Yuzuncu Yıl University
Journal of Agricultural Science

http://dergipark.gov.tr/yyutbd

Research Article

Cost Efficiency Status of Rice Farmers Participating in IFAD/VCD Programme in Niger State of Nigeria

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

[1]Federal University Dutse, Faculty of Agric., Dep. of Agricultural Economics and Extension, Dutse, Nigeria
[2]S.K. Rajasthan Agricultural University, College of Agriculture, Dep. of Agricultural Economics, Bikaner, India
[3]Bayero University Kano, Department of Agricultural Economics and Extension, P.M.B. 3011, Kano, Nigeria
[1]https://orcid.org/0000-0003-4336-57231 [2]https://orcid.org/0000-0002-1886-5956 [3]https://orcid.org/0000-0003-4565-0683
*Corresponding author e-mail: sadiqsanusi30@gmail.com

Article Info

Received: 05.06.2020
Accepted: 21.05.2021
Online Published 30.06.2021
DOI: 10.29133/yyutbd.748367

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

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 the 2018 cropping season *viz.* well-structured questionnaire complemented with interview schedule from a sample size of 110 respondents selected through a multi-stage sampling technique. The sampled data were analysed using the stochastic cost frontier model. The empirical evidence showed that none of the farmers was 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 the poor health status of the farm family which led to the extra cost incurred in labour substitution and diseconomies of scale due to their small-scale mode of operation. Therefore, the study recommends that the policymakers should sensitize the farmers on the importance of health preventive measures and should endeavour to improve on the existing basic health centres both in human capital and logistics. In addition, the farmers should be encouraged to explore cooperative marketing so as to take advantage of the bulk discount in input purchase and have bargaining power in the marketing of their output, thus tackling the problem of diseconomies of scale in their farm operations.

Nijerya'nınNijerDevletinde IFAD / VCD ProgramınaKatılanPirinçÇiftçilerininMaliyetVerimliliği Durumu

Makale Bilgileri

Geliş: 05.06.2020
Kabul: 21.05.2021
Online Yayınlanma 30.06.2021
DOI: 10.29133/yyutbd.748367

Anahtar Kelimeler
Maliyet etkinliği,
Sınır,
IFAD,
Nijerya,
Pirinç,
Stokastik.

Öz: Bu araştırma, Nijerya'nın Nijer Eyaleti'ndeki IFAD / VCD programına katılan çiftçilerin maliyet etkinliğini ampirik olarak belirlemiştir. Çalışma, çok aşamalı bir örnekleme tekniği ile 110 katılımcıdan oluşan bir örnekleme büyüklüğünden seçilen röportaj usulü ile tamamlanan iyi yapılandırılmış bir anket ile 2018 üretim sezonunun çapraz kesit verilerini ortaya çıkardı. Örneklenen veriler, stokastik maliyet sınır modeli kullanılarak analiz edilmiştir. Ampirik kanıtlar, çiftçilerden hiçbirinin maliyet sınırında olmadığını, yani incelenen alanda pirinç ekiminde ideal minimum maliyete ulaşılamadığını göstermiştir. Maliyet verimliliğine engel olan belirgin kendine özgü değişkenler, işçi ikamesinde katlanılarak ekstra maliyete yol açan çiftlik ailesinin kötü sağlık durumu ve küçük ölçekli çalışma biçimleri nedeniyle ölçek ekonomileriydi. Bu nedenle çalışma, politika yapıcıların çiftçileri sağlığı koruyucu önlemlerin önemi konusunda duyarlı hale getirmelerini ve hem beşeri sermaye hem de lojistik alanlarda mevcut temel sağlık merkezlerini iyileştirmek için çaba göstermeleri gerektiğini önermektedir. Buna ek olarak, çiftçiler, girdi satin alımında toplu indirimden yararlanmak ve çıktılarının pazarlanmasında pazarlık gücüne sahip olmak ve böylece çiftlik faaliyetlerindeki ölçek ekonomisi sorununu çözmek için kooperatif pazarlamayı keşfetmeye teşvik edilmelidir.

1.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.* identifications of their needs and implementations 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. Ogundariet 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.

