FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 3 No. 4, December, 2019, pp 144 –152

EFFICIENCY OF URBAN FOOD CROP FARMING HOUSEHOLDS IN OYO STATE, NIGERIA

***Olaleye, D. T., Obayelu, A. E. and Ogunmola, O. O.**

Department of Agricultural Economics and Farm Management
Federal University of Agriculture, Abeokuta, Nigeria, PMB 2240, Abeokuta Ogun State, Nigeria
Corresponding Email: olaleyedavidtobi@gmail.com Mobile: +2348164512705

ABSTRACT

This study examined the efficiency of urban farming households in Oyo state Nigeria. Multi-stage sampling procedure was used to select 159 farm households. A Structured questionnaire was used to collect data on socio-economic characteristics, quantities and prices of inputs and outputs from the respondents. Data were analysed using descriptive statistics and Stochastic Frontier Analysis (SFA). Results revealed that 84.9% of the respondents were male; the average household size, age, farm experience, farm size, years of formal education and monthly income were 6 persons, 49.6 years, 16.2 years, 1.1 hectares, 13.5 years and ₦11,902.50 respectively. The SFA revealed that 84.7%, 94.6% and 89.7% of the respondents were economically, technically and allocatively respectively. Furthermore, cultivated farmland ($\beta = 0.2$, $p<0.05$) and seeds ($\beta = 0.9$, $p<0.01$) increased urban farmers' technical efficiency while years of formal education ($\beta = 2.1$, $p<0.05$) reduced technical efficiency and return to scale was 1.3. Also, prices of labour ($\beta = 0.4$, $p<0.01$) and cultivated farmland ($\beta = 0.2$, $p<0.01$) enhanced farmers' allocative efficiency. The study concluded that respondents can still improve their levels of efficiency. Therefore inputs such as cultivatable farm land and seeds should be made available to farmers in order to improve their efficiency.

Keywords: Urban food crop, Farm Household, Efficiency, Stochastic Frontier Analysis, Oyo State

INTRODUCTION

Many urban residents are forced to become totally self-reliant in a range of basic services including housing, employment and food supply within a context of what is often the near absence of state infrastructure, housing and social services (FAO, 2012). Regardless of this, it is apparent that in many developed urban cities, agricultural activities (growing of food or the rearing of animals) within or on the periphery of urban areas are a vital source of food supply and often a significant source of income for urban households (FAO, 2012). It is however believed that some 50% of the urban food needs are met by agricultural food producers within the urban boundaries (Binns and Nel, 2014). With this effort made, urban agriculture is gradually being recognised as a determinant to sustainable and successful urban growth and household survival.

Urban agriculture is defined as the production of crop and livestock within cities and towns (Kenneth *et al.*, 2013). Some studies have shown that 200 million people are employed in urban farming and related enterprises, contributing to the food supply of 800 million urban dwellers (Zezza and Tasciotti, 2010). Many urban residents in Nigeria rely on urban agriculture to close the gap between sources of food and the market, and an important strategy to keep down the transaction costs (Kenneth *et al.*, 2013).

Efficiency can be explained as the association that exists between all outputs and inputs in a production process (Rodríguez *et al*., 2004). Different efficiency measures can be used to check the performance of a farm or decision unit. More specifically, technical efficiency can be defined as the ability of a farm to produce the maximum feasible output from a given bundle of inputs or to use minimum feasible amounts of inputs to produce a given level of output (Farell, 1957; Rao *et al.*, 2004). It can be deduced from the definitions that efficiency measures are "output-oriented'' and the "input-oriented'' (Coelli *et al*., 2002; Dhungana *et al.*, 2004; Rodríguez *et al*., 2004). Also efficiency connotes efficient utilization of resources in the production process (Farrel, 1957; Rao *et al.*, 2004). However, resource productivity can be expressed in terms of individual resource inputs or in combinations. For example, human labour productivity is expressed as the ratio of total output to labour inputs. In addition, Farrel's definition of efficiency rest on three related terms. Firstly, he defines technical efficiency as the measure of firms' success in producing maximum output from a given sets of inputs. Secondly, he defines "price efficiency'' as the measure of a firm's success in choosing an optimal set of inputs. Thirdly, he defines "overall efficiency" as the simple product of the technical and price efficiencies.

