RESOURCE USE EFFICIENCY OF WETLAND FARMERS IN IBADAN METROPOLIS

Abiodun-Ayeni B. and Omonona B.T.
Agricultural Economics Department, Faculty of Forestry and Agriculture, University of Ibadan, Nigeria
E-Mail: abiodunayenibamike@yahoo.com

ABSTRACT

Given the small areas cultivated by limited resource farmers, it is difficult to determine how they are able to maintain their families from such low-productivity farms. Hence, the resource use efficiency and profitability of wetland farmers in Ibadan metropolis Nigeria was investigated. A multistage sampling was employed for the study. Ibadan metropolis was stratified into two: urban and semi-urban. This was followed by random selection of two Local Government Areas (LGAs) from each of the strata. Lastly, 122 respondents were randomly selected from the local government based on probability proportionate to the size. Data on household demographic characteristics and farm production input and output variables were collected with structured questionnaire. The data were analyzed using descriptive statistics, budgetary and production frontier analysis. Mean age and household size were 45.5±11.2 years and 6.0±1.3 respectively. Farmers had at least six years of education and are mostly female. The result of profitability analysis showed that a farmer made an average profit of ₦36, 103.52. The Gross Ratio (GR) of the farm was 0.48 which showed that 48% of the gross income went for total cost. The returns on naira invested in production by the farmers were ₦0.93 that is 93.0%. The results of frontier model revealed that Technical Efficiency of farmers varied due to the presence of technical inefficiency effects in agricultural production. Land size, herbicide, water, family and hired labour were found to be the significant production factors which accounted for changes in the output of farmers. The distribution of the technical efficiency indices revealed that most of the farmers were technically efficient with mean Technical Efficiency Index of 0.519 (about 43.5.22% of the farmers had technically efficiency above 59%). The results of the inefficiency model showed that the age, years of education and household size significantly increased the farmers' technical efficiency. The wetland farmers are therefore encouraged to continue in the business because it is profitable.

Keywords: wetland farmers, profitability, technical efficiency, Ibadan metropolis.

INTRODUCTION

Agriculture is an important tool and vehicle for reducing the effects of household food insecurity, unemployment and poverty which are major problems in urban areas in Nigeria (Moore, 2000). Poverty, food insecurity and malnutrition in Africa were for decades viewed as largely rural problems. Although food insecurity and poverty are still more prevalent in rural areas today, rising deprivation in urban areas now presents a serious challenge in Nigeria. As food insecurity continues to worsen in urban areas more households are turning to urban farming as a means of coping. Nigeria has now recognized the role of urban agriculture in the urban economy but there is no legal provision to protect the poor engaged in urban farming which affects productivity levels (UNICEF, 1993).

Vegetables are of great importance in our diet because they are good sources of vitamins and minerals. They are inexpensive source of protein and they acts as supplements or substitutes to animal protein like meat and fish which are quite costly. They thus help in maintaining adequate health standards. Vegetables are low in cholesterol, low in saturated fats, and low in calories and contain essential fats requirement, high in fibre and nutrients. They also provide essential mineral element like iron, magnesium, calcium, potassium, copper, ascorbic acid, thiamin, riboflavin and niacin. Most common vegetables are low in protein with a content of about 0.5-1.5%. Leafy vegetables are also good source of crude fibre and hence act as good laxatives. Vegetable production forms a substantial percentage about 25% of the major food crop cultivated in the tropics and so it is the source of livelihood for a considerable section of the population. In the continual fight against hunger and malnutrition, significant increases in food production have been achieved through the use of improved seeds, fertilizers, improved production practices etc. The term frontier involves the concept of maximality in which the function sets a limit to the range of possible observations (Forsund *et al*., 1980). Thus it is possible to observe points below the production frontier for firms producing less than the maximum possible output but no point can lie above the production frontier given the technology available. The frontier represents an efficient technology and deviation from the frontier is regarded as inefficient. An economically efficient input-output combination will be on both the frontier function and the expansion path.

