International Journal of Advanced Studies in Economics and Public Sector Management
Volume 3 Number 1, May 2015.

PUBLICATION INDEX: GERMANY

ECONOMIC EFFICIENCY OF PERI-URBAN FOOD CROP PRODUCTION IN ADAMAWA STATE, NIGERIA: IMPLICATION FOR FOOD SELF- SUFFICIENCY

[1]Ngari A. F. & [2]Adebayo E. F
[1&2]*Department of Agricultural Economics and Extension,*
Modibbo Adama University of Technology,
Yola,

Abstract
The study examined the economic efficiency of peri-urban food crops production in Adamawa State, Nigeria. Data were collected from 198 peri-urban farmers using multi stage sampling technique and well-structured questionnaire. Stochastic frontier production and cost functions were used as analytical tools. The maximum likelihood estimates of the parameters of the stochastic frontier model for the farmers were statistically significantly different from zero. Family labour, inorganic fertilizer, land size and seeds were significantly related to food crops output. The mean technical efficiency was 0.82 with the minimum and maximum efficiencies of 0.50 and 0.93 respectively. The inefficiency model revealed that educational level, household size and farming experience increased technical efficiencies of farmers. The maximum likelihood estimates (MLE) of the parameters of the stochastic cost frontier model were also significantly different from zero with mean allocative efficiency (AE) of 0.80 and minimum and maximum allocative efficiencies of 0.40 and 0.92 respectively. The mean economic efficiency (EE) was 0.65 with minimum and maximum economic efficiencies of 0.22 and 0.82 respectively. This shows that the respondents are not fully economically efficient. The results of the analysis indicate that the presence of technical and allocative efficiencies had effects in peri-urban food crop production as depicted by the significant gamma coefficient of the model, predicted technical and allocative efficiencies among the farmers. The study recommends improved input delivery system and education of farmers to increase efficiency and subsequently food security and farmers should be given proper orientation and basic training in major farm management techniques; this will help them to be more efficient in allocation of productive inputs.

Keywords: *Economic Efficiency, Food Crop, Peri-Urban, Food Security and Adamawa State.*

Background to the Study

Nigeria is still largely an agrarian state. Agriculture provides raw materials for our ever growing industrial sector, it provides job for a large section of our teeming population and contributes significantly to the nation's Gross Domestic Product. Despite this, the nation has not been self-sufficient in her food production effort. The past governments have launched series of programs such as Agricultural Development Project (1975), Operation

Feed the Nation (1976), Green Revolution (1980), Back to Farm, Directorate of Food Roads and Rural Infrastructure (1986) and several projects include the present government's Agricultural Transformation Agenda.

The increasing demand for food and jobs in urban and peri urban areas, has made it necessary for employed wage earning urban and peri-urban dwellers to practice peri-urban agriculture as a means of filling the food demand and supply gap and providing income to supplement their wages (Amodu, 2010). In recent times however, farming in the cities (urban agriculture) seems to be gaining recognition. The United Nation Development Programme (UNDP) estimated that more than 800 million people are involved in Urban and peri-urban Agriculture (UNDP, 1996a), out of these, 200 million people practice market oriented farming on underdeveloped urban space. Moreover, 40 percent of the people who lived in cities in Africa were into Urban and Peri urban agriculture (Mougeot, 1994).

Peri-urban agriculture are practiced on farm units close to town that operate intensive semi- or fully commercial farms to grow vegetable and other horticultural crops, raises chicken, and produce milk and eggs. Peri-urban agriculture also embraces other activities such as fish farming, forestry and fodder production (Food and Agricultural Organization) (FAO, 2001). Italso refers to farming activities horticulture and crop production, animal husbandry, aquaculture and forestry carried out within, or at the periphery of the cities. These activities draw on a set of existing resources (land, water, labor, waste, energy, etc.) that can be used for either agricultural or non-agricultural uses, and generate food and non-food flows towards the urban centers (Moustier and Mbaye, 2000).

Peri-urban agricultural areas are generally areas that can act as connecting elements between open spaces and as separators between different urban spaces. Given that, in many cases, peri-urban agricultural areas are the result of the survival and continuation of historic agricultural activity that has generated a significant tangible and intangible cultural heritage, it is a heritage that requires conservation and transmission to future generations. Peri-urban areas are defined as those areas in which productive agricultural activity is carried out, so as to generate an ecosystem altered by farming and livestock and a typical rural landscape, and, by definition, fundamentally a producer of food and raw materials. However these areas are under severe pressure as a result of urban growth and its related infrastructure, which is leading to a loss, fragmentation and deterioration of productive agricultural land (FAO, 2001).