Knowledge of the efficiency level at both the firm and fleet level and its determinant factors are valuable information for understanding the problems of urban farming in agriculture. Efficiency can be measured by different techniques (Färe *et al*., 1994; Rao *et al.*, 2004), but given the stochastic nature of urban farming, the stochastic frontier approach has so far been advocated in the literature (Kirkley *et al*., 1995; Rao *et al.*, 2004). Production efficiency is an approach which examines whether or not a firm is producing its output profitably (Sivarajah, 2017). Home gardening in urban area is a means of survival strategy to show reasons for agricultural involvement. The type of crops grown and access to and use of different inputs and the different strategies used to cope with unavailability of inputs (May and Fortune, 2011).

Urban areas in Nigeria are faced with the problem of increasing population, increasing inaccessibility to social services, unemployment and underemployment and consequently inadequate supply of food items. A large proportion of urban households in Nigeria merely eat for survival despite their involvement in urban agriculture, just like many rural households whose occupation is predominantly agriculture (Obayelu, 2012). It is against these backdrop that this study aim to analyse the efficiency of urban food crop farming in Oyo state, Nigeria. The objective of the study is to estimate the efficiency of urban farming and proffer possible recommendations with a view to increasing the level of efficiency in urban farming enterprise.

METHODOLOGY

Study area: Oyo state covers an area of 28,454 square kilometers and has a population of about 7,840,900 people. The State lies between latitudes 7º 3¹N and 9º12¹N and longitudes 2º 47¹E and 4º 23¹E (NPC, 2016). Its climate favours the cultivation of crops like maize, yam, cassava, millet, rice, fruit and leafy vegetables, cowpea, sorghum, plantain, cocoa yam, palm tree, mellon, guinea corn, groundnut, mango, banana, cocoa, pineapple, citrus and cashew (Daud *et al.* 2018)