Several studies have been carried out on UA in Africa (Parikh and Shah, 1995; Adewumi, 2008; Arene and Mbata, 2008; Fasasi, 2006). All these studies concluded that it has the potential for poverty reduction, food security and employment generation. However, there is still much gap between demand and supply of food with increasing poverty in urban areas, especially consumption poverty. To achieve the Millennium Development Goal of halving the proportion of hungry people by 2015, it is projected that 22 million people must achieve food security every year. This could only be possible if the available resources are efficiently utilized. This is because the urban food production problem has been heightened by the relatively low level of productivity of resources used by the farmers (Ojo, 2004). The improvement of agricultural productivity has attracted the attention of policy makers, researchers and development practitioners in developing countries for two main reasons (Odhiambo and Nyangito, 2003). First, they rely heavily on agriculture for economic growth, export earnings, and employment generation. Second, indications in many sub-Saharan African countries are that agriculture is becoming progressively less productive. A declining trend in both labour and land productivity constitutes a major challenge and portends lower living standards in the farm sector and the rest of the economy. In order to enhance the productive capacity of the farmers, knowledge of the availability of the aggregate farm level resources and differences in their productivities is essential. Therefore, the study of their present level of efficiency and the analysis of the factors influencing their level of efficiency is necessary. This will indicate the possibility of increasing their productivity level by highlighting the direction of resource use adjustment and allocation, because increases in production and productivity are direct consequences of efficiency of input combination given the available technology (Ogundari and Ojo, 2007). In this regard the study addresses the following research questions.

- What are the socio-economic characteristics of urban farming household?
- Whether vegetable farming is profitable and the farmers are efficiency in the use of their resources?

This study is to examine the resource use efficiency and profitability of wetland farmers in Ibadan metropolis.

Conceptual/theoretical framework and literature review

The concept of technical efficiency entails a comparison between observed and optimal values of output and inputs of a production unit (Sadoulet and Janvry, 1995). This comparison takes the form of the ratio of observed to maximum potential output obtainable from the given input, or the ratio of the minimum potential to observed input required to produce the given output, or some combination of the two. These two give rise to the concepts of technical and allocative efficiency. A productive entity is technically inefficient when, given its use of inputs, it is not producing the maximum output possible (output distance), or given its output, it is using more inputs than is necessary. Similarly, a production unit is allocatively inefficient when it is not using the combination of inputs that would minimize the cost of producing a given level of output (Sadoulet and Janvry, 1995). Changes in productivity are due to differences in production technology, differences in the efficiency of the production process, and differences in the environment in which production takes place (Grosskopf, 1993). Productive efficiency is therefore an important determinant of productivity and should be incorporated in productivity analyses. The empirical challenge is to measure productive efficiency and to apportion its share in the productivity variations.

The use of econometric techniques in estimation of efficiency has increased considerably in recent times. This has mainly taken the form of estimating a frontier production function. Econometric approaches developed by Aigner, Lovell and Schmidt (1977) are among the first to use non-stochastic frontier methods of estimation. Since then, there have been several attempts to use the technique. These attempts vary according to the type of data used (cross-section or panel), the type of variables (quantities only, or quantities and prices) and the number of equations in the model.

Cross-sectional designs

These are by far the most widely used techniques in the estimation of productive efficiency. The process involves the specification and estimation of a production function of the form:

$$Yi = f(x_i, \beta) \exp\{v_i + u_i\} \quad (1)$$

where β is a vector of technology parameter, x are the inputs used and i=1….I indexes producers. The model specifies two random disturbance terms v_i and u_i. The random disturbance term v_i is intended to capture the effects of the stochastic noise. It is assumed to be independently distributed with a mean equal to zero and standard deviation equal to σ2 v.

The disturbance term ui captures technical inefficiency and is assumed to be independent of v_i. Lovell (1993) shows that the technical efficiency (TE) can be expressed as a reciprocal of the Dubreau-Farrel output oriented technical efficiency. This can be written as:

$$TE_j = \frac{y_i}{\{f(x_i; B)\exp(v_i)\}} = \exp(u_i) \quad (2)$$

Estimation of technical efficiency was first accomplished by Aigner, Lovell and Schmidt (1977), Battese and Corra (1977) and Meeusen and Van den Broeck (1977). These studies provide estimates of the average technical efficiency over all the observations. The data used was cross sectional in nature. To estimate the equations, a number of assumptions are necessary. First, it can be assumed that v_i=0 and then estimate a deterministic production frontier. The maximum likelihood method (MLE) can then be used as an estimation procedure in this case. The second assumption will be to assume that vi≠0 and estimate a stochastic production frontier.