In Nigeria, the practice of peri-urban agriculture has continued to increase in recent years. The rise in food prices, un-employment, and inflation brought by the structural adjustment (World Bank, 1993) and the decline in the average real income of both rural and urban households have compelled many urban dwellers into farming in the peri-urban areas. The urban farmer, like any other farmer, will typically produce to satisfy household food needs or make profit or both. If the interest were in producing for home consumption, the farmer would want to obtain the optimum from his / her effort, if on the other hand, the farmer produces for the market, then the cost of production and the returns accruable to the farmer's effort become important measure of performance. Either of the two objectives of production requires efficient use of farm resources.

Urban and peri-urban agriculture (UPA) can offer wide ranging benefits (Pasquini, 2006). It can contribute substantial amounts to the proportion of food consumed in the city. Sweet (1999), for example, has estimated that 15 - 20% of the world's supply of vegetables and meat is produced in per-urban areas. Peri-urban agriculture is practiced for a variety of reasons, for crisis management when markets are not working (e.g. in Cuba), as a strategy to overcome cash shortages or even for commercial purposes as well as improving food security and nutrition, and creating employment for the jobless (Lynch *et al.*, 2001).

However, despite the glaring facts on the presence and potentials of peri-urban agriculture in Nigeria, especially in the big cities, policy makers and government have deliberately neglected a veritable sector and have not made concerted efforts to acknowledge it and channel attention to it. Given the level of poverty in Nigeria therefore, Peri-urban agriculture could be harnessed as a strategy for poverty reduction (Egbuna, 2001). In spite of the potential benefits of peri-urban agriculture as itemized, governments of many developing countries, including Nigeria, have not formally incorporated this system of human activities into the economic programming for the development of their nations. This paper therefore examined the overall economic efficiency of peri-urban farmers with a view to examining their productive efficiency in food crop production.

Objective of the Study

The objective of the study is to examine the economic efficiency of peri-urban food crops production in Adamawa State, Nigeria.

Methodology

The Study Area: The study was conducted in Adamawa State in the North-eastern geopolitical zone of Nigeria. The State lies between Latitudes 7^0 and 11^0 North of the equator and Longitudes 11^0 and 14^0 East of the Greenwich. Its shares boundaries with Taraba state in the South west, Gombe in its North-west and Borno to the North. The state has an international boundary with the Cameroon Republic along its eastern border (Adebayo, 1999). The population of the state according to 2006 census figure stood at 3.17 million people with the total land area of 38,741 square kilometres, this is about 4.4 percent of the land area of Nigeria. (NPC, 2006). It has 21 Local Government Areas.

Adamawa climatic elements are characterized by distinct dry and rainy seasons, which is typically of tropical climate. The rainy season starts in April and ends in October. The average rainfall ranges from 700mm in the northwest to 1600 mm in the southern part (Adebayo, 1999). The dry season is from November to March, which is also part of the harmattan period when the dust laden easterly trade winds from the Sahara desert have a marked effect on the climate of the state.

Majority of the people in Adamawa State are farmers. Crops produced include groundnut, cotton, maize, yam, cassava, guineacorn, millet, beans, sweet potato and rice. Cattle rearing are a major occupation, while village communities living on the banks of River Gongola and Benue in the State engage in fishing and dry season production of vegetable crops like tomato, onion, pepper, amaranthus, okra, garden egg and melon using bore holes and tube well irrigation with water pumps.

Method of Data Collection:

Primary data were collected through the use of structured questionnaires and interview schedule which was administered to the peri-urban food crops farmers by the researcher and trained enumerators.

Sampling Procedure and Sample Size:

The target population for this study was all the peri-urban farmers in Adamawa state. A Multi-stage sampling technique was used for the study. The first stage involves the purposive selection of one urban center from each of the three senatorial zones in the state. These are Yola, Mubi and Numan. In the second stage, two (2) peri-urban areas were selected from each of the three urban centres Yola (Ngurore and Gerio), Mubi (Vimtim and Muchalla) and Numan (Ngballang and Vulpi).