2. Materials and Methods

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 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, craftwork, *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 well-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 analyse the collected data. The Cochran's formula used is shown below:

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

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

Where:
n_a = adjusted sample size for finite population
n_r = sample size for infinite population
N = population size
Np = proportion of population having a particular characteristic
Nq = 1 – p
e^2 = error gap (0.07)
Thus, p = 0.40 and q = 1 – 0.60 = 0.40

Table 1. Sampling frame of participating farmers

LGAs	Villages	Co-operative Associations	SF	SS
Katcha	Baddegi	Managi Badeggi Farmers CMPS	24	10
		Aminci Ebanti Twaki CMPS Ltd	25	10
	Edostu	Edotsu Co-Operative Credit & Marketing CMPS	25	10
		Edotsu JinjinWugakunYema 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 GwariNasara CMPS	16	7
	Kanko	Kanko Arewa Farmers	25	10
		Kanko Unguwar Ndakogi Cooperative Multipurpose Society Ltd	25	10
Total			270	111

Source: IFAD-VCDP farmers' database, 2018.
Note: SF and SS mean sampling frame and sample size respectively.

2. Material and Methods

2.1 Model specification

Stochastic Cost Frontier Function: Following Battesse and Coelli (1995); Ogndari et al. (2006); Sadiq and Isah (2015); Sadiq and Singh (2016) and Sadiq and Samuel (2016), the adopted stochastic cost frontier (SCF) function is shown below:

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

C_i = Total production cost of the ith farmer;
P_i = Vector prices of the actual jth inputs used by the ith farmer;
Y_i = Vector of the actual jth output of the ith farmer;
β_i = parameter to be estimated;

V_i = Uncertainty which is beyound 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 (C^b) to the corresponding minimum cost (C^{min}), and it is given below:

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

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:

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

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 (₦), andP_7= rental value of land (₦/hectare); Y_i= Farm output (kg) from i^{th}farmer; V_i = random variability in the production that cannot be influenced by the i^{th} farmer also known as uncertainty; U_i= deviation from maximum potential output attributable to cost inefficiency and also known as risk. β_0=intercept; β_k=vector of cost parameters to be estimated;β_l=vector of output parameter to be estimated; $i = 1,2,3 \ldots \ldots n\ farmers$; $j = 1,2,3 \ldots \ldots \ldots m\ inputs$.

The inefficiency model is:

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

Where Z_1 = 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.

A Frontier version 4.1 was used for the stochastic cost efficiency estimation.

3. Results

3.1 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 and gamma (0.8631) 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 86.31% variation in the total cost (Table 2). In addition, the calculated log-likelihood ratio test being greater than the tabulated Chi^2 indicates the presence of one-sided error, thus an indication that the traditional response function (OLS) cannot fit the data (Table 3).

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, cost of urea fertilizer, cost of herbicides, 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 33.39%, 43.22%, 36.56% and 29.48%, respectively. Besides, a percent increase in the output level of rice would increase the total cost by 35.86%. 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 behaviour under traditional agricultural setting they are efficient giving the available technology at their disposal (Schultz, 1964; Ogundari et al., 2006; Sadiq and Singh, 2016).

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 a 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 1.655%. 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 ₦20600.51, ₦1484.39 and ₦107948.10 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. Similar result was found by Yakubu (2017) in his study on economic efficiency of small-scale rice farmers in Kwara State of Nigeria. However, in maize crop, Sadiq and Singh (2016); Paudel and Matsuoka (2009) and Ogundari et al. (2006) observed similar result in their respective studied areas.

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	0.078993	3.043***
NPK fertilizer (₦)	0.33385	0.134949	2.473**
Urea fertilizer (₦)	0.43218	0.123087	3.511***
Herbicides (₦)	0.36561	0.141361	2.586**
Human labour labour (₦)	0.119099	0.074115	1.606^{NS}
Rent value of land (₦)	0.294837	0.0885465	3.329***
Depreciation on cap. (₦)	0.042828	0.0427875	1.001^{NS}
Output (kg)	0.3585499	0.196904	1.820*
Inefficiency model			
Constant	-3.00142	1.05781	2.837***
Education	0.032828	0.03319	0.988^{NS}
Illness of member	0.21368	0.11938	1.789*
Extension visit	0.03062	0.058304	0.525^{NS}
Access to credit	-0.08388	0.3113	0.269^{NS}
Age	0.009622	0.02615	0.368^{NS}
Household size	-0.074497	0.05432	1.372^{NS}
Income	0.35555E-06	0.41535E-06	0.856^{NS}
Farm size	1.65495	0.31176	5.308***
Farming Experience	-0.008799	0.02537	0.347^{NS}
Non-farm income	0.051108	0.33811	0.151^{NS}
Language spoken	-0.46844	0.27972	1.675*
Variance parameters			
Sigma-squared(σ^2)	0.15649	0.04682	3.342***
Gamma (γ)	0.86307	0.044471	1.941**

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

Table 3. Generalized likelihood ratio test of hypothesis for parameters of SCFF

H_o	Log likelihood function	λ	Critical (5%)	Decision
$\gamma = 0$	23.602	21.05	16.91	$\gamma \neq 0$

Source: Field survey, 2018.