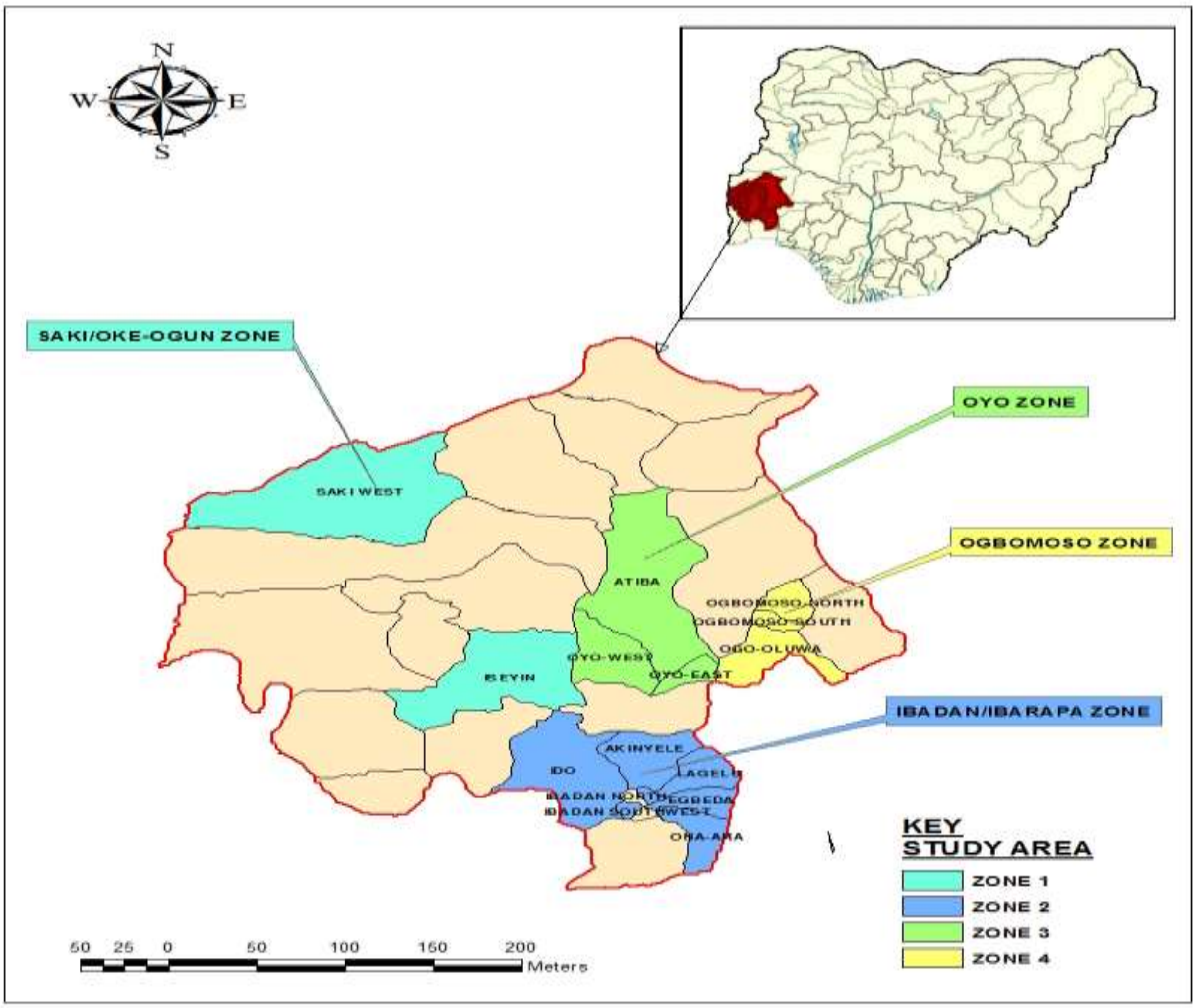

Figure 1: Map of Oyo state showing the study area
Source: Field Survey, 2018

Sampling procedure and sample size

A multistage sampling procedure was used in the selection of 159 households from the study area. Oyo State is divided into: Saki/Oke-ogun, Ibadan/Ibarapa, Oyo, and Ogbomoso zones. In the first stage, all the four agricultural zones of the state were used for proper representation of urban food crop farmers in the study area. The second stage was a purposive selection of blocks in each zone where urban food crop farmers were identified; two (2) blocks were purposively selected from Saki/Oke-ogun, seven (7) from Ibadan/Ibarapa, three (3) from Oyo, and three (3) from Ogbomoso zones making fifteen (15) blocks in all; they were purposively selected because the targeted respondents were primarily urban food crop farmers. The third stage involved the selection of 28 food crops farm households from the blocks in Saki/Oke-ogun zone, 83 from the blocks in Ibadan/Ibarapa zone, 20 from the blocks in Oyo zone and 28 from the blocks in Ogbomoso zone through a snowball sampling technique as the urban farmers were not easily located without their colleagues assistance.

Analytical techniques

Data collected were analysed using descriptive statistics and Stochastic Production Frontier (SFA) model. Descriptive statistics such as frequency distribution (in percentage and presented in form of table) were used for socio-economic characteristics of household and other variables necessary for this study. Stochastic Production Frontier (SFA) model was used to carry out the analysis of urban food crop production and the determinants.

Stochastic production frontier (SFA) model

Stochastic Production Frontier was used to analyse the production efficiency of the urban food crop farmers in the study area. The food crops considered for this study are: maize, yam cassava, rice, beans, groundnut, sweet potato, *Amaranth*, tomato, saluyot leaves (*Chochorus*), okra, pumpkin leaves (ugu), garden egg, pepper, banana, plantain, moringa, orange, pawpaw and cucumber.