The third stage involved the random selection of peri-urban food crop farmers from each of the six (6) peri-urban centers earlier selected- Ngurore, Gerio, Muchalla, Vimtim, Vulpi and Ngballang (Table 1). A total sample of two hundred (200) peri-urban food crop farmers was therefore used for the study while 198 well completed questionnaires were analyzed.

Table 1: List of Main Urban Centers and Peri-urban areas

Main Urban Centers	Peri-Urban areas Sampled	Number Questionnaires Administered
Yola	Ngurore	35
	Gerio	47
Numan	Vulpi	26
	Ngballang	30
Mubi	Vimtim	23
	Muchalla	37
Total Number		198

Methods of Data Analysis:
Stochastic frontier model were used to determine the technical, allocative and economic efficiencies of peri-urban food crops farmers in the study area. The model was based on the one proposed by Battese and Coelli (1995) in which the stochastic frontier specification incorporates models for the technical inefficiencies effects and simultaneously estimate all the parameters involved in the production function models.

The stochastic frontier production function specifies output (Y) as a function of inputs(X) and disturbance term e. that is:

$$Y_i^* = f(X_i; í) \exp V_i - U_i \ldots 1$$

Where Y_i^*=denotes the output of the i^{th} farm (frontier output), X_i =the vector of actual input quantities used by the i^{th} farm, í = the vector of parameters to be estimated; V_i= represents the random variation in output due to factors outside the control of the farmer, such as weather, disease, measurement errors, topography and U_i=is a non-negative one sided disturbance term used to represent technical inefficiency (or production losses) due to the managerial performance of the farmer, soil and environmental factors and is independent of Vi.
It is explained by the stochastic frontier, that is

$$Y = f(X_i; í) \exp(V_i) \ldots\ldots 2$$

Thus, U_i= 0, for farm whose output lies on the frontier, and U_i<0 for farm whose output lies below the frontier.

Technical efficiency (TE) is the ability of the firm or farm to maximize output for a given set of resource inputs. (TE) therefore is the ratio of observed output to the frontier output, that is;

$$TE = Y_i / Y_i^* = f(X_i; í) \exp(V_i - U_i) / f(X_i; í) \exp(V_i) \ldots\ldots\ldots 3$$
$$TE = \exp(-U_i) \ldots\ldots\ldots\ldots 4$$

Where TE<1 and U_i>0. Y_i achieves its maximum feasible value of $f(X_i; í) \exp(V_i)$ if and only if TE=1, otherwise TE<1 provides a measure of the output. The corresponding cost frontier as used by Ogundari and Ojo (2007) specified a stochastic cost function with behavior inefficiency component to estimate all the parameters together in one step maximum likelihood estimation. This was used in estimating the allocative efficiency of the farmers. The model is implicitly expressed as:

$C_i = g(P_i; ί) + (V_i + U_i)$.......5

Where C_i =is the total input cost of the i-th farm, P_i= is a vector of variable input prices employed by the i-th farm in food crop production, g=is a suitable functional form ί =parameter to be estimated, V_i =is the system component which represent random disturbance cost due to factors outside the control of the farmers and U_i =is the one-sided disturbance term used to represent allocative inefficiency and is independent of V_i.

The cost efficiency of an individual farm is defined in terms of the ration of observed cost (C^b) to the corresponding minimum cost C^{min}) (given the available technology. That is

$$\text{Cost efficiency } ?C_E? = \frac{C^b}{C^{min}} = \frac{g?P_i, Y_i;\ \beta? + (V_i + U_i)}{g?P_i, Y_i;\ \beta?} = \exp\ (U_i) \ldots 6$$

Allocative efficiency ranges between zero and one. Allocative efficiency is its ability to use the inputs at its disposal in optimal proportions given their respective prices and the available production technology.

Economic efficiency ($E_{E)}$ is obtained as the product of technical and allocative efficiency. That is,

$E_E = (T_E)_x (C_E)$...7

Economic efficiency (E_E) is the farmer's ability to produce a predetermined quantity of output at minimum cost given the available technology.