Table 4. Frequency distribution of cost efficiency scores

Efficiency level	Frequency	Relative efficiency %
1.00-1.09	59	53.63636
1.10-1.19	18	16.36364
1.20-1.29	10	9.090909
1.30-1.39	4	3.636364
1.40-1.49	4	3.636364
1.50-1.59	3	2.727273
1.60-1.69	3	2.727273
1.70-1.79	2	1.818182
1.80-1.89	2	1.818182
1.90-1.99	1	0.909091
≥2.00	4	3.636364
Total	110	100
Mean	1.218	
Maximum	2.305	
Minimum	1.025	
Standard deviation	0.271	

Source: Field survey, 2018.

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	88821.27	13056.73	12.81604	FM31	1.051	81028	77096.1	3931.901	4.852521
FM2	1.113	80138	72001.8	8136.203	10.15274	FM32	1.069	87877.5	82205.33	5672.168	6.45463
FM3	1.662	251170	151125.2	100044.8	39.83153	FM33	1.058	88180	83345.94	4834.064	5.482042
FM4	1.078	117802	109278.3	8523.707	7.235622	FM34	1.103	109225	99025.39	10199.61	9.338169
FM5	1.466	172935	117963.8	54971.15	31.78718	FM35	1.449	162670	112263.6	50406.37	30.98689
FM6	1.066	118750	111397.7	7352.251	6.19137	FM36	1.051	98844	94047.57	4796.426	4.852521
FM7	1.064	110810	104144.7	6665.263	6.015038	FM37	1.087	101500	93376.26	8123.735	8.00368
FM8	1.092	125364	114802.2	10561.8	8.424908	FM38	1.087	117453	108052.4	9400.562	8.00368
FM9	2.123	303630	143019.3	160610.7	52.89684	FM39	1.056	96130	91032.2	5097.803	5.30303
FM10	1.495	206164	137902.3	68261.66	33.11037	FM40	1.06	90705	85570.75	5134.245	5.660377
FM11	1.058	106340	100510.4	5829.603	5.482042	FM41	1.077	84087	78075.21	6011.791	7.149489
FM12	1.07	95722.77	89460.54	6262.237	6.542056	FM42	1.395	101340	72645.16	28694.84	28.31541
FM13	1.109	114145.5	102926.6	11218.99	9.828674	FM43	1.074	90420	84189.94	6230.056	6.89013
FM14	1.141	99182.77	86926.18	12256.59	12.35758	FM44	1.039	45610	43897.98	1712.021	3.753609
FM15	2.016	277590	137693.5	139896.5	50.39683	FM45	1.051	68245	64933.4	3311.603	4.852521
FM16	1.227	124260	101271.4	22988.61	18.50041	FM46	1.067	58396	54729.15	3666.853	6.279288
FM17	1.039	66505	64008.66	2496.338	3.753609	FM47	1.035	74920	72386.47	2533.527	3.381643
FM18	1.121	109085.5	97310.92	11774.62	10.79393	FM48	1.074	102725	95647.11	7077.886	6.89013
FM19	1.57	215878	137501.9	78376.09	36.30573	FM49	1.095	83250	76027.4	7222.603	8.675799
FM20	1.508	165909	110019.2	55889.77	33.687	FM50	1.04	85190	81913.46	3276.538	3.846154
FM21	1.103	114570	103871.3	10698.74	9.338169	FM51	1.111	77755	69986.5	7768.501	9.990999
FM22	1.395	203565	145924.7	57640.27	28.31541	FM52	1.656	121800	73550.72	48249.28	39.61353
FM23	1.17	139235	119004.3	20230.73	14.52991	FM53	1.1	84050	76409.09	7640.909	9.090909
FM24	1.069	84440	78989.71	5450.29	6.45463	FM54	1.073	97500	90866.73	6633.271	6.803355
FM25	1.086	100820	92836.1	7983.904	7.918969	FM55	2.021	151600	75012.37	76587.63	50.51954
FM26	1.047	96930	92578.8	4351.203	4.489016	FM56	1.11	104945.5	94545.54	10400.01	9.90991
FM27	1.046	76930	73546.85	3383.155	4.397706	FM57	1.078	111525	103455.5	8069.527	7.235622
FM28	1.417	159760	112745.2	47014.76	29.42837	FM58	1.098	110165	100332.4	9832.577	8.925319
FM29	1.855	209695	113043.1	96651.87	46.09164	FM59	1.058	95145.55	89929.63	5215.918	5.482042
FM30	1.074	95280	88715.08	6564.916	6.89013	FM60	1.15	111310	96791.3	14518.7	13.04348

Source: Field survey, 2018.