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MATERIALS AND METHODS

Area of study

This study was carried out in Ibadan city, the largest indigenous city in sub-Saharan Africa. Ibadan, the capital of Oyo State is located between longitude 70 20' and 70 40' East of the Greenwich meridian and between latitude 30 55' and 40 10' North of the equator. The city lies in the equatorial rain forest belt and has a land area of 445 - 455km^2. Ibadan land has 11 local governments made up of five within the metropolis and six at the periphery of the metropolis. Ibadan is the largest indigenous city in West Africa and is located in the South Western part of Oyo State of Nigeria. It is the capital city of Oyo State and is located about 145 km north-east of Lagos, the federal capital of Nigeria. Its population is 2, 550, 593 according to 2006 census results, including 11 local government areas. The population of central Ibadan, including five LGAs, is 1 338 659 according to census results for 2006, covering an area of 128 km².

Majority of the soils ranged between typic and typic tropaquent. However, they are scattered all over the landscape of the Ibadan city and majority are not used at all for either agriculture or for any form of land use (Taiwo, 2007). The site is dominated by a range of hills in all directions. As the dominant urban centre in Oyo State, its administrative and commercial functions transcend beyond the city boundaries. Ibadan metropolitan area covers a total land area of 3, 123km^2 of which the main city covers 463.33km. The site is dominated by a range of hills in all directions. As the dominant urban centre in Oyo State, its administrative and commercial functions transcend beyond the city boundaries. These include the banks of streams as well as isolated wetland areas that dot the city, which is enclosed by valleys and swamps. Eleven Local Government Areas make up Ibadan metropolitan area, Ibadan region or Ibadan land. The overall population density of Ibadan metropolitan area is 586 persons per km^2. The administrative and commercial importance of Ibadan has resulted in land being a key investment asset and a status symbol for the population.

Economic activities undertaken by people in Ibadan include trading, public service employment, and agriculture in decreasing order of importance. The volume and diversity of demand for food products stimulated the need for agricultural production within the vicinity of the city. Many people in the city engage in agriculture. The inability of rural farmers to cope with the food demand triggered the practices of UPA in Ibadan city. Moreover, economic needs and knowledge of residents have transformed the land left over by urbanization into gardens notable for their ecological richness and variety. The predominant crop produced in Ibadan is staple food-cassava, maize and vegetables such as Chinese spinach, okra, cucumber, tomatoes, pepper.

Data and sampling technique

Primary data were collected for the purpose of this study using structured questionnaire. The questionnaires were pretested to collect information based on individual and household characteristics. Some of the data include: socio economic and demographic characteristics, such as age, gender, access to credit and extension services, proximity to road, output from crops, quantity consumed at home, quantity sold, inputs used, and expenditure on agricultural productive activities were collected.

The stratified random sampling method was employed for this study. Ibadan metropolis was stratified into two: urban and peri-urban. The farming population used consists of urban farmers. The next stage involved the random selection of two Local Government Areas (LGA) from the two strata used for the study. Respondents were selected from the two LGAs based on probability proportionate to the number of urban farmers. The proportionality factor used in the selection of urban farmers is stated as:

$$Xi = n/N*30 \tag{3}$$

Where

Xi = number of urban farmers to be sampled from a local government
n = number of urban farmers in the particular local government area
N = total number of urban farmers in all the local government areas

The desired total number of urban farmers for the two stages is 150

In all, a total of one hundred and fifty (150) urban farmers were interviewed. However, only one hundred and twenty-two had meaningful information for analysis.

Analytical tools and models

The tools include: Descriptive statistics, budgetary analysis and stochastic frontier model.

(i) Descriptive statistics: Descriptive statistics such as frequencies, mean and percentages were used for socio-economic and households' variables.
(ii) Budgetary analysis (Gross margin): This was used to estimate the cost and return in urban farming in the study area. It is given as:

$$GM = TR - TVC \tag{4}$$

Where GM = Gross Margin, TR = Total Revenue and TVC = Total Variable Cost (cost incurred in the use of variable inputs)

Mathematically,

$$GM = \sum PiQi - \sum R_iX_j$$

Where

GM = Gross margin of the farmers (Naira)
Pi= Price of ith crop in Naira
Qi= Total sales of ith crop in Naira

R_i = Unit cost of variable input j used in producing i^{th} crop in naira. The variable cost include, working capital(₦) cost of planting material, fertilizer, chemicals, insecticide, water, Cost per cropping season (family and hired labour) and other production inputs
X_j = Quantity of variable input j used in ith selected size of crop.

