely on empowering the rural poor communities *viz.* identification of their needs and implementation of broad based agricultural and rural development initiatives. The failure to sustain most of the agricultural projects in the studied area is not due to lack of interest of the target groups in farming but rather poor productivity of capital investment which is not remunerative to sustain the livelihood of the beneficiaries more less the business going concern. The rationality of any farmer in enterprise allocation solely lies on the cost of production which is a function of the market prices of inputs and outputs, a condition which the farmers have little or no control over. Thus, the business concern of a farmer to continue or pull-out from the business of crop farming depends on cost.

For the study area to achieve rice food security and alleviate poverty which is the goal of the programme, it is important to identify the factors that affect farmers' cost efficiency in rice production and further measure the extent to which they limit the cost efficiency of the decision units. In view of the foregoing, this research was conceptualized with the aim of having a clearer understanding of cost efficiency and the feasibility of predicting the allocative efficiency of the target groups in the studied area.

Therefore, for the IFAD programme not to be a fail project, it becomes very imperative to determine the cost efficiency status of the farmers participating in the programme in Niger State of Nigeria using the parametric cost frontier model. Ogundari *et al.*(2006); Paudel and Matsuoka (2009); and Sadiq and Singh (2016) have opined that improvement in the understanding of farmers' status of cost efficiency and its interlink with their idiosyncratic covariates would greatly assist policymakers in promulgating efficiency enhancing policies as well as judging the efficiency of the current and previous reforms.

RESEARCH METHODOLOGY

Niger State is located in Nigeria, a sub of Africa continent and it lies between latitudes 8°20'N and 11°30'N of the equator and longitudes 3°30'E and 7°20'E of the Greenwich Meridian time. The vegetation of the state is northern guinea savannah with a sparse of southern guinea savannah around Mokwa Local Government Area (LGA). Agriculture is the major occupation in the study area and it's complemented with civil service jobs, artisanal, craft-work, *Ayurveda* medicines and petty trade. The study made use of a multi-stage sampling technique to draw a sample of 110 active participants in the programme. In the state, the programme is currently mounted in five (5) LGAs with Agricultural Zone A (Bida) and C (Kontagora) having two LGAs each namely Bida and Katcha; and, Wushishi and Kontagora, respectively, while Zone B has one participating LGA *viz.* Shiroro. In the first stage, Katcha was randomly selected from Zone A while Shiroro LGA was automatically selected being the only participating LGA in Zone B. Wushishi LGA due to its comparative advantage in rice production throughout the year, owing to the presence of Tungan Kawo irrigation dam, was purposively selected from the Agricultural Zone C. In the second stage, two villages were randomly selected from each of the chosen LGAs. Thereafter, two active co-operative associations from each of the selected villages were randomly selected. It is worth to note that Microsoft excel inbuilt random sampling mechanism was used for the random selections of the villages and the co-operative associations. In the last stage, using the sampling frame obtained from IFAD/VCD office (Table 1), the Cochran's formula was used to determine the representative sample size. Thus, a total of 110 active rice farmers form the sample size for the study. A structured questionnaire complemented with interview schedule was used to elicit information from the respondents during the 2018 cropping season, and stochastic cost frontier model was used to analyze the collected data. The Cochran's formula used is shown below:

$$n_a = \frac{n_r}{1+\frac{(n_r-1)}{N}} \quad \text{......(1)}$$

$$n_r = \frac{(1.96)^2 pq}{e^2} \quad \text{......(2)}$$

Where:

n_a = adjusted sample size for finite population
n_r = sample size for infinite population
N = population size
p = proportion of population with a particular characteristic
p = 1 – p
e^2 = error gap (0.07)

Thus, p = 0.40 and q = 1 – 0.40 = 0.60

Model Specification

Stochastic Cost Frontier Function: Following Battesse and Coelli (1995); Ogndari *et al.*(2006); Sadiq and Singh (2016) and Sadiq and Samuel (2017), the adopted stochastic cost frontier (SCF) function is shown below:

$$C_i = f(P_{ij}, Y_{ij};\beta) + (V_i + U_i) \quad (i = 1,2 \ldots\ldots n) \text{......(3)}$$

C_i = Total production cost of the i[th] farmer;
P_i = Vector prices of the actual j[th] inputs used by the i[th] farmer;
Y_i = Vector of the actual j[th] output of the i[th] farmer;
β_i = Parameter to be estimated;
V_i = Uncertainty which is beyond the control of the i[th] farmer; and,
U_i =Risk which is attributed to the error of the i[th] farmer;

Positive sign preceded the composite error term because inefficiency is always assumed to increase cost.