The empirical model of the stochastic frontier production functions used in determining technical efficiency of food crop production in peri urban is given by:

$InY_i = ί_0 + ί_1 InX_1 + ί_2 InX_2 + ί_3 InX_3 + ί_4 InX_4 + ί_5 InX_5 + ί_6 InX_6 + V_i\ \ U_i$...8

Where: In = denote logarithm to base e,.Y_i = Output from food crops (Kilogram grain equivalent) X_1 = Hired labour used in production (man days) X_2= Family labour used in production (man days)X_3 = Land size under production (in hectares) X_4 = Quantity of inorganic fertilizers used (in Kilogram) X_5 = Seeds (Kilogramgrain equivalent) and X_6= Amount of agro-chemicals used (in litres) V_i = Random variability in the production that cannot be influenced by the farmer;

U_i = Deviation from maximum potential output attributable to technical inefficiency.
$ί_0$ = Intercept;
ί = Vector of production function parameters to be estimated;
i = 1, 2, 3, n farms;
j = 1, 2, 3, m inputs.

The technical efficiency for individual farm is computed as an index and the mean technical efficiency for the production system is determined. The socio economics factors that influence the technical efficiency of the peri-urban agriculture were identified and the parameters of the variables would be estimated using the Coelli and Battese, (1996) inefficiency model. The model assumes that the inefficiency effect U_i is independently distributed and follows a truncated (at zero) normal distribution, with mean μ_i and variance s^2

The inefficiency model is:

$\mu_i = d_0 + d_1 Z_1 + d_2 Z_2 + d_3 Z_3 + d_4 Z_4 + d_5 Z_5 + d_6 Z_6 + e_i$...9

Where: μ_i = Technical inefficiency effect of the i^{th} farmer, Z_1 = Represent years of formal education completed (Numbers), Z_2 = Household size (Numbers of persons in households), Z_3 = Gender of farmer (dummy; 1= male, 0= female), Z_4 = Age of farmer in years (Numbers of years), Z_5= Farming Experience (Numbers of years) and Z_6= Cooperative Membership (dummy, Yes=1, No=2)d = Parameters to be estimated. e_i= Random disturbance following half-normal distribution

The corresponding cost as applied by Ogundari and Ojo, (2007) framework for analysis of data, the explicit cost function of food crops farmers in peri-urban areas was specified thus;

The stochastic cost function is specified thus:

InC_i=í $_0$+ í $_1InP_1$+ í $_2InP_2$+ í $_3InP_3$+ í $_4InP_4$+ í $_5InP_5$+ í $_6InP_6$+ (V_i-U_i)...10

Where: In=logarithm to base e, C_i=Total cost of production (₦/Ha), P_1=Costs of Seeds (₦/Ha) P_2=Cost of Inorganic fertilizer (₦/Ha), P_3=Cost of Transportation (₦/Ha), P_4=Cost of Hired labour (₦/Ha), P_5=Cost of Empty sacks (₦/Ha) and P_6=Cost of Agro-chemicals (₦/Ha)

It is assumed that the cost of inefficiency effects are independently distributed and U_i arises by truncation (at zero) of normal distribution with mean u_i and variance d^2,

Where $u_i$is defined by:
U_i= d_0+ d_1Z_1 + d_2Z_2 + d_3Z_3 +d_4Z_{4+} d_5Z_5 +d_6Z_6.....11

Where: U_i= Cost of inefficiency of the i^{th} farmer Z_1= Years of farming experience, Z_2= Represent years of educational level (years of schooling), Z_3= Extension visits (Number of meetings), Z_4= Household size (Number in the households), Z_5= Primary occupation (1 if farming and 0 otherwise) and Z_6= Degree of crop diversification (dummy, where one is indicated mixed cropping and zero sole cropping)

The parameters of the models will be obtained by the maximum likelihood estimation method using the computer Programme, FRONTIER version 4.1c (Coelli, 1994).

Results and Discussion

Technical Efficiency of Food Crops Production in Peri-urban areas of Adamawa State

The maximum likelihood estimates of the parameters of the stochastic frontier model for food crops production is presented in Table 2.The estimated coefficients of family labour, inorganic fertilizer, land size, and seeds were all positive which conform to a priori expectations, while the coefficient of hired labour and agrochemicals were negative.

The Sigma-squared (s ^{2}) (0.12) is statistically different from zero at 1% level. This indicates a good fit and the correctness of the specific distributional assumption of the composite error term, italso implies that technical inefficiency plays a minimal role in the variation of observed peri-urban farms output.The Gamma (?) estimated as 0.66 implies that the existence of technical inefficiency among the peri-urban farmers accounts for 66% of the variations in output level of the crop produced. This confirms that in the specified model, there is presence of one sided error term component of technical inefficiency which is significant and that classical regressions model of production function on the ordinary least squares (OLS) estimation would be inadequate representation of the data.