The stochastic efficiency frontier production function is defined as follows:

$Yi = f\,(Xi, \beta)\ \exp\,(Vi - Ui)$ …………………………………………………………..... (1)

Yi = urban food crop output for ith household (in grain equivalent using the conversion factor of Table 5)

The output of each urban farm was weighed and multiplied by the corresponding conversion factor by so doing, the various urban food crops were converted to a common and standard food crop measurement using the FAO grain equivalent table (FAO, 1984)

Xi = corresponding vector of inputs

$Yi = f(X_1 \ldots\ldots Xn)$ ………………...………….…..………………..………….…… (2)

$Yi = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 \ldots + \beta_nX_n + e_i$ …………………………………………...…… (3)

Where ei = Vi-Ui,

$Yi = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 \ldots + \beta_nX_n + V_i - U_i$ …………………….……..…………........... (4)

V_i = is independently and identically distributed random errors, having $N(0, \sigma^2)$ distribution.

U_i = technical inefficiency

e_i = error term

Where:

Yi = urban food crop output for ith household (in grain equivalent using the conversion factor of Table 5)

X_1 = labour in mandays

X_2 = pesticides (litres)

X_3 = cultivated farmland (hectares)

X_4 = fertilizer (in kilogramme)

X_5 = Seed/planting material (in kilogramme)

In the frontier model specified, to estimate β, which is the vector of the regression parameter, the stochastic production model is linearized thus:

$\ln Yi = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5$ …………………..………...…….….. (5)

$RTS = \sum_{i=1}^{n} \beta i$ ……………………………………………………………………...… (6)

$RTS = \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5$ ………..(7)

The technical inefficiency is specified as:

$Ui = \delta_0 + \delta_1Q_1 + \delta_2Q_2 + \delta_3Q_3 + \delta_4Q_4 + \ldots + \delta_nQ_n - Ui$ ….…………………….................. (8)

Equation (8) specifies the technical inefficiency effect and it also indicates that these effects in a stochastic frontier are expressed in terms of various explanatory variables, which include the following:

Q_1 = age of respondent (years)

Q_2 = household size (head count)

Q_3 = years of experience of the ith respondent (years)

Q_4 = level of Education of the ith respondent (years)

Q_5 = value of off-farm income of ith respondent (naira)

Q_6 = Gender of respondent (1=male, 0=female)

Q_7 = Marital status of respondent (1=married, 0= single)

δ_0, $\delta 1$, δ_2, ...δ_7 are parameters to be estimated.

The stochastic frontier cost function for estimating the allocative efficiency is specified as

$Ai = f(Pi, \beta) \exp(Vi - Ui)$ ………………………………………………………………… (9)

Ai = urban food crop total cost for ith household

Pi = corresponding vector of input prices

$Ai = f(P_1 \ldots\ldots Pn)$ ……………………………………………………………………….. (10)

$Ai = \alpha_0 + \alpha_1 P_1 + \alpha_2 P_2 + \alpha_3 P_3 + \alpha_4 P_4 + e_i$……………………………………………………………… (11)

Where ei = Vi-Ui,

$Ai = \alpha_0 + \alpha_1 P_1 + \alpha_2 P_2 + \alpha_3 P_3 + \alpha_4 P_4 + \alpha_5 P_5 + V_i - U_i$ ………………………………………………... (12)

Where:

Ai = urban food crop total production cost for ith household in naira

P_1 = price of labour in naira

P_2 = price of pesticides in naira

P_3 = price of cultivated land in naira

P_4 = price of seed/planting material in naira

P_5 = price of fertilizer in naira

Economic efficiency (EE) is estimated as:

$EE = AE * TE$………………………………………………………………………………… (13)

Note that $0 \leq EE \leq 1$

RESULTS AND DISCUSSION

The socio-economic and demographic characteristics of urban food crop farmers in the study area are presented in Table 1. These characteristics include: age, sex, household size, farmland, farming experience, years of formal education, and farm monthly income.