Given the level of technology at the disposal of a technical unit, the cost efficiency is expressed as the ratio of the observed cost to the corresponding minimum cost (C^{min}), and it is given below:

$$C_e = \frac{C^b}{C^{min}} = \frac{f(P_{ij}, Y_{ij};\beta)+(V_i+U_i)}{f(P_{ij}, Y_{ij};\beta)+V_i} = \exp(U_i) \text{...(4)}$$

Where C_e is the cost efficiency and takes the value of ≥1 with 1 defining cost efficient technical unit. The observed cost (C^b) represents the actual total cost while the minimum cost (C^{min}) represents the frontier total cost or the least total cost level.

The explicit form of the Cob-Douglas functional form of the SCF function is as follow:

$$lnC_i = ln\beta_0 + \sum \beta_k lnP_{ij} + \beta_l lnY_{ij} + V_i + U_i \text{ ..(5)}$$

Where C_i = Total production cost of i[th] farmer; P_i = Vector of unit prices of farm inputs used: P_1 = unit price of seed (₦/kg), P_2 = unit price of NPK fertilizer (₦/kg), P_3 = unit price of urea fertilizer (₦/kg), P_4 = unit price of herbicides (₦/litre), P_5 = unit price of human labour (₦/man-day), P_6 = depreciation on capital items (₦), and P_7 = rental value of land (₦/hectare); Y_i = Farm output (kg)

Table 1: Sampling frame of participating farmers

LGAs	Villages	Co-operative Associations	SF	SS
Katcha	Baddegi	Managi Badeggi Farmers CMPS	24	10
		Aminci EbantiTwaki CMPS Ltd	25	10
	Edostu	Edotsu Co-Operative Credit & Marketing CMPS	25	10
		Edotsu Jinjin WugakunYema CMPS	25	10
Shiroro	Baha	Baha Abmajezhin Cooperative Multi-Purpose Society Ltd	15	7
		Abwanubo Najeyi Development Association	18	8
	Paigado	Paigado Achajebwa Development Farmers Soc.	25	10
		Paigado Farmers Cooperative Society Ltd	25	10
Wushishi	Bankogi	Bankogi Alheri Farmers Coop. Multipurpose Soc Ltd	22	9
		Bankogi Gwari Nasara CMPS	16	7
	Kanko	Kanko Arewa Farmers	25	10
		Kanko Unguwar Ndakogi Cooperative Multipurpose Society Ltd	25	10
Total			**270**	**111**

SF and SS mean sampling frame and sample size respectively. *Source: IFAD-VCDP farmers' database, 2018* from i[th] farmer; V_i = random variability in the production that cannot be influenced by the farmer also known as uncertainty; U_i = deviation from minimum potential cost attributable to cost inefficiency and also known as risk. β_0 =intercept; β_k =vector of cost parameters to be estimated; β_1 =vector of output parameter to be estimated; i=1,2,3……n farmers; j=1,2,3………m inputs.

The inefficiency model is:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 \dots \dots \dots . + \delta_n Z_n \cdots (6)$$

Where U_i = Educational level (year); Z_2 = Sickness of farm family member (number); Z_3 = Extension visit (number); Z_4 = Access to credit (yes =1, no = 0); Z_5 = Age (year); Z_6 = Household size (number); Z_7= Income (yes =1, no = 0); Z_8 =Farm size (hectare); Z_9= Farming experience (year); Z_{10}= Non-farm income (yes =1, no = 0); Z_{11} = Language spoken (number); δ_0= intercept; and, δ_{1-n} = parameters to be estimated.