Table 5 (continuation). Individual-wise CES, Actual cost, Frontier cost and wasted cost

Farm	CES	Actual	Frontier	WC	% WC	Farm	CES	Actual	Frontier	WC	% WC
FM61	1.063	115645.5	108791.7	6853.875	5.926623	FM87	1.05	77760	74057.14	3702.857	4.761905
FM62	1.044	64900	62164.75	2735.249	4.214559	FM88	1.045	75700	72440.19	3259.809	4.30622
FM63	1.034	64540	62417.79	2122.205	3.288201	FM89	1.056	79950	75710.23	4239.773	5.30303
FM64	1.025	60860	59375.61	1484.39	2.439024	FM90	1.049	61280	58417.54	2862.459	4.671115
FM65	1.048	68300	65171.76	3128.244	4.580153	FM91	1.134	108770	95917.11	12852.89	11.81658
FM66	1.168	99485.55	85175.98	14309.56	14.38356	FM92	1.0617	85140	80192.14	4947.855	5.811434
FM67	1.075	86700	80651.16	6048.837	6.976744	FM93	1.134	120900	106613.8	14286.24	11.81658
FM68	1.353	109845.5	81186.66	28658.89	26.09017	FM94	1.056	81600	77272.73	4327.273	5.30303
FM69	1.085	105740	97456.22	8283.779	7.834101	FM95	1.047	78780	75243.55	3536.447	4.489016
FM70	1.201	84220	70124.9	14095.1	16.73605	FM96	1.134	125500	110670.2	14829.81	11.81658
FM71	1.034	58000	56092.84	1907.157	3.288201	FM97	1.0559	87690	83047.64	4642.363	5.294062
FM72	1.089	95620	87805.33	7814.674	8.172635	FM98	1.967	196400	99847.48	96552.52	49.16116
FM73	1.39	114955	82701.44	32253.56	28.05755	FM99	1.299	278400.8	214319.3	64081.47	23.01771
FM74	1.041	62940	60461.1	2478.905	3.938521	FM100	2.305	190667	82718.87	107948.1	56.61605
FM75	1.099	106990	97352.14	9637.862	9.008189	FM101	1.092	74390	68122.71	6267.289	8.424908
FM76	1.737	182280	104939.6	77340.45	42.42948	FM102	1.274	123310	96789.64	26520.36	21.50706
FM77	1.057	105510	99820.25	5689.754	5.392621	FM103	1.1595	145000	125053.9	19946.1	13.75593
FM78	1.273	153140	120298.5	32841.49	21.4454	FM104	1.2052	161880	134318	27562.04	17.02622
FM79	1.064	90017	84602.44	5414.556	6.015038	FM105	1.861	154638	83094.04	71543.96	46.26545
FM80	1.058	80838	76406.43	4431.573	5.482042	FM106	1.601	141230	88213.62	53016.38	37.53904
FM81	1.2495	146260	117054.8	29205.18	19.96799	FM107	1.101	90338	82050.86	8287.137	9.173479
FM82	1.222	125220	102471.4	22748.64	18.16694	FM108	1.297	112458	86706.25	25751.75	22.899
FM83	1.047	70540	67373.45	3166.552	4.489016	FM109	1.282	145330	113361.9	31968.07	21.99688
FM84	1.515	146092	96430.36	49661.64	33.9934	FM110	1.738	142564	82027.62	60536.38	42.4626
FM85	1.078	93040	86307.98	6732.022	7.235622	Mean	1.218	115098.3	94497.77	20600.51	17.89819
FM86	1.077	91380	84846.8	6533.203	7.149489						

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

4. Discussion and Conclusion

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., & 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., & Ajibefun, I.A. (2006). Economics of scale and cost efficiency in small-scale maize production: Empirical evidence from Nigeria. *Journal of Social Sciences*, 13(2), 131-136.

Paudel, P., & Matsuoka, A. (2009). Cost efficiency estimates of maize production in Nepal: A case study of the Chitwan District. *Agricultural Economics-Czech*, 55(3), 139-148.

Sadiq, M.S., & Isah, M.A. (2015).Neoclassical test of cost efficiency in sorghum production among small- scale farmers in Niger State, Nigeria. *International Journal of Tropical Agriculture*, 3(2), 423-431.

Sadiq, M.S., & 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(4), 9-23.

Sadiq, M.S., & 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(1), 55-63.

Shultz, T. W. (1964). *Transforming Traditional Agriculture*. New Haven: Yale University Press.

Yakubu, G. (2017). *Economic efficiency of small-scale rice farmers in Kwara State of Nigeria*. A B.Tech. Thesis submitted to the Department of Agricultural Economics and Extension Technology, Federal University of Technology, Minna, Nigeria