(iii) Stochastic frontier function: This was used to estimate the resource use efficiency in wetland farming. It is given by:

$$\ln Y_i = \ln ß_o + \Sigma ß_j \ln X_{ij} + v_i - \mu_i \quad (5)$$

Where

Yi = Farm output (ton/ha) from farm i
X_i = Vector of farm inputs used
X_1 = Farm size (in hectares)
X_2 = Inorganic fertilizer (Kg)
X_3 = Organic fertilizer (Kg)
X_4 = Herbicides (Kg)
X_5 = Seeds/planting material
X_6 = Water (litre)
X_7 = Family labour (man-day) and
X_8 = Hired labour
v = random variability in the production that cannot be influenced by the farmers; μ = deviation from maximum potential output attributable to technical inefficiency. $ß_o$ = intercept; ß = vector of production function parameters to be estimated; i = 1, 2, 3, n farms; j = 1, 2, 3, m inputs. The inefficiency model is:

$$\mu_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \ldots + \delta_4 Z_4 \quad (6)$$

Where

μ_i = Technical inefficiency effect of the ith farm
Z_1 = Sex of farmer (dummy; 1= male, 0 female)
Z_2 = Age of farmer (years)
Z_3 = Year of formal education of farmer (years)
Z_4 = Marital status of farmer (dummy; 1= married, 0= otherwise)
Z_5 = Household size
Z_6 = Experience of farmer in years
δ = Parameters to be estimated

The ß and δ coefficients are un-known parameters to be estimated along with the variance parameters δ_2 and γ. The δ_2, and γ, coefficients are the diagnostic statistics that indicate the relevance of the use of the stochastic production frontier function and the correctness of the assumptions made on the distribution form of the error term. The δ_2 indicates the goodness of fit and the correctness of the distributional form assumed for the composite error term.

The γ, indicates that the systematic influences that are unexplained by the production function are the dominant sources of random errors. The statistical significance of the shows the presence of a one-sided error component, v_i, in the model specified.

RESULTS AND DISCUSSIONS

The socio-economic characteristics of urban vegetable wetland farmers are shown in Table-1. The distribution of the respondent by sex shows that 37.7% of the farmers are males while only 62.3% of the farmers are females. This implies that female involvement in urban farming is high. The result confirmed Sigot (1995) that women in Africa are responsible for higher proportion of total food production throughout the continent. The farming women undertake is mostly for subsistence, i.e., providing urgent needs of families". As home-makers, more women than men may be involved in urban farming in order to supplement the food needs of their households from market purchases.

Majority of urban farmers (69.7%) are in the age bracket (31-40) and (41-50) years while only 12.3% of the farmers had age greater than 60 years. However, the average age of the farmer was 45.5 years. This age is still within the economic active age when they can carry out the rigour of farming. The implication of this is that, if other farm inputs are available in the right quantity and time, urban agriculture though not an alternative to rural farming or replacing it, can add substantially to output of rural agriculture. This conclusion is premised on the assumption that the young urban farming population would be productive. Age of farmer is an indicator of experience in farming. The result shows that over half of the wetland farmers had six year of formal education. However, less than 5% of the farmers are educated to tertiary level and spent twelve of more years in school. Nonetheless, some of the respondents (72.1%) did not meet the minimum prescription of nine years of basic education under the Universal Basic Education Programme of the present administration. This may not be un-related to a possible largely migrant farming population in the urban. It is recognized that it is the able bodied and educated men and women who migrate from rural to urban centers.

In other hand, the distribution of the respondents according to their marital status showed that about 91% of the wetland farmers are married while the remaining are unmarried. The present economic challenges in Nigeria have made married and poor rural and urban households to engage in all kind of businesses in order to augment their income. This may also be attributed to the quest by married people to provide for their family members.

Result of distribution of wetland farmers by household size shows that 73.8% of the farmers had household size of 4-8 persons while few farmers have household size of 1-3 persons. Household size was high in the area with an average of about 6.0±1.3 persons per household. Farmers have the tendency to bear as many children as possible in the belief the greater the opportunity to use them as source of family labour.

The result of farming experience revealed that majority (54.1%) of the farmers had less than five years experience in farming whereas, 20.5% farmers had over ten years. The implication is the present economic hardship in the country has pushed more people to farming in the urban area to cushion the effect of hunger.

Table-1. Socio-economic characteristics of urban vegetable wetland farmers.