RESULTS AND DISCUSSION

Cost Efficiency of IFAD Rice Farmers

A cursory review of the maximum likelihood estimates (MLE) of the stochastic cost frontier function showed the variance parameters *viz.* sigma (0.157) and gamma (0.863) to be different from zero at 10% degree of freedom. The implication of the significance of the sigma-squared and gamma indicate the goodness of fit of the specified SCF and the correctness of the composite error term; and the presence of the cost inefficiency, respectively. Therefore, it can be inferred that the differences in the cost efficiencies of the sampled farmers accounted for 86.3% variation in the total cost (Table 2).

In addition, the calculated log-likelihood ratio test being greater than the tabulated Chi² indicates the presence of one-sided error, thus an indication that the traditional response function (OLS) cannot fit the data (Table 3).

Table 2: MLE of the stochastic cost frontier of IFAD rice farmers

Variable	Coefficient	Standard error	t-statistic
Deterministic model			
Constant	1.06895	0.99335	1.076 NS
Seed (₦)	-0.24035	0.07899	3.043 ***
NPK fertilizer (₦)	0.33385	0.13495	2.473 **
Urea fertilizer (₦)	0.43218	0.12309	3.511 ***
Herbicides (₦)	0.36561	0.14136	2.586 **
Human labour (₦)	0.11910	0.07411	1.606 NS
Rent value of land (₦)	0.29484	0.08855	3.329 ***
Depreciation on cap. (₦)	0.04283	0.04279	1.001 NS
Output (kg)	0.35855	0.19690	1.820 *
Inefficiency model			
Constant	-3.00142	1.05781	2.837 ***
Education	0.03283	0.03319	0.988 NS
Illness of member	0.21368	0.11938	1.789 *
Extension visit	0.03062	0.05830	0.525 NS
Access to credit	-0.08388	0.31130	0.269 NS
Age	0.00962	0.02615	0.368 NS
Household size	-0.07450	0.05432	1.372 NS
Income	0.35555 E-06	0.41535 E-06	0.856 NS
Farm size	1.65495	0.31176	5.308 ***
Farming Experience	-0.00880	0.02537	0.347 NS
Non-farm income	0.05111	0.33811	0.151 NS
Language spoken	-0.46844	0.27972	1.675 *
Variance parameters			
Sigma-squared	0.15649	0.04682	3.342 ***
Gamma	0.86307	0.04447	1.941 **

, **, * and NS means significance at 10%, 5%, 1% and non-significant respectively* *Source: Field survey, 2018*

Table 3: Generalized Likelihood ratio test of hypothesis for parameters of SCFF

H_0	Log likelihood function	λ	Critical (5%)	Decision
γ = 0	23.60	21.05	16.91	**γ ≠ 0**

Source: Field survey, 2018

Furthermore, with the exception of seed price, all the parameter estimates (capital and labour costs) induced monotonicity in the cost function as evident by the positive sign associated with their coefficients (Table 2). The non-monotonicity of the seed price coefficient is an indication of congestion in the use of seed input which owes to the provision of subsidy, thus the negative sign associated with the seed price coefficient. The empirical evidence showed that the total cost incurred in the production of rice was influenced by seed cost, costs of agrochemicals, rental cost and rice output as indicated by their respective probability levels which were different from zero at 10% degree of freedom.

The negative significance of the seed cost coefficient implied that improved rice seed varieties were sold to the farmers at subsidized price, thus the non-monotonicity of the total cost despite increase in the seed cost. The elasticity of the significant parameter estimates *viz.* NPK fertilizer cost, urea fertilizer cost, herbicides cost, rental fees and output (kg) being positive implies that the total cost increase monotonically with an increase in the prices of these inputs and the only output parameter included in the SFC. Thus, a percent increase in the prices of NPK fertilizer, urea fertilizer, herbicides and land rental fee each would increase the total cost of production by 33.4%, 43.2 %, 36.6 % and 29.5 %, respectively. Besides, a percent increase in the output level of rice would increase the total cost by 35.9 %. The non-significance of the human labour and depreciation on capital items implied that the farmers relied on excess available family labour which is free of cost and incurred negligible costs on the fixed capital as they used primitive implements in the production of rice.

