TECHNICAL EFFICIENCY OF DRY SEASON VEGETABLE IN OSUN STATE-NIGERIA

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Abstract: The study was designed to examine the profitability and measure the level of technical efficiency of dry season vegetable farmers using stochastic frontier production function. A purposive sampling technique was used to select 60 vegetable farmers in the study area. The estimated farm technical efficiency ranges from 75% to 98% with a mean of 92%. This indicates that ample opportunities exist for the farmers to increase their productivity and income through a more efficient utilization of productive resources. Inefficiency determinants are all directly related to technical efficiency but are not significantly determined the technical efficiency of the farmers.
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1. Introduction

Vegetable are generally regarded as essential herbaceous plant having high moisture content in their fresh forms with considerable quantities of vitamin, A, B, C, D, E and K, which help to protect the body against diseases and contribute in no small measures to good health (Agusiobo 1984). Vegetables are therefore, complementary foods of the first order and are much more important to man's health than product of animal origin since nobody will suffer from eating quite large amount of different vegetables whereas eating too much meat is pointless and may cause health problems.

The daily need for vegetables as recommended by FAO and reported by Wainjemberg (1981), is normally 150 –250g per person. This is expected to provide balanced diet needed by people particularly in diet characterized by low inclusion of meat and other animal proteins (Afolami and Ayinde, 1996). According to the CBN statistical Bulletin (1998), the production level of vegetable crops in Nigeria is 3.82 million tones in 1997. Although they are vast inter-country differences, current vegetable supplies in many developing countries including Nigeria cannot even meet one half of FAO recommendation. Olayide (1980) projected vegetable food deficits to reach 1.178 million tones by 1995, the situation is not so different even till today.

Apart from the general problem facing food crops farmers in Nigeria, vegetables and fruit crops farmers still faces other unique problems due to high perishability of these products which warranted that the product must be transported quickly to the point of consumption in other to reduce losses due to spoilage. In some cases up to 40% post harvest loses had been recorded for some vegetables and fruits. Dry season vegetables production make it possible for farmers to grow the crop all year round alone non-saline river bank, valley and non-waterlogged swamps. The most important requirement for dry season production is availability of water source for irrigation purpose.

The recent Fadama III project jointly sponsored by World Bank and Africa development bank is a step in the right direction towards encouraging dry season farming especially vegetables production.

Problem of low productivity and non-availability of vegetable all year round being experienced by the producers and consumers of dry season vegetable is due partly to inefficient management of resources/inputs available to the farmers especially the chemical input. This articles therefore aim at examining the profitability and technical efficiency of dry season vegetables farm in Osogbo Local Government Areas of Osun-State; Nigeria.

2. Theoretical framework

The efficiency of a firm is the ability to derive from a fixed amount of inputs the greatest amount of output possible. An efficient firm is that which, given a state of technical know-how, can produce a given quantity of goods by using the least quantity of input possible.

The efficiency of a firm has two components, namely technical and allocative efficiency. Technical efficiency is the ability to produce a given level of output with a minimum quantity of input under a given technology, while allocative efficiency measures the degree of success in achieving the best combination of different inputs in producting a specific level of output, having regard to the relative prices of these inputs.

The first analysis of efficiency measures started with Farrell (1957), who drawing inspiration from Debrew (1951) and Koopmans (1961) proposed a division of efficiency into two components as started before.

The stochastic frontier model was independently proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and Vanden Broeck (1977). According to (Onyenweaku and Nwaru 2005), a stochastic frontier production function is defined by;

$Y = f(Xi, B1) \exp (Vi - Ui), i = 1, 2------n$

Where; Yi is output of the ith farm

Xi is the vector of input quantities used by the ith farm. Bi, is a vector of unknown parameters to be estimated

Vi is a symmetric error, which accounts for random variations in output due to factors beyond the control of the farmers.