Variable	Frequency	%
Sex		
Female	76	62.3
Male	46	37.7
Total	122	100
Age (years)		
< 30	5	4.1
31-40	45	36.9
41-50	40	32.8
51-60	17	13.9
>60	15	12.3
Total	122	100
Mean	45.5	
SD	11.2	
Min	15	
Max	73	
Years of education (years)		
Less than 5	25	20.5
6	63	51.6
12	31	24.4
Greater than 12	3	2.5
Total	122	100
Mean	6.1	
SD	1.3	
Min	0	
Max	15	
Marital status		
Married	111	90.9
Single	11	9.1
Total	122	100
Household size		
1-3	3	2.4
4-8	90	73.8
Greater than 8	29	23.8
Total	122	100
Mean	6.0	
SD	1.3	
Min	0	
Max	10	
Years of experience (years)		
Less than 5	66	54.1
6-10	31	25.4
Greater than 10	25	20.5
Total	122	100
Mean	4.1	
SD	1.1	
Min	0	
Max	15	

Source: Field Survey, 2011

ARPN Journal of Agricultural and Biological Science

The result of cost and return to wetland farming by farmers is shown in Table-2 presented the result of cost and return to wetland farming by farmers. The table shows that farmers incurred an average cost of ₦38, 625.78 per hectare; and within the same period they had an average estimated return of ₦74, 729.30. This implies that the farmers made a profit of ₦36, 103.52. The Gross Ratio (GR) of the farm was 0.48 which showed that 48% of the gross income went for total cost. A ratio less than 1 is always desirable for any farm business. The lower the ratio, the higher the returns on naira invested (Olukosi and Erhabor, 1988). The returns on naira invested in production by the farmers were ₦0.93 that is 93.0%.

Table-2. Cost and return in wetland farming.

Cost item	Average cost (Naira)	Percentage
Land preparation	18322.04	47.4
Planting	14910.60	38.6
Fertilizer application	3106.90	8.0
Weeding	1429.70	3.7
Harvesting	600.40	1.6
Spraying of chemical	1200.15	3.1
Seeds	256.14	0.6
Total cost	38625.78	100.0
Total variable cost	38625.78	
Total revenue	74729.30	
Gross margin	36103.52	
Return on naira invested	0.93	
Gross Ratio	0.48	

Source: Field Survey, 2011

The results of the estimates of the parameters of the stochastic frontier and the inefficiency model are presented in Table-3. The result shows that gamma has a coefficient that is significant. This implies that there is the presence of technical inefficiency in agricultural production among the wetland farmers. With an estimated gamma value of 0.99, this study shows that about 99.9% of the variation in the output of the respondents from the frontier is due to their technical inefficiency. The coefficient of farm size was found to be positive and significant at 1% level. The result could mean that it is possible to expand farming activity in urban area in spite of keen competition between urbanization and farming activities. It may be possible that competition between infrastructure development and crops for land is not yet keen enough to jeopardize the expansion of agricultural activities. Statistically, the magnitude of the coefficient of farm size shows that output is inelastic to land or farm size. If the farm size is increased by 10%, output level will improve by less than proportionate (by a margin of 0.2%). The coefficient of herbicide use was significant and had a negative sign at 10% level. This shows the importance of herbicide in wetland farming in the study area.

In the other hand, the coefficient of water used was negative and significantly affected the quantity of output. The estimates show that the correct use of water determining the output of farmers. The coefficient of water is 0.04 indicating that increasing the water usage by 10.0% will lead to decrease output of wetland farmer by 0.4%. The coefficients of family and hired labor were significant and had a positive sign at 10% and 1% levels. However, 100% increase in family and hired labour by wetland farmer led to increased output of 40.1% and 4.5% respectively. This shows the importance of labour in wetland farming. Wetland farming involves the use of traditional farming implements such as hoe and machete. Human power plays crucial role in virtually all farming activities. This situation has variously been attributed to small and scattered land holding, poverty of the farmers and lack of affordable equipment (Umoh and Yusuf, 1997). It appears that labour will continue to play important role in agriculture, affecting its efficiency, until those factors constraining mechanization are addressed.

The inefficiency model shows that the coefficients of year of education was positive while age of wetland farmer's head and household size were negative and significantly affected output of farmers in the study area. Level of education is also positively related to technical inefficiency. This implies that there is increased level of technical inefficiency as level of education increases. This is in contrast with the findings of Ferenji and Heidhues (2007) and Raphael (2008) that education of the household has negative and significant influence on the technical inefficiency of farmers. The reason for this is probably because of the orientation of most people in the country linking education with white collar job. As such, the more educated ones among the farmers may develop inferiority complex which might be responsible for their efficiency in agricultural production.