It was observed that the farmers despite operating in the rational stage i.e. decreasing return to scale they were experiencing diseconomies of scale as indicated by the economies of scale (ES) index of -3.84. This did not come as a surprise as these farmers are resource-poor who cultivate rice on small-scale basis, thus an increase in the output will increase the cost of production. This finding is contrary to the Schultz's efficient hypothesis for poor farmers, that in their resource allocation behavior under traditional agricultural setting they are efficient giving the available technology at their disposal (Schultz, 1964; Ogundari *et al.*, 2006; Sadiq and Singh, 2015).

Table 4: Frequency distribution of cost efficiency scores

Efficiency level	Frequency	Relative efficiency %
1.00-1.09	59	53.6
1.10-1.19	18	16.4
1.20-1.29	10	9.10
1.30-1.39	4	3.64
1.40-1.49	4	3.64
1.50-1.59	3	2.73
1.60-1.69	3	2.73
1.70-1.79	2	1.82
1.80-1.89	2	1.82
1.90-1.99	1	0.91
≥ 2.00	4	3.64
Total	110	100.00
Mean	1.218	
Maximum	2.305	
Minimum	1.025	
Standard deviation	0.271	

Source: Field survey, 2018

Furthermore, it was observed that cost efficiency is influenced by sickness of household member, household size, farm size and number of language spoken as evident from their respective parameter estimates which were different from zero at 10% degree of freedom. The positive significance of the coefficient for sickness of household member implied that a farmer with health challenge affecting his household incurred extra labour cost due to substitution of family labour with hired labour, thus affecting the cost efficiency of the farmer. Thus, a farm family having a sick fellow will have his/her cost inefficiency increased by 0.214%. The negative significance of the household size coefficient implied that farmers with large household size composed of able-bodied people incurred less cost on labour due to access to free labour, thus an increase in their cost efficiency, Thus, a unit increase in the farm family household size by one person would lead to a decrease in his/her cost inefficiency by 0.075%. The positive significance of the farm size revealed that farmers with large farm size experienced diseconomies of scale, thus affecting their cost efficiency. Therefore, the implication of a unit increase in the farm size by one hectare would lead to an increase in cost inefficiency by 1.65%. The negative significance of the parameter estimates for language spoken implied that farmers who understand or speak more than one lingua had access to information concerning innovative and appropriate practices of allocation of farm inputs, thus making them more cost efficiency than their counterpart who understands only one language. Thus, the tendency of a farmer to speak more than one language would increase his/her cost efficiency by 0.469%.

A perusal of the cost efficiency scores showed the average cost efficiency to be 1.218 while the best and worse cost inefficiency scores were 1.025 and 2.305, respectively (Table 4). Therefore, the implication is that the average, best and worse cost inefficiency farmers incurred an extra cost of 21.8 %, 2.5 % and 130.5 % respectively relative to the best practiced farm producing the same output and facing the same technology at their disposal. In nominal value, it translates into ₦20600, ₦1484 and ₦107948 for the average, best and worst inefficient farms respectively (Table 5). The individual-wise results showed the potential minimum cost expected of each farm and the wasted incurred cost that need to be averted for the inefficiency farms so as to optimize profit in the short-run (Table 5). The frequency distribution of the cost efficiency scores showed none of the farmers to be on the frontier as evident by their respective cost efficiency scores which were above the frontier score of 1.00. It was observed that majority (53.6 %) of the farmers had their efficiency scores close to the frontier level while very few (3.6 %) of the respondents recorded an efficiency scores that are farther from the frontier surface.