While Ui is a non negative random variable representing inefficiency in production relative to the stochastic frontier. The random error Vi is assumed to be independently and identically distributed as $N(O, 6^2)$ random variables independent of the U is which are assumed to be non negative truncation of the $N (0,6^2)$ distribution or have exponential distribution. Technical efficiency is define as,

$TE = Yi/Yi^* = f(Xi, B) \exp (Vi - Ui)/f(Xi, B) \exp (Vi) = Exp. (-Ui)$

Where Yi is the observed output

Yi* is the frontier output

The parameters of the stochastic frontier production function are estimated using the maximum likelihood method.

3. Methodology

3.1 Study Area

The study was carried out in Osogbo Local Government area of Osun state with the head quarter at Oke-bale, in Osogbo. Osogbo has a population of I80,000 people according to 1991 census. Osogbo is situated on a raised land, which is well over 500m above the sea level.Agriculturally, a bench mark survey of the territory conducted by the Osogbo ADP in 1992 revealed that maize, cassava, yam, melon, sorghum, rice are among major crops grown by over sixty percent of the farmers. Other crops grown include vegetable, sugar cane, millet, cowpea, soybean and ground nut etc.

3.2 Population of the Study, Sampling Procedure and Sampling Size.

Population of the study are all dry season vegetable farmers in Osogbo local government area. The purposive sampling procedure was adopted for the study. Based on the information earlier collected from the Osun state Agricultural Development Programme (OSADEP) officials, farm settlement and Oke-pupa rural community farmers who engage themselves in dry season vegetable were purposively selected based on the fact that these two communities have irrigation schemes and formed the majority of registered vegetables growers. In the end, sixty respondents were selected from the list of registered vegetable growers for this study.

3.3 Methods of Data Collection and Analysis

Interview schedule was used to collected data from the selected respondents. Data collected was analyzed using descriptive statistics such as frequency table and percentages. Stochastic frontier production function was used to examine the technical efficiency of the respondents, while budgetary analysis was used to determine the profitability (or otherwise) of the enterprise.

3.4 Model Specification

The stochastic frontier production function of the Cobb Douglas types was specified for this study due to its advantage over other functional forms. It is widely used in the frontier production function studies (Kalirajan and Finn, 1983). The model was specified as;

$Yi = Bo + Bi \log Xi + B_2 \log X_2 + B_3 \log X_3 + B_4 \log X_4 + Vi + U_1$

Where

Y = Yield (tones)

X_1 = Rent (N)

X_2 = Seed (kg)

X_3 = Labour (manday)

X_4 = chemical

i = 1, 2, 3 and 4

Bo, B_1 ----B_4= Regression parameters.

V_i is the error component representing statistical wise and is assumed to follow, a normal distribution with mean zero and constant variance.

U_i is the error component representing the farm specific effect of technical efficiency.

The inefficiency model is stated as;

$\mu = \delta o + \delta_1 Z_1 + \delta_2 Z_2 + .. + \delta_4 Z_4$

Where μ = Technical inefficiencies effect on the farm

Z_1 = Production (Years)

Z_3 = Other Occupation

Z_3 = Extension worker

Z_4 = Years of experience

Z_5 = Farm Size

Z_6 = Age

Z_7 = Extension benefit

Z_8 = Association benefit.

The Gross margin (Gm) is given as;

GM = TR – TVC

And the Net profit is (NP) is given as;

NP = GM – TFC

Where, TR is Total Revenue (₦), TVC is the Total Variable Cost (₦), while TFC is the Total Fixed Cost (₦).

4. Result and discussion

The costs of vegetable production include the cost of fixed inputs (land and implements) and variable inputs such as seed, labour, and chemicals. All costs have been computed per hectare. Table 2 shows that the total fixed cost was ₦3,415.42, while the total variable cost was N33,880.42, this give the total cost of production as ₦37, 295.42. The total revenue was ₦81, 252.50. Using the two formula stated before. A positive gross margin (₦47, 372.08) and a positive Net profit (₦43,957.08) was obtained. This shows that dry season vegetable production is profitable in the area. A benefit cost ration of 2.18 further confirm the above finding and revealed that for every naira (₦) invested in the enterprise N2.18 is realized as return.