Findings from the study area revealed that 32.80% of the respondents have their ages between 51 and 60 years. The mean age of 49.58 years indicated that many of the respondents were adults. In the study area, 84.90% of the households were male headed while 15.10% were female headed households. Many (46.60%) of the respondents had a household size of between 4 and 6 in the study area. This average household pattern is consistent with previous study by Ahmed and Abah, (2014). Majority (91.2%) of the respondents practiced their farming activities on a land area of less than 3hectares; and the mean farm size was 1.06 hectares. This suggests that the respondents were primarily small holder farmers. It was observed that 72.3% of the respondents had a farming experience of between 1 and 20 years a mean of 16.24 years. This by implication means that the respondents have fundamental knowledge of farming. Same Table also revealed that the mean years of respondents' formal education was 13.53 years, suggesting that the respondents were educated. The mean farm monthly income of the respondents was ₦11,902.52; suggesting that an average urban farmer who practices urban farming for commercial purpose makes a monthly profit that is 62.13% of the Nigerian civil service minimum wage (₦18,000) NLC (2009).

Table 1: Socio-economic and demographic characteristics of the respondents

Variable	Frequency	Mean	Percentage
Age			
21-30	12		7.5
31-40	31		19.5
41-50	35		22
51-60	52		32.8
61-70	26		16.3
71-80	3	49.6	1.9
Sex			
Male	135		84.9
Female	24		15.1
Household size			
1 – 3	36		22.6
4 – 6	74		46.6
7 – 9	36		22.6
10 – 12	9		5.7
13 – 15	4	6.0	2.5
Farm size (hectares)			
≤ 3.0	145		91.2
3.1 - 6.0	11		6.9
6.1 - 9.0	1		0.6
9.1 - 12.0	2	1.1	1.3
Farming Experience (years)			
1 – 20	115		72.3
21 – 40	40		25.2
41 – 60	4	16.2	2.5
Years of formal education (years)			
0 – 6	27		17
7 – 12	30		18.8
13 – 18	91		57.3
19 – 24	10		6.3
25 – 30	1	13.5	0.6
Farm monthly income (naira)			
≤ 20,000	135		84.9
20,000 - 40,000	13		8.2
40,000 - 60,000	9		5.6
≥ 60,000	2	11,902.5	1.3

Source: Data Analysis Result, 2018

Determination of farmers' efficiency levels

Table 2 shows the result of Cobb-Douglas production function which revealed that the estimated coefficient (0.2254) for cultivated farmland was positive and significant ($p<0.05$) which is in conformity with theoretical *a priori;* also the estimated coefficient (0.8651) for seeds or planting materials was also positive and significant ($p<0.01$). This suggests that the seeds planted were viable and by implication the level of technical efficiency of urban food crop farmers tend to increase for the large scale urban farms. This result agrees with previous work by Fasasi, (2007). The log-likelihood function is -186.1835 and a chi-square value of 842.70 which is significant ($p<0.01$); implies that the model used was well fitted and appropriate for the analysis. The estimated sigma square (0.2315) which is significant ($p<0.01$) indicates the goodness of fit and the correctness of the specified distribution of the composite error term. Gamma was estimated (-2.3166) and was found to be statistically significant ($p<0.01$). Return to scale (RTS) which gives the outcome from a proportionate increase of all the inputs and was estimated by summing the coefficients (elasticities) of the estimated inputs to obtain 1.2680. This indicates that urban food crop farming in the study area was in the stage 1 of the production surface. It is the stage of increasing positive RTS; increasing RTS results in economies of scale. This could be because efficiency increases when organizations move from small scale to large scale production. The result is close to findings by (Akinbode *et al.*, 2011).