Table 5: Individual-wise CES, Actual cost, Frontier cost and wasted cost

Farm	CES	Actual	Frontier	WC	% WC	Farm	CES	Actual	Frontier	WC	% WC
FM1	1.147	101878	88821	13056	12.8	**FM31**	1.051	81028	77096	3932	4.8
FM2	1.113	80138	72002	8136	10.1	**FM32**	1.069	87877	82205	5672	6.4
FM3	1.662	251170	151125	100044	39.8	**FM33**	1.058	88180	83346	4834	5.5
FM4	1.078	117802	109278	8523	7.2	**FM34**	1.103	109225	99025	10199	9.3
FM5	1.466	172935	117964	54971	31.8	**FM35**	1.449	162670	112263	50406	31.0
FM6	1.066	118750	111398	7352	6.2	**FM36**	1.051	98844	94047	4796	4.8
FM7	1.064	110810	104145	6665	6.0	**FM37**	1.087	101500	93376	8124	8.0
FM8	1.092	125364	114802	10561	8.4	**FM38**	1.087	117453	108052	9400	8.0
FM9	2.123	303630	143019	160610	52.9	**FM39**	1.056	96130	91032	5098	5.3
FM10	1.495	206164	137902	68261	33.1	**FM40**	1.06	90705	85571	5134	5.7
FM11	1.058	106340	100510	5829	5.5	**FM41**	1.077	84087	78075	6012	7.1
FM12	1.070	95723	89460	6262	6.5	**FM42**	1.395	101340	72645	28695	28.3
FM13	1.109	114145	102927	11218	9.8	**FM43**	1.074	90420	84190	6230	6.9
FM14	1.141	99183	86926	12256	12.3	**FM44**	1.039	45610	43898	1712	3.7
FM15	2.016	277590	137693	139896	50.4	**FM45**	1.051	68245	64933	3312	4.8
FM16	1.227	124260	101271	22988	18.5	**FM46**	1.067	58396	54729	3667	6.3
FM17	1.039	66505	64009	2496	3.7	**FM47**	1.035	74920	72386	2533	3.4
FM18	1.121	109085	97311	11774	10.8	**FM48**	1.074	102725	95647	7078	6.9
FM19	1.570	215878	137502	78376	36.3	**FM49**	1.095	83250	76027	7223	8.7
FM20	1.508	165909	110019	55889	33.7	**FM50**	1.040	85190	81913	3276	3.8
FM21	1.103	114570	103871	10698	9.3	**FM51**	1.111	77755	69986	7768	10.0
FM22	1.395	203565	145925	57640	28.3	**FM52**	1.656	121800	73551	48249	39.6
FM23	1.170	139235	119004	20230	14.5	**FM53**	1.100	84050	76409	7641	9.1
FM24	1.069	84440	78990	5450	6.4	**FM54**	1.073	97500	90867	6633	6.8
FM25	1.086	100820	92836	7983	7.9	**FM55**	2.021	151600	75012	76588	50.5
FM26	1.047	96930	92579	4351	4.5	**FM56**	1.110	104945	94545	10400	9.9
FM27	1.046	76930	73547	3383	4.4	**FM57**	1.078	111525	103455	8069	7.2
FM28	1.417	159760	112745	47014	29.4	**FM58**	1.098	110165	100332	9832.	8.9
FM29	1.855	209695	113043	96652	46.1	**FM59**	1.058	95145	89930	5216	5.5
FM30	1.074	95280	88715	6565	6.9	**FM60**	1.150	111310	96791	14519	13.0
FM61	1.063	115645	108792	6854	5.9	**FM87**	1.050	77760	74057	3703	4.8
FM62	1.044	64900	62165	2735	4.2	**FM88**	1.045	75700	72440	3260	4.3
FM63	1.034	64540	62418	2122	3.3	**FM89**	1.056	79950	75710	4240	5.3
FM64	1.025	60860	59376	1484	2.4	**FM90**	1.049	61280	58417	2862	4.7
FM65	1.048	68300	65172	3128	4.6	**FM91**	1.134	108770	95917	12853	11.8
FM66	1.168	99485	85176	14309	14.4	**FM92**	1.062	85140	80192	4948	5.8
FM67	1.075	86700	80651	6049	7.0	**FM93**	1.134	120900	106614	14286	11.8
FM68	1.353	109845	81187	28659	26.1	**FM94**	1.056	81600	77273	4327	5.3
FM69	1.085	105740	97456	8284	7.8	**FM95**	1.047	78780	75243	3536	4.5
FM70	1.201	84220	70125	14095	16.7	**FM96**	1.134	125500	110670	14830	11.8
FM71	1.034	58000	56093	1907	3.3	**FM97**	1.056	87690	83048	4642	5.3
FM72	1.089	95620	87805	7815	8.2	**FM98**	1.967	196400	99848	96552	49.2
FM73	1.390	114955	82701	32253	28.0	**FM99**	1.299	278400	214319	64081	23.0
FM74	1.041	62940	60461	2479	3.9	**FM100**	2.305	190667	82719	107948	56.6
FM75	1.099	106990	97352	9638	9.0	**FM101**	1.092	74390	68123	6267	8.4
FM76	1.737	182280	104940	77340	42.4	**FM102**	1.274	123310	96790	26520	21.5
FM77	1.057	105510	99820	5690	5.4	**FM103**	1.159	145000	125054	19946	13.7
FM78	1.273	153140	120298	32841	21.4	**FM104**	1.205	161880	134318	27562	17.0
FM79	1.064	90017	84602	5414	6.0	**FM105**	1.861	154638	83094	71544	46.3
FM80	1.058	80838	76406	4432	5.5	**FM106**	1.601	141230	88214	53016	37.5
FM81	1.249	146260	117055	29205	20.0	**FM107**	1.101	90338	82051	8287	9.2
FM82	1.222	125220	102471	22749	18.2	**FM108**	1.297	112458	86706	25752	22.9
FM83	1.047	70540	67373	3166	4.5	**FM109**	1.282	145330	113362	31968	22.0
FM84	1.515	146092	96430	49661	34.0	**FM110**	1.738	142564	82028	60536	42.5
FM85	1.078	93040	86308	6732	7.2	**Mean**	**1.218**	**115098**	**94498**	**20600**	**17.9**
FM86	1.077	91380	84847	6533	7.1						