Note that: N 155 = $

TABLE 1: ANALYSIS OF COST AND RETURNS FROM DRY SEASON VEGETABLE PRODUCTION PER HECTARE

		₦	₦
Total revenue			81,252.50
Costs			
(1) Variable Cost			
(a)	Fertilizer/ chemical	10,166.53	
(b)	Hired labour	22,358.69	
(c)	Seeds	1,355.20	
Total variable cost			33,880.42
Gross margin			47,372.08
(2)	Fixed Costs		
	Depreciation		
(a)	Land (Rent)	1,500	
(b)	Hoes	320	
(c)	Cutlass	595	
(d)	Basket and Others	1,000	
Total fixed cost		3,415.00	

$$\text{Benefit cost ratio} = \frac{\text{Total Revenue}}{\text{Total Cost}}$$

$$\text{B/C ratio} = \frac{\text{N}81{,}252.50}{\text{N}37{,}298.42} = 2.18 > 1$$

4.1 OLS AND MLE ANALYSIS.

The ordinary least square (OLS) and the maximum likelihood estimate (MLE) of the production function parameters for dry seasonal vegetable production in Osogbo is presented in table 2. A comparison of the function shows that stochastic production function has a higher intercept term than the OLS production function. All the variables included in the models followed the production expectation with the exception of labour and chemical inputs that has an inverse relationship with the yield.

In OLS models, labour is statistically significant at 1% level of probability, rent and seed also have significant impact on the yield. The coefficient of rent paid on land is 0.95, this implies that 1% increase in access to land will lead to about 0.95% increase in yield while reducing the chemical and labour input by 1% would lead to about 0.70% and 0.80% increase in yield. The sum of the regression coefficient (elasticities) in Cobb-Douglass gives the return to scale. The value of return to scale is –0.13. This implies in decrease return to scale.

In MLE of the frontier production function estimate shows that sigma-square which indicates the goodness of fit and correction of distribution assumption is significantly different from zero. The variance ratio which measure the effect of technical efficiency in the variation of observed output has a value of 0.26. This shows that about 26% of the difference between the observed and production frontier output were due to differences in the farmers output of technical efficiency and not related to random variability. In MLE model, only seed have a coefficient that is significant at 1% level of probability. This implies that, if we increase seed input by 1%, it will lead to 0.42% increase in yield.

TABLE 2: Estimation of Production Function For Dry Season Vegetable Farmers

Variable	Parameter	Average OLS Function	Frontier Function (MLS)
Constant	bo	0.33	0.42
		(3.60)*	(0.45)
Rent	b_1	0.95	0.92
		(3.21)*	(0.95)
Seed	b_2	0.42	0.42
		(3.53)*	(4.17)*
Labour	b_3	-0.70	-0.70
		(-3.47)*	(-0.70)
Chemical	b_4	-0.80	-0.80
		(-0.32)	(-0.80)
R^2		0.811	
F-ratio		30.180*	
Sigma (8)			0.26
			(0.030)
Gamma (y)			0.50
			(0.500)

Figures in parentheses are t-ratio
* = significant at 1%

4.2 Estimates of Parameters of Technical Efficiency

The frequency distribution of technical efficiency of dry season vegetable farmers in the study area is presented in Table 3, the individual technical efficiency indices range between 0.75 to 0.98 percent. This shows that the efficiency of farmers can still be improved on. Though most efficient farm is very close to the frontier, none of the farmers was on the efficiency frontier. Inter-farm variation in technical efficient are very small as suggested by the small gap between the least efficiency index (0.70-0.79) and the highest efficiency index (0.90-0.99).