The estimated coefficients of the inefficiency function provide some explanations for the relative efficiency levels among individual farms (Fasasi, 2007). Since the dependent variable of the inefficiency function represents the mode of inefficiency, a positive sign of an estimated parameter implies that the associated variable has a negative effect on efficiency and a negative sign indicates the reverse (Fasasi, 2007). Positive coefficient of the education level of the respondents in Table 2 implies that urban farmers with higher level of education had increased technical inefficiency; suggesting that they had reduced technical efficiency. This is however contrary to *a priori* expectation.

Table 2: Stochastic production frontier of technical efficiency of urban food crop farmers

Variable	**Parameters**	**Coefficient**	**t-ratio**
Seed	$\beta 1$	0.8651***	10.82
Labour	$\beta 2$	0.1494	1.1
Pesticides	$\beta 3$	-0.0123	-0.17
Farm size	$\beta 4$	0.2254**	2.55
Fertilizer	$\beta 5$	0.0404	0.38
Constant	$\beta 0$	5.4523***	24.77
Inefficiency model			
Age	$\delta 1$	2.1232	0.65
Household size	$\delta 2$	-0.2370	-0.14
Farming experience	$\delta 3$	-3.4925	-1.44
Years of education	$\delta 4$	2.0941**	2.02
Off farm income	$\delta 5$	-0.3245	-0.34
Sex	$\delta 6$	-4.0238	-1.56
Marital status	$\delta 7$	-4.7616	-1.53
Constant	$\delta 0$	-3.1564	
Diagnostic statistics			
Return to scale	RTS	1.2680	
Sigma square	$\sigma 2s=\sigma 2v+\sigma 2u$	0.2315***	
Gamma	$\Upsilon=\sigma 2u/\sigma 2s$	-2.3166	
Log-likelihood function	LLF	-186.1835	
Chi-square	$\chi 2$	842.70***	

* Significance at 10%, ** Significance at 5%, *** Significance at 1%
Source: Data Analysis Result, 2018

Table 3 presents the result of the maximum likelihood estimates of the stochastic cost frontier model of the food crop farmers in the study area. The result revealed that the prices of labour and cultivated farmland which enhanced allocative efficiency were both significant ($p<0.01$) and positive. Furthermore, the price of fertilizer was significant ($p<0.1$) and positive as well implying that the price of fertilizer improves allocative efficiency.

The log-likelihood of -165.2614 and chi-square of 501.52 which both showed the overall significance of the model were significant ($p<0.01$) indicating the appropriateness and goodness of fit of the model for the analysis. The gamma was estimated at 8.5160 while sigma square value was -0.0905.They were both significant ($p<0.01$).

The estimated sigma square indicated the goodness of fit and the correctness of the specified distribution of the composite error term; while the gamma estimate revealed that the total variation in the total cost of urban food crop from a given mix of input prices was due to the urban farmers' allocative efficiency.

Table 3: Stochastic cost function frontier of allocative efficiency of urban food crop farming

Variable	Parameters	Coefficient	t-ratio
Price of seed/planting material	β_1	0.0459	0.86
Price of labour	β_2	0.3757***	8.29
Price of land	β_3	0.1842***	15.30
Price of pesticides	β_4	0.0053	0.27
Price of fertilizer	β_5	0.0323*	1.88
Constant	β_0	5.5749***	15.07
Inefficiency model			
Age	δ_1	1.8888	0.74
Household size	δ_2	1.3472	0.97
Farming experience	δ_3	-0.0728	-0.08
Education level	δ_4	-0.6729	-0.90
Off farm income	δ_5	-0.6952	-1.10
Sex	δ_6	6.1500	0.98
Marital status	δ_7	-3.9113	-1.45
Constant	δ_0	-6.6630	-0.64
Diagnostic statistics			
Sigma square	$\sigma^2s=\sigma^2v+\sigma^2u$	-0.0905	
Gamma	$\Upsilon = \sigma^2u/\sigma^2s$	8.5160	
Log-likelihood function	LLF	-165.2614	
Chi- square	χ^2	501.52***	

* Significance at 10%, ** Significance at 5%, *** Significance at 1%
Source: Data Analysis Result, (2018)

Table 4 revealed frequency distribution and percentage of the technical efficiency, allocative efficiency and economic efficiency of the urban food crop farmers in the study area. The mean technical efficiency of the urban farm household was 0.9464; suggesting that the urban farmers were 94.64% technically efficient. 85.53% of the urban farm households had the best technical efficiency of between 0.91 and 1.00.