The coefficient of family labour (0.70) carried the expected positive sign and is statistically significant at 5% level. The positive sign shows that, an increase in man days of family labour of 10% would increase food crops production output by 7%. The implication of this

Is that farmers with relatively large household size have the potential to increase their total farm output. This is line with the study of Amaza*et al.*, 2006, who reported that farmer that tends to emphasize on technical efficiency would be more concerned with maximizing their output per unit of resources used, especially family labour.

The coefficient of land size carried expected positive sign and is statistically significant at 1%. The positive sign shows that, an increase in land size is likely to increase the output of peri- urban agriculture. A 10 percent increase in land size will bring about one percent increase the total food crops output all things being equal (*ceteris paribus*).This also implies that the magnitude of the coefficient shows inelastic nature of output with respect to land size. This suggest that land size is a significant factor associated with changes in crops output and this agrees with finding by Maurice *et al.*, (2005), Udoh and Falake (2006)

Inorganic fertilizers have an elasticity coefficient of (0.19) and statistically significant at 5% this means that a 10% increase in the quantity of inorganic fertilizer used in food crops production would increase output by 1.9%. This implies that the use of inorganic fertilizer enhances productivity and also enables farmers to cultivate large hectares of land which in turn bring about increase in output.

Seeds input has an elasticity coefficient of (0.21) and positively related to total output of foods crops production in peri-urban areas. This shows that 10% increase in the quantity of seeds used in production would increase output of food crops by 2.1%. This implies that, raising the productivity of seed is expected to translate into a more proportionate increase in the output of peri-urban farmer per hectare.

The inefficiency parameters include farming experience, educational level, extension contacts, household size, primary occupation, crop diversification. They are specific as those relating to farmers specific socio-economic characteristics and were examined by using the estimated coefficients. According to Adebayo (2007), a negative coefficient indicates that the parameters have a positive effect on efficiency and vice versa.

The coefficient of educational level (-0.18) was estimated to be negative and statistically significant at 1% level. This implies that farmers with more years of formal schooling tend to be more efficient in peri urban production, presumably due to their enhanced ability to acquire technical knowledge. This is very plausible that the farmers with education respond readily to the use of improved technology, such as the application of fertilizers, use of pesticides and so on, which makes them move close to the frontier output. This result agrees with works of Tashikalma (2001), Awotide and Adejobi (2006) and Ogundari and Ojo (2007) who identified education as a catalyst in the improvement of technical efficiency of farmers in Nigeria.

The coefficients of household size (-0.27) is estimated to be negative and statistically significant at 5% level. This implies that increase in the household size by 10 percent will increase efficiency of the farmers by 2.7%. This is because the more adult members are added the more quality labour is increased to carry out farm operations timely, and hence making the production process more efficient. This agrees with Giroh*et al.* (2009), who reported that household size have positive influence on efficiency.

The coefficient of farming experience (-0.25) carried the expected negative sign and is significant at 5% level. Farming experience increase the technical efficiency of the peri urban farmers and this result is inconformity with the finding of Maurice *et al.* (2005).

Table 2 Maximum Likelihood Estimates of the parameters of the Stochastic Frontier production Function

Variables	Parameters	Coefficients	t-ratio
Production factors			
Constant	β_0	0.34	21.45*
Hired labour(X_1)	β_1	-0.77	-0.72
Family labour(X_2)	β_2	0.70	2.07**
Land size(X_3)	β_3	0.10	14.54*
Inorganic fertilizer(X_4)	β_4	0.19	2.15**
Seeds(X_5)	β_5	0.21	2.24**
Agrochemicals(X_6)	β_6	-0.15	-1.08
Inefficiency model			
Educational level(Z_1)	δ_1	-0.18	-4.61*
Household size(Z_2)	δ_2	-0.27	-2.21**
Gender(Z_3)	δ_3	-0.24	-0.56
Age(Z_4)	δ_4	0.94	0.32
Farming experience(Z_5)	δ_5	-0.25	-7.53*
Cooperative orgn (Z6)	δ_6	0.49	0.8
Variance parameters			
Sigma-squared	σ^2	0.12	13.80*
Gamma	?	0.66	2.51**
Number of observation		198	

** Significant 5% and Significant at 1%

Allocative Efficiency

The maximum likelihood estimate (MLE) of the parameters of stochastic cost frontier model of food crops production in the study area is presented in Table 3. All the parameters estimated have expected positive sign. Most of the parameters estimates are significant, meaning that those parameters are significantly different from zero and thus, these are important determinant of food crops output.