Table-3. Maximum likelihood estimates of the stochastic frontier function and technical inefficiency in wetland farming.

Variable	Description	Parameter	Coefficient	Standard error	T-statistic
		Stochastic frontier			
Constant		β_0	1.3824*	0.69954	1.97
Log land size	Hectare	β_1	0.01605***	0.00517	3.10
Log inorganic fertilizer	Quantity of inorganic fertilizer used (Kg)	β_2	0.07016	0.09610	0.73
Log organic fertilizer	Quantity of organic fertilizer used (Kg)	β_3	-0.11754	0.48051	-0.65
Log herbicide	Volume of herbicide used in litre	β_4	-0.27329***	0.05122	5.33
Log seed	Quantity of seed used (Kg)	β_5	-0.01619	0.03877	-0.41
Log water	Volume of water in litre	β_6	-0.042768**	0.01741	2.45
Log family labour	Family labour (man-day)	β_7	0.400747*	0.20478	1.95
Log hired labour	Hired family (man-day)	β_8	0.04472***	0.01259	3.55
			Inefficiency parameter		
Constant		Z_0	0.353117	0.51005	0.69
Sex	(male=1, 0=female)	Z_1	0.111995	0.74405	0.15
Age	years	Z_2	-0.349721**	0.11736	-2.97
Year of education	years	Z_3	0.02119***	0.00351	6.02
Marital status	(Married=1, 0= other)	Z_4	0.016297	0.01679	0.97
Household size	Continuous	Z_5	-0.330729**	0.11541	-2.86
Year of experience	years	Z_6	-0.13728	0.54947	-0.24
			Variance parameter		
Sigma-squared (δ^2)			0.51456***	0.16921	3.04
Gamma			0.99999***	0.00017	5743.1
Log likelihood function			-80.0095		
LR test			0.22243		

Source: Field Survey, 2011

Table-4 shows that there was a minimum estimated efficiency of 14.5%, maximum efficiency of 99.9% and mean technical efficiency of 51.9%. Even though about 52.0% of the respondents are operating at about 50% level of technical efficiency, the mean value indicates that if the efficiency of input usage is increased by 48.1%, the wetland farmers will be operating on the production frontier. Thus, greater opportunity still exists for increasing farmers' productivity and income through increased efficiency in the use of existing farm technology.

Table-4. Farm specific resource efficiency indices among wetland farms.

Class interval	Frequency	Percentage
0.01-0.19	2	1.6
0.20-0.39	48	39.3
0.40-0.59	19	15.6
0.60-0.79	30	24.6
0.80-1.00	23	18.9
Total	122	100.0
Mean efficiency = 0.519788	Min = 0.145145	Max = 0.99895

Source: Field Survey, 2011

CONCLUSIONS AND RECOMMENDATIONS

The results obtained in this study showed that wetland agricultural production is a profitable business in the study area with a net income of ₦36, 103.52. The market for wetland crops also is different from other food crops and is prone to price fluctuations. A Cobb-Douglas production frontier was estimated by maximum likelihood estimation method to obtain maximum likelihood estimates (MLE) and inefficiency determinants. The MLE results revealed that technical efficiency of wetland farmers varied due to the presence of technical inefficiency effects in wetland agricultural production. Land size, herbicide, water, family and hired labour were found to be the significant production factors which accounted for changes in the output of farmers. The distribution of the technical efficiency indices revealed that most of the farmers were technically efficient with mean Technical Efficiency Index of 0.519 (about 43.5.22% of the farmers had technically efficiency above 59%). The results of the inefficiency model showed that the age, years of education and household size significantly increased the farmers' technical efficiency. This study showed that farmers were not fully technically efficient and therefore there is allowance of efficiency improvement by addressing some important policy variables that could negatively and positively influence farmers' levels of technical efficiency in the area.

The policy implication of this study is that there is scope for raising the present level of technical efficiency of wetland farming in the study area given the variation in the levels of technical efficiency i.e., the mean technical efficiency of 0.519 could be increased by 48.0% through better use of available resources. It was shown that education (years of schooling) had a positive relationship with technical efficiency and therefore farmers should be encouraged to improve their levels of education adult literacy programme in the area.

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