Table 4: Stochastic production frontier efficiency class

Efficiency score	Technical efficiency		Allocative efficiency		Economic efficiency	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
≤ 0.10	1	0.63	-	-	1	0.63
0.11-0.20	-	-	-	-	1	0.63
0.21-0.30	2	1.26	-	-	1	0.63
0.31-0.40	-	-	-	-	1	0.63
0.41-0.50	-	-	-	-	1	0.62
0.51-0.60	2	1.25	2	1.26	4	2.52
0.61-0.70	4	2.52	-	-	4	2.52
0.71-0.80	6	3.77	14	8.8	22	13.83
0.81-0.90	8	5.04	49	30.82	65	40.88
0.91-1.00	136	85.53	94	59.12	59	37.11
Total	159	100	159	100	159	100
Mean	0.9464		0.8969		0.8468	
Minimum	0.0833		0.5816		0.0815	
Maximum	0.9999		0.9964		0.9794	

Source: Field Survey, (2018)

CONCLUSION AND POLICY IMPLICATIONS

Increase in urban farm households' years of formal education was found to increase the technical inefficiency. Furthermore, the respondents' returns to scale indicated that they were in the stage 1 of the production surface which results in economies of scale. The mean technical efficiency, allocative efficiency and economic efficiency of 94.7%, 89.7% and 84.7% respectively showed that there is room for improvement in technical efficiency by 5.3%, allocative efficiency by 10.3% and economic efficiency by 15.3% with the present technology.

The study recommends that urban food crop farmers should increase the use of seeds/planting materials which enhance their technical efficiency, and that urban food crop farmers need to expand their cultivated farmland to ensure efficient utilization of resources.

REFERENCES

Ahmed, F.F. and Abah, P.O. (2014). Determinants of Food Security among Low-income Households in Maiduguri Metropolis of Borno State, Nigeria.*Asian Journal of Social Sciences and Humainities.* 3(1) p.4-86

Akinbode, S.O., Dipeolu, A.O. and Ayinde, I.A. (2011). An Examination of Technical, Allocative and Economic Efficiencies in Ofada Rice Farming in Ogun State, Nigeria. *African Journal of Agricultural Research.* 6(28) p.6027-6035

Binns, J.A. and Nel, E. 2014. The Significance of Urban Agriculture in Food Security and Sustainable Livelihoods in Response to Economic Restructuring in Zambia's Copperbelt Province. Global Education Programme International Development Research Fund Final Report p. 112

Coelli T., Rahman S. and Thirtle C. (2002). Technical, allocative, cost and scale efficiencies in Bangladesh rice cultivation: A Non-parametric approach. *J. Agric. Econ.*, 53(3) p.607-627

Daud S.A., Omotayo A.O., Aremu A.O. and Omotoso A.B. (2018). Rural Infrastructure and Profitability of Food Crop Production in Oyo State, Nigeria. *Applied Ecology and Enviromental Research* 16(4) p.4655-4665

Dhungana B.R., Nuthall P.L. and Nartea G.V. (2004). Measuring the Economic Inefficiency of Nepalese Rice Farms using Data Envelopment Analysis. *The Australia Journal of Agricultural and Resource Economics* 48(2) p.347-369.