The estimated sigma-squared (0.44) is statistically significant at 1%, indicating a good fit and correctness of the specific distributional assumption of the composite error terms. Gamma (0.61) is highly significant at 5% level, indicating that 61% of the variation in the total cost of production among sample farmers is due to differences in their cost efficiencies.

The results shows that the variable costs i.e cost of seeds, cost of hired labour, cost of inorganic fertilizers, cost of agrochemicals, cost of empty sacks and cost of transportation used in stochastic analysis have direct relationship with the total cost of food crops production in in peri -urban areas. The cost of elasticity with respect to all inputs variables used in the production analysis are all positive, which implies that Increase in the cost of seed, inorganic fertilizer, transportation, hired labour, empty sacks and agrochemicals increases total cost of production.

The estimated coefficient of cost of seeds (0.25) is positive and is statistically significant at 1% level. This implies that, the variables influence the cost of food crop production. This means that 10% increase in the cost of seed will lead to increase in the total cost by 2.5%.

The cost of hired labour (0.78) was positive and statistically significant at 1% level. Peri-urban farming also incur in employment of hired labour for production. This indicates that, 10% increase in the cost of labour result to an increase in total cost of production by 7.8%. Farmers who have the main objective of income maximization in food crop production would tend to allocate resources more efficiently, including the allocation of hired labour (Amaza and Gwary, 2000).

The estimated coefficient of cost of agrochemicals (0.24) was statistically significant at 1% level. The coefficient of the variables is highly associated with the reduction of fatigue, drudgery. This means that 10% increase in cost of agrochemicals will increase the total cost of production by 2.4%. The analysis of the cost inefficiency model on Table 3 shows that, three of the six variables have the expected signs. The results revealed that the coefficient of farming experience, extension contacts, and primary occupation are negative indicating that these factors increase allocative efficiency of food crops production in peri-urban areas. This result agrees with the finding of Obidi, (2009) on the economic efficiency of maize producers in Adamawa state.

The coefficients of farming experience (-0.15) was estimated to be negative and statistically significant at 5% level. This implies that most of the respondents were well experienced in peri-urban farming and are expected to have acquired relevant skills for effective operations. Farming experience had a positive relationship with output and was significant. therefore be better able to access and manage the risks involved in the system than inexperienced ones. This is consistent with the works of Egwu*et al.*(2010) who found positive impacts of farm experience on the efficiency of farmers' vegetable production.

The coefficients of extension visit (-0.22) was estimated to be negative and statistically significant at 5% level. Availability of extension services and information about technical aspects of crop technologies play an important role in increasing farm level efficiency. The significance of extension in this study corroborates the findings of Seyoum*et al.* (1998), who reported positive influence of extension contact on efficiency in their study of technical efficiency and productivity of maize farmers in eastern Ethiopia. Farmers who are members of extension related organizations exhibit higher levels of efficiency

The coefficients of Primary occupation (-0.13) was estimated to be negative and statistically significant at 5% level. The nature of primary occupation in peri-urban agriculture affects the technical efficiency negatively. That is, civil/public servants that take peri urban agriculture occupation simultaneously are more efficient than farmers that take urban farming as full time occupation.

Estimation of Technical, Allocative and Economic Efficiencies of peri urban Farmers

The range of the frequency distribution of the estimated technical efficiencies is presented in Table 4. The technical efficiencies ranged between 50 and 93 percent with the mean technical efficiency of 82 percent. The mean level of technical efficiency indicates that on the average, peri-urban crop output falls 18 percent short of the maximum possible level. Majority (69.2%) of the peri-urban farmers have technical efficiency indices greater than 80 percent meaning that most of them were technically efficient given the existing technology. The predicted allocative efficiencies differ substantially among the peri-urban farmers ranging between 40 and 92 percent with a mean of 80.2 percent.

Table 3: Maximum Likelihood Estimate of the Parameters of the Stochastic Frontier cost Function.