Note: CES = Cost efficiency score; WC = Wasted cost *Source: Field survey, 2018*

CONCLUSION AND RECOMMENDATIONS

From the foregoing findings, it can be inferred that the farmers were not efficient in minimizing their farm costs which was largely due to health challenge of the farm family and diseconomies of scale which owed to their mode of operation i.e. small-scale holdings. Furthermore, all the sampled farms experienced cost wastage relative to the best practiced farm producing the same output using the same available technology in the studied area. Therefore, it was recommended that both public and private institutions should sensitize the farmers on the importance of health preventive measures, improvise basic health centres with adequate staffing of health personnel, and affordable and subsidized medications. In addition, the farmers should be enlighten on the importance of social capital *viz.* co-operative marketing in order to benefit from pecuniary advantages, thus addressing the problem of diseconomies of scale.

REFERENCES

Battese, G.E. and Coellli, T.J. (1995). A model for technical inefficiency effects in stochastic frontier production for panel data. *Empirical Economics*, 20: 325-345.

Ogundari, K., Ojo, S.O. and Ajibefun, I.A.(2006). Economics of scale and cost efficiency in small scale maize production: Empirical evidence from Nigeria. *Journal of Social Sciences*, 13: 131-136.

Paudel, P. and Matsuoka, A.(2009). Cost efficiency estimates of maize production in Nepal: A case study of the Chitwan District. *Agricultural Economics-Czech*, 55: 139-148.

Sadiq, M.S. and Samuel, P.E. (2016). Lucid investigation of cost efficiency of small-scale poultry broiler farms in Niger State of Nigeria. *International Journal of Innovative Research and Review*, 4: 9-23.

Sadiq, M.S. and Singh, I.P.(2016). Empirical analysis of economics of scale and cost efficiency of small-scale maize production in Niger state, Nigeria. *Indian Journal of Economics and Development*, 12: 55-63.