Färe R., Grosskopf S. and Lovell C.A.K. (1994). Production frontiers, Cambridge, Cambridge University press p. 1-15

Farrell, M.J. (1957). The Measurement of Productive Efficiency. *Journal of Royal Statistical Society.* 120(3) p.253-290

Fasasi, A.R. (2007). Technical Efficiency in Food Crop Production in Oyo State, Nigeria: *Journal of Humanity and Ecology.* 22(3) p.245-249

Food and Agriculture Organisation of the United Nations (FAO) (1984). The State of Food and Agriculture 1984. Rome, Italy p.1-209

Food and Agriculture Organisation of the United Nations (FAO) (2012). Growing Greener Cities in Africa, Rome, Italy p.1-116

Kenneth, L., Roy, M., Tony, B., Paul, T. and Kabba, B. (2013). Meeting the Urban Challenge? Urban Agriculture and Food Security in Post-conflict Freetown, Sierra Leone. *Journal of Applied Geography.* 36(1) p.31-39

Kirkley J.D., Squires D. and Strand I. (1995). "Assessing technical efficiency in commercial fisheries: The Mid-Atlantic Sea Scallop fishery". Am. J. Agric. Econ., 77(1) p.686-697

May M. and Fortunate C. (2011). Home Gardening as a Coping Strategy for Urban and Peri Urban Households: The Case of Mutare City, Manicaland Province, Zimbabwe during the 2008 hyperinflation period. Proceeding of IFPRI Conference on Agricultural Productivity and Food Security, Addis Ababa, Ethiopia p.13-25

National Population Commission (NPC) (2016). Popuplation Projection Results, Abuja, Nigeria. https://www.citypopulation.de/php/nigeria-admin.php?adm1id=NGA031

Nigeria Labour Congress (NLC) (2009). Demand for the Review of the National Minimum Wage and General Wage Review: p.1-7

Obayelu, A. E. (2012). Comparative Analysis of Household's Socioeconomic and Demographic Characteristics and Food Security Status in Urban and Rural Areas of Kwara and Kogi States of North-Central Nigeria, *African Journal of Food, Agriculture Nutrition and Development.* 12(3) p.6027-6054

Rao, D.S.P., O'Donnell, C.J.O. and Battese, G.E. (2004). Metafrontier Functions for the Study of Inter-regional Productivity Differences. A Working Paper Series by Centre for Efficiency and Productivity Analysis. School of Economics University of Queensland St. Lucia, Qld. 4072 Australia p.1-37

Rodríguez D.J.A., Camacho P. and López L.R. (2004). Application of Data Envelopment Analysis to Studies of Irrigation Efficiency in Analusia. J. Irrigation Drainage Engineering, 130(1) p.175-183

Sivarajah P. (2017) Farm Efficiency Measurement of Paddy Production in Northern Sri Lanka Using Data Envelopment Analysis (DEA) Approach. *International Journal of Research-Granthaalayah* 5(9) p.164-170

Zezza, A. and Tasciotti, L. (2010). Urban Agriculture, Poverty and Food Security: Empirical Evidence from a Sample of Developing Countries *Journal of Food Policy.* 35(4) p.265-273

Appendix

Table 5: Grain equivalent conversion

Commodity	Conversion factor	Commodity	Conversion factor
Maize	1.00	Ground nut oil	2.40
Sorghum	0.96	Others	2.20
Millet	0.93	Sugar	1.07
Rice	1.00	Beef	0.62
Wheat	0.92	Goat meat	0.60
Other cereals	0.90	Mutton	0.67
Cassava	0.30	Poultry meat	0.36
Sweet potato	0.30	Pork	1.05
Irish potato	0.28	Cow meat	0.40
Yam	0.25	Others	0.40
Cocoyam	0.24	Off	0.40
Plantain	0.21	Eggs	0.45
Groundnut	1.51	Fish	0.35
Beans	0.96	Milk	0.40
Other legumes	1.10	Butter	2.75
Melon seed	1.56	Cheese	0.75
Others	1.04	Animal oil and fats	2.20
Vegetables	0.06	Beverages	0.06
Fruits	0.01		
Palm oil	2.40		

Source: Grain Conversion Table (FAO) Report 1984.