Variables	Parameters	Coefficients	t-ratio
Production factors			
Constant	β_0	0.25	13.79
Cost of seed(P_1)	β_1	0.16	2.92*
Cost of fertilizer(P_2)	β_2	0.28	5.34*
Cost of transportation(P_3)	β_3	0.49	2.78*
Cost of Hired Labour(P_4)	β_4	0.78	2.13**
Cost of empty sacks(P_5)	B_5	0.29	6.72*
Cost of Agrochemicals(P_6)	β_6	0.24	4.14*
Inefficiency Model			
Farming Experience (Z_1)	δ_1	-0.15	-41**
Educational level (Z_2)	δ_2	-0.19	-1.41
Extension contacts (Z_3)	δ_3	0.22	2.45**
Household size (Z_4)	δ_4	0.23	-0.12
Primary occupation (Z_5)	δ_5	-0.13	2.13**
Crop diversification (Z_6)	δ_6	0.22	1.38
Variance parameters			
Sigma-squared	σ^2	0.44	4.22*
Gamma	?	0.61	2.58**
Number of observations	198		

** Significant 5% and * Significant at 1%

This implies that if the average peri-urban farmer in the sample was to achieve allocative efficiency level of its most efficient counterpart, then, the average farmer could achieve 20 percent cost saving. The combined effect of technical and allocative efficiencies shows that economic efficiency ranges from 20 to 89 percent with a mean of 65 percent (Table 4). It implies that if the average peri-urban farmer in the sample were to attain the economic efficiency level of its most efficient counterpart, the average farmer could experience a cost saving of 35 percent. These results reveal that allocative inefficiency constitutes a more serious problem than technical inefficiency and also evident that economic efficiency could be improved substantially. Amaza and Olayemi (2002) observed that a wide variation in farmer-specific efficiency level is a common phenomenon in developing countries.

Table4: Frequency distribution of Technical, Allocative and Economic Efficiency of the Peri-urban Farmers

Efficiency	Technical efficiency		Allocative efficiency		Economic efficiency	
Range	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
20-29	-	-	-	-	2	1.0
30-39	-	-	-	-	3	1.5
40-49	-	-	3	1.5	9	4.6
50-59	7	3.5	4	2.1	37	18.7
60-69	12	6.1	22	11.1	84	42.4
70-79	42	21.2	60	30.3	56	28.3
80-89	111	56.1	81	40.9	7	3.5
90-99	26	13.1	28	14.1	-	-
Mean (%)		82		80		65
Minimum (%)		50		40		22
Maximum (%)		93		92		82

Source: Computer Print-out from Frontier 4.1c.

Conclusion

The technical efficiency of the farmers revealed that they are not operating at the frontier. The mean Allocative efficiency was 0.80; the implication is that the allocative efficiency of the farmers can be increased in the short run by 20%. The mean economic efficiency was 0.65, thus revealing wide economic efficiency disparities of about 35% from the economically efficient frontier. Many variables have been identified to influence the various efficiencies of the peri- urban farmers. The study therefore recommends improved input delivery system and education of farmers to increase efficiency and subsequently food security.

References

Adebayo, A. A (1999), "Climate I & II.Adamawa State in Maps". (eds) Paraclete publisher, Yola, Nigeria. Pp 20-26

Adebayo, E. F. (2007), "Resources use efficiency of Dairy pastoralists in Adamawa State, Nigeria". Journal of Arid Agriculture vol.17.Pp 1-6

Adejobi A.O, P.M Komawa, V.M Manyong, J.K Olayemi. (2003), "Optimal Crop Combinations under limited Resource use: Application of Linear Goal Programming model to small holder farmers in the drier savannah zone of Nigeria". Journal of TechnolInstInnoSustRurDevelopt, 17(1): 8 -10

Amaza, P.S, Bila. Y & Iheanacho, A.C. (2006), " Identification of Factors that Influence Technical Efficiency of Food Crop Production in West Africa: Empirical evidence from Borno State, Nigeria". Journal of Agriculture & Rural Development in the Tropics, vol. 107, No 2 pp.139-147.

Amaza, P.S. & Gwary, D. M. (2000), "The Effect of Ecological change in farming Systems in Borno State" Journal of Arid Agriculture; 10:125129;

Amaza, P.S & Olayemi. J. K. (2002), “Analysis of Technical Inefficiency in food crop Production in Gombe state, Applied Economics Letters, vol 9 Pp 51-54

Amodu, M.Y. (2010), “Economic Analysis of Part time Farming in Idah, Local Government Area of Kogi State Nigeria”. Unpublished M.Sc thesis, Department of Agricultural Economics, Ahmadu Bello University, Zaria, Nigeria.

