DE GRUYTER OPEN
10.1515/ats-2016-0006 AGRICULTURA TROPICA ET SUBTROPICA, 49/1-4, 45-49, 2016

Original Research Article

Technical Efficiency of Catfish Farming in Alimosho Local Government Area of Lagos State, Nigeria: a Gender Perspective

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Abstract

This research was undertaken to examine the gender perspective of the technical efficiency of catfish farming in Alimosho Local Government Area of Lagos State. Primary data elicited from a sample size of 70 catfish farmers (38 male and 32 female catfish farmers) were employed in the study. Analysis of the data was done using descriptive statistics and stochastic frontier production function. The maximum likelihood estimates of the stochastic frontier production function revealed that the mean technical efficiency of the male catfish farmers (86%) was higher than that of the female catfish famers (20%) and this implies that the male and female catfish farmers have the scope of improving their efficiency by 14% and 80%, respectively, through the use of farming practices used by the most efficient male and female catfish farmers. The factors that were significant in influencing the technical efficiency of the female catfish farmers were farming experience and credit while in the case of the male catfish farmers, farming experience significantly influenced their technical efficiency. In the light of the low technical efficiency of the female catfish farmers relative to the male catfish farmers, it was recommended that gender equality infishery training, extension delivery, distribution of resources and access to supportive services should be encouraged in a bid to improve the technical efficiency of the catfish farmers especially that of the female catfish farmers.

Keywords: descriptive statistics; stochastic frontier production function; equal opportunities.

INTRODUCTION

Fisheries occupy a unique position in the agricultural sector of the Nigerian economy. Its contribution of the agricultural share of gross domestic product was estimated as 1.3% in the year 2010, out of the total estimate of 40.9% being contributed by agriculture to GDP (CBN, 2011). As a maritime nation with a vast population of over 160 million people and a coastline measuring approximately 853 kilometres, fish production as an enterprise possesses the capacity to contribute significantly to the agricultural sector (Osagie, 2012). As reported by FAO (2005), Nigeria have aquaculture potential which constitutes 75% of 923,768 km^2 of the land mass and 14 million hectares of inland freshwater, but less than 1% is utilized for fish production. Despite the popularity of farming in Nigeria, the fish farming industry can be best described as being at the infant stage when compare to the large market potential for its production and marketing (Nwiro, 2012). Nigeria can substitute fish importation with domestic production to create jobs, reduce poverty in rural and peri-urban areas where 70 per cent of the population live and ease the balance of payments deficits (Areola, 2007).

Nigeria spends ₦100 billion on fish importation annually and the current fish demand consumption in Nigeria stands at over 2.66 million tonnes per annum, while the present importation rate is over 750,000 metric tonnes (Oota, 2012). With importation of more than 750,000 MT of fish, more than USD 600 million are spent in hard currency and thousands of jobs are exported (USAID, 2010). The continuous importation of fish portends a colossal loss of foreign exchange earnings to Nigeria. In order to bridge the demand-supply gap, an aquaculture transformation agenda plans to increase annual fish production from the current production of 0.78 million metric tonnes to 3.0 million metric tonnes in order to achieve self-sufficiency in fish production and supply by the year 2015 (Tijani, 2011). This will be achieved through fish farm development program, fish seeds and feed mill development program, fish pen and cage culture development program and fish post-harvest management and marketing program. However, Oyinbo et al. (2013) noted that fishery extension program should be included as a component of the fishery transformation plan of Nigeria so as to facilitate the delivery of fishery extension services to fish farmers, fish marketers, fish feed millers and other actors in the fish value chain.

Efficiency is a very important factor for productivity growth and hence in an economy where resources are scarce and opportunities to use new technologies are limited, inefficiency studies indicate the potential possibility to raise productivity by improving efficiency without necessarily developing new technologies or increasing the resource base (Bifarin et al., 2010). Measuring technical efficiency at the farm level, identifying important factors associated with the efficient production systems would serve as a panacea to assessing potential for developing sustainable aquaculture (Kareem et al., 2008). It is worth noting that several studies (Adewuyi et al., 2010;Akinrotimi et al., 2009;Nwiro, 2012 and others) on catfish production have been carried out but there exists dearth ofempirical information on gender-based analysis of technical efficiency of cat fish farming and therefore, this study was undertaken to fill the knowledge gap by providing information on the gender perspective of technical efficiency of cat fish farming. A gender perspective is necessary as it allows for the advancement of gender equality and equity regardless of whether it is women or men who are disadvantaged and whose position needs to be addressed in a bid to enhance efficiency of production.