TABLE 3: FREQUENCY DISTRIBUTION OF FARM SPECIFIES TECHNICAL EFFICIENCY FREQUENCY

Efficiency	Frequency	Percentage
0.70-0.79	04	6.67
0.80-0.89	15	25.0
0.90-0.99	41	68.33
Total	60	100

Mean efficiencies = 0.92

4.3 Sources of Technical Efficiency

The effect of the selected socio-economic factors on the estimated technical efficiency was examined. It has observed that all the inefficiency determinations fitted in the model have positive but insignificant relationship with the technical efficiency, this implies that, though they tend to have a positive association with the technical indexes, they cannot significantly determined an improvement on productivity. Table 4 give a better description of the Inefficiency determinants.

TABLE 4: Estimate of determinants of efficiency differentials

Variable	Parameter	Coefficient
Constant	Z_0	0.16
		(0.001)
Education	Z_1	0.10
		(0.103)
Other occupation	Z_2	0.85
		(0.009)

Extension worker	Z_3	0.12 (0.012)
Years of Experience	Z_4	0.82 (0.009)
Farm size	Z_5	0.73 (0.073)
Age	Z_6	1.94 (0.098)
Extension Benefit	Z_7	0.21 (0.002)
Membership of Association	Z_8	0.86 (0.089)

Figures in parentheses are t-ratio.

Conclusion

The result of this study show that technical efficiency in dry season vegetable production in Osogbo local government area, Nigeria ranges between 75% to 98% with a mean of 92%. This suggested that there are substantial opportunities to increase productivity and income of the dry season vegetable farmers in the study area through a more efficient utilization of productive resources.

All the inefficiency determinants are all directly related to technical efficiency but are not significantly determined the technical efficiency of the farmers.

The result of the study revealed that dry season vegetable production in the area is profitable since the gross margin/ha (₦47,372.08) and the Net profit/ha (₦43,957.08) are positive. The benefit cost ratio of 2.18 indicates that for every naira invested in the business ₦2.18 is realized as returns from investment.

References

1. Afolami C.A and Ayinde I (1996); Sustainable vegetable production: Analysis of the profitability and resource use efficiency in vegetable farming in Yewa North local Government area of Ogun State,. Conference of Horticultural society of Nigeria Vol. 1.
2. Agusiobo O.H (1994). Sustainable food production, role of UNAAB Graduates. The harest publication of National Association of Agricultural Students (NAAS), University of Agriculture chapter Vol. 1, No 1.
3. Aigner D.J, C.A.K Lovell ad P. Schmidt (1997). A formulation and estimation of stochastic frontier production function mode, "Journal of econometrics Vol 1(pp 21-37.
4. CBN (1998); Central Bank of Nigeria statistical bulletins 1998.
5. Debren. G (1951): "The coefficient of resource utilization" Econometrica 19:273-292.
6. Farrel, M.J. (1957): "Measurement of production efficiency". Journal of the Royal statistical society, series A. 120(B); 253-290.
7. Kaliraian K and J.C. Finn (1983), The measurement of farm specific technical efficiency" Pakistan Journal of Applied Economics Vol. 2(2) Pp167-180.
8. Koopmans, T.C (1951) "An analysis of production as an efficient combination of activities" in TC/Coopmars (edition) Activity analysis of production and allocation. Cowles commission for research in economics, Monograph No13, Willey, New York.
9. Olayinde S.O (1980); Nigerian small farmers; problems and prospect in integrated rural development. Published by center for agricultural rural development (CARD), U.I Nigeria.
10. Onyenweaku C.E. and Nwaru J.C. (2005): "Application of a stochastic frontier production function to the measurement of technical efficiency in food crop production in Imo State, Nigeria." Nigeria Agricultural Journal. Vol. 36; 1-12.
11. Meewen . N and J. Vanden Broeek (1977). "Efficiency estimation from Cobb Douglass production function with composite error" International Economic Review Vol. 18(2). Pg 123-134
12. Wain Temberg (1981); The vegetable garden in the tropics with special reference to Africa. Macmillan London.

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