Battese, G.E. & Colli,T.J. (1995), “A Model for Technical Inefficiency Effects in Stochastic Frontier Production for Panel Data”. EmpiricalEcon.20:325-345.

Coelli, T. J & Battese, G. (1996), “Identification of Factors which Influence Technical Inefficiency of Indian Farmers “. Australian Journal of Agricultural Economics, 40 (2), 103-128.

Coelli, T. J (1994), 'A Guide to FRONTIER Version 4.1: A Computer Program for Stochastic Frontier Production & Cost Function Estimation”. Department of Econometrics, University of New England, Armidale, Australia.

Egbuna, E.N. (2001), “Urban Agriculture & Food Security in Abuja: An Enquiry”. Unpublished PhD Dissertation Proposal. University of Agriculture Abeokuta, Nigeria. Pp.2-5.

Egwu, E.W, P.O, Kalu & Mbanasor, J.S. (2010), “Technical Efficiency of Commercial Vegetable Production in AkwaIbom State, Nigeria”. The Nigerian Agricultural Journal.

F.A.O, (2001), “A Briefing Guide for the Successful Implementation of urban & peri-urban agriculture in developing countries & countries of transition”. Revision 2, Handbook Series. Volume III. Rome.

Giroh, D.Y & Adebayo E.F. (2009), 'Analysis of Technical Inefficiency of Rubber Research institute in Nigeria”. Journal of Human Ecology, 27(3)171-174East, Nigeria' International Journal of Agricultural Management & Development.2 (1).

Lynch, K. Binns, T. & Olofin, E. A. (2001), 'Urban Agriculture under threat: the land security question in Kano, Nigeria. Cities 18:159 71

Maurice, D.C (2012), “Optimal Production Plan & Resource Allocation in food crop production in Adamawa State, Nigeria”. Unpublished PhD thesis Modibbo Adama University of Technology Yola, Nigeria.

Maurice, D.C. Amaza, P.S & Tella, M.O. (2005), “Analysis of Technical Inefficiency in Rice-based Cropping Patterns among Dry Season Farmers in Adamawa State, Nigeria”. Nigerian Journal of Tropical Agriculture 7 (1) : 125-130

Mougeot, L. J. A. (1994), “Urban Food Production Evolution, Official Support & Significance”. Cities Feeding People Report 8. Ottawa: IDRC

Moustier, P. & Mbaye, A. (2000), “Market-oriented Urban Agricultural Production in Dakar”. In N. Bakker, M. Dubbeling, S. Guendel, U. SabelKoschella, & H. de Zeeuw(eds). 2000. 'Growing cities, growing food, urban agriculture on the policy agenda' pp 235256. DSE ,Feldafing.

NPC (National Population Commission (2006), “Population Census of the Federal Republic of Nigeria”. Analytical Report at the National Level, National Population Commission, Abuja

Obidi, C.N. (2009), "Economic Efficiency of maize Production in Yola North & Yola South Local Government areas of Adamawa State, Nigeria". Unpublished Master's thesis, Department of Agric Economics & Extension, Federal University of Technology, Yola.

Ogundari, K., & Ojo, S.O. (2007), "Economic Efficiency of Small Scale Food Crop production in Nigeria: A Stochastic Frontier Approach". Journal of Social Sciences 14(1):123-130

Pasquini, W.M. (2006), The use of town refuse ash in urban agriculture around Jos, Nigeria: health & Environmental Risks". Science of the Total Environment 354 (2006) 43 59.

Seyoum, E. T. Battese, G. E. I Fleming, E. M. (1998), "Technical Efficiency & Productivity of Maize Producers in Eastern Ethiopia: A study of farmers within & outside the Sasakawa-Global 2000 Project" Agricultural Economics; 19:341348

Sweet, L. (1999), "Room to live-healthy cities for the urban century". IDRC briefing. Ottawa, Canada. 7 IDRC.

Tashikalma, A.K. (2001), "Comparative Economic Analysis of some rain fed & irrigated food crops in Adamawa State, Nigeria". Unpublished PhD thesis, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

Udoh, E.J. & Falake, O. (2006), "Resources use Efficiency & Productivity among farmers in Nigeria". Journal of Agriculture & Social Sciences. 4, 264-268

UNDP, (1996a), "Urban Agriculture, Food, Jobs, & Sustainable Cities. United Nations Development Project".

World Bank, (1993), "World Development Report, & Rural Development, (1993): Investment in health". Oxford University Press, Pp. 38-54