MATERIALS AND METHODS

Description of the study area

The study area is located in the north-western part of Lagos State. It is located at latitude 6.61056 ° N and longitude 3.29583 ° E with a temperature range of 28 °C to 33 °C. It occupies a land area of 173.6 square km (67 square miles). Geographically, the River Owo demarcates the study area from Ado-Odo/Ota Local Government Areas of Ogun state on the northern and western side. Towards the east, it is bounded by IfakoIjaye, Agege and Ikeja Local Government Areas of Lagos State. The old Abeokuta expressway forms the frontier line between the Local Government Areas. On the southern part, the study area is bounded by Oshodi/Isolo, Amuwo Odofin and Ojo Local Government Areas of Lagos State. It is the largest local government area in Lagos state with 1,277,714 inhabitants according to the official 2006 Census. It is estimated that the population will increase to 1,592,911 by 2013 based on national Population Commission (NPC) annual growth rate of 3.2%.

Sampling procedure

A two-stage sampling technique was used in the study. The first stage involved a purposive selection ofwards M1, G North, G South, H, D, F, and ward E1 out of the eleven wards in the local government area on the basis of the peculiarity of catfish farming in the wards. The second stage involved a random selection of 10 fish farmers from each of the 7 selected wards to give a sample size of 70 fish farmers which represents 50% of the sampling frame (140 fish farmers) of the fish farmers in the study area.

Data collection

Primary data were used in this study. The primary data were obtained from the respondents using a well structured questionnaire with the aid of personal interview during the field survey. The primary data collected include socio-economic characteristics of catfish farmers in the study area, inputs used for catfish production per production cycle and the output of catfish production cycle.

Analytical framework

The Cobb-Douglas functional form of the stochastic frontier production function was employed to estimate the technical efficiencies of the male and female cat fish farmers in the study areausing frontier version 4.1 software. The stochastic frontier production function has the advantage of allowing simultaneous estimation of individual technical efficiencies of farmers as well as the determinants of technical efficiency (Battese and Coelli, 1995).

It is assumed that the farm frontier production function is expressed as:

$$Q = f(X_i; \beta) + e_i \quad (1)$$

Where:

Q = quantity of output,

X_i= vector of input quantities

β = vector of parameters

e_i = farm specific composite residual term comprising of a random error term (V_i) and an inefficiency component (U_i).

The explicit form of the Cobb-Douglas stochastic frontier production function employed in the study is expressed as:

$$lnY = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + V_i - U_i \quad (2)$$

Where:

Y= Quantity of output (Kg)

X_1 = pond size (m^2)

X_2 = Labour in man-days

X_3 = cost of fingerlings (₦)

X_4 = quantity of feeds (Kg)

β_0 = Intercept

β = Vector of the coefficients for the associated independent variables in the production function

U_i = one-sided component, which captures deviation from frontier as a result of inefficiency of the firm

V_i = effect of random stocks outside the firm control, observation and measurement error and other stochastic (noise) error term.

The technical inefficiency model is expressed as:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 \quad (3)$$

Z_1 = age (years)

Z_2 = education (years of formal schooling)

Z_3 = household size

Z_4= years of farming experience (years)

Z_5 = number of contact with extension agents per cropping season (number of contacts)
Z_6 = member of cooperative (years)
Z_7 = amount of credit obtained (naira)
$\delta_1\delta_7$- = are the scalar parameters to be estimated.

RESULTS AND DISCUSSION

The Maximum likelihood estimate (MLE) of the Cobb-Douglas stochastic frontier production function of the male and female catfish farmers in the study area is presented in Table 1. The estimated sigma square (δ^2) value of the male catfish farmers was significant at 1% probability thereby indicating goodness of fit of the model. The gamma (γ) coefficient for the female catfish farmers implies that 92% of shortfall below the frontier output of the female catfish farmers was due to technical inefficiency of the female catfish farmers. For the male catfish farmers, the estimated sigma square (δ^2) and gamma (γ) values were not significant

The analysis shows that the estimated coefficients for pond size (X_1) were positive but not significant for both categories of catfish farmers. This finding corroborates that of the earthen pond type fish farming obtained by Kareem et al. (2008). The coefficients for labour (X_2) were found to be positive and significant at 1% probability level. This indicates that an increase in labour will lead to an increase in output of catfish harvested. This finding disagrees with Asogwa et al. (2011) who found that labour had a negative influence on the output. The estimated coefficients for fingerling (X_3) were positive for both male and female catfish farmers and significant at 1% probability level for only the female catfish farmers. This implies that a unit increase in the number of fingerlings stocked will lead to an increase in the output of catfish harvested. The estimated coefficient for feed (X_4) was positive and significant at 5% probability level for only the female catfish farmers.The estimated coefficient of feed for the female catfish farmers was in line with Kareem et al. (2008) who reported similar result in an earthen pond type of fish rearing. The positive sign agrees with the *a priori* expectation and it implies that as the quantity of feed consumed increases, catfish output increases. For the male catfish farmers, the estimated coefficient for feeds was negative and this is against *a priori* expectation. A plausible explanation for the inverse relationship could be due to the use of inappropriate fish feed type, feeding frequency/levels and feeding time. Majority of the male catfish farmers may be using feeds that are not best suited for catfish (inappropriate feeds), adhering to inappropriate feeding frequency/levels as well inappropriate feeding time and this could affect the feed conversion efficiency and growth of the catfish raised by the male farmers. This is in line with empirical findings which revealed that feed type, feeding frequency and feeding time affects survival rate, growth and feed conversion ratio of fish

Table 1. Maximum likelihood estimates of the stochastic frontier production function for male and female catfish farmers

Variable	Male catfish farmers		Female catfish Farmers	
	Coefficient	t ratio	Coefficient	t ratio
Production Model				
Constant	0.311	0.366	2.399	0.826
Pond size	0.0590.768	0.124	1.087	
Labour	1.104*	9.376	0.424*	3.465
Fingerling	0.039 0.521	0.432*	6.581	
Feeds	-0.951	-0.589	0.445**	2.051
Inefficiency Model				
Constant	1.101	0.529	2.837	2.046
Age	-0.023	-0.425	-0.025	-1.627
Education	-0.040	-0.487	-0.028	-1.032
Household size	-0.278	-1.509	0.044	0.757
Farming experience	0.267*	2.4520.193**	2.331	
Extension contact	0.074	0.597	-0.142	-1.197
Association	0.042	0.199	0.101	1.149
Access to credit	-0.027	-0.138	-0.130*	-4.283
Variances				
Sigma squared	0.149	1.1240.393*	4.075	
Gamma 0.530	1.1500.920**	2.440		
Log likelihood function	-9.556-30.280			
LR test	23.746		11.751	
Mean efficiency (%)	86	20		

NB: * $P < 0.01$, ** $P < 0.05$

(Hossain et al. 2002; Ashley-dejo et al. 2015; Karabulut et al. 2010; Jamabo et al. 2015).

The result presented in Table 1also revealed the determinants of the technical inefficiency of the male and female catfish farmers. Farming experience ($P < 0.01$) was the only significant factor that influenced the technical inefficiency of the male cat fish farmers whereas in the case of the female catfish farmers, farming experience ($P < 0.05$) and access to credit ($P < 0.01$) were the significant factors that influenced their technical inefficiency. The result implies that an increase in farming experience of the male cat fish farmers will reduce the technical inefficiency of the farmers. This result is in consonance with the finding of Asogwa et al. (2011) who obtained similar results in their study. The positive coefficients of farming experience for the male and female catfish farmers were against *a priori* expectation and a plausible explanation for this is that as the farming experience of the catfish farmers increases, there is tendency for them to become conservative and get to use the old but less productive farm management practises for catfish farming. This result is against that of Ajibefun et al. (2002) who reported that farming experience was negative and significant. The negative sign of credit for the female catfish farmers implies that as the access of the farmers to credit increases, their technical efficiency tends to increase and this is because credit enables them to acquire farm inputs and other necessary resources for catfish production. This result compares favourably with that of Bifarin et al. (2010) who noted that access to credit was negatively and significantly related to technical inefficiency.

The mean technical efficiency of the male catfish farmers (86%) was higher than that of the female catfish famers (20%) and this implies that the male and female catfish farmers have the scope of improving their efficiency by 14% and 80%, respectively, through efficient resource utilization given the current level of available resources. This result is not consistent with that of Olagunji et al. (2013) who reported that female sweet potato producers had a higher technical efficiency (80%) compared to male sweet potato producers with technical efficiency of 54%. The higher efficiency of the male catfish farmers relative to the female catfish farmers could be attributed to the differences in the access to and control of productive resources, differences in access to extension services and other supportive services as well as differences in decision making power between the male and female catfish farmers with the female catfish farmers being more disadvantaged. Hence, in order to enhance the efficiency of the cat fish farmers especially the female ones, mainstreaming gender in fishery training, extension delivery, distribution of resources and access to supportive services should be encouraged so as to offer both categories of catfish farmers equal opportunities in enhancing their productivity. Promoting equality in access to production resources and services towards enhancement of their efficiencies was necessitated as the efficiencies of both categories of catfish farmers is low compared to the technical efficiencies of 89% and 94% for small catfish farms and large catfish farms respectively in a study on technical efficiency of catfish production in Anambra State by Ugwumba (2011).

CONCLUSION AND RECOMMENDATION

The kernel of this study was to determine the technical efficiency differential of catfish production on the basis of gender. Male catfish farmers were established to be more technically efficient than their female counterparts in the study area and this was attributed to favourable disposition of male catfish farmers in terms of access to productive resources, access to fishery training and other supportive services. On the account of the foregoing, it was recommended that policy measures aimed at encouraging gender equity in fishery training, extension delivery, distribution of resources and access to supportive services should be encouraged in a bid to improve the technical efficiency of the catfish farmers especially that of the female catfish farmers.

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Received: October 14, 2015
Accepted December 20, 2016

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