RESOURCE USE EFFICIENCY IN CATFISH PRODUCTION IN OYO STATE NIGERIA

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Abstract: The study analyses the resource use efficiency in catfish production in Oyo state, Nigeria. Primary data were collected with structured questionnaire from one hundred and five catfish farmers selected from three Local Governments in Oyo State using multistage sampling. Frequency tables, percentages and means were used to present the socio economics profile of the respondent. Result showed that majority of the respondents were male (94.8%), with the mean age of 39 years, majority (83.3%) of the respondents were married with a mean household size of 5 persons. Also majority (67.8%) had tertiary education and an average of 8 years of farming experience, cost and return analysis of catfish production in the study area revealed average variable cost production as ₦ 1,979,017.98 with the cost of fish feed accounting for 72.21% of variable cost of production. The result also revealed that although several inputs were being used by the farmers. The resource use efficiency result indicates that quantity of fingerlings; fuel and labour used were underutilized. However, the findings show that amount of feed used was over utilized since the efficiency estimate for feed is less than one. The finding of this study implies that increasing the usage of fingerlings, fuel and labour would improve the efficiency of these inputs. The study therefore concludes that Catfish farmers in the study area should be encouraged by extension agents through technical training on production techniques or practices that will improve their productivity especially in those areas of inefficiency and underutilization of inputs.

Keywords: Catfish, efficiency, input, resource use, production, Nigeria

Introduction

Fish farming is the art and science of controlled rearing of fish in ponds, farms and in some instances natural water bodies from hatchlings (freshly hatched fishes) to mature sizes. It involves the controlled feeding, fertilization, stocking combination, reproduction and harvesting of fish (FAO, 2015). It has been established as the best alternative to bridging the gap between the demand for and supply of food fish in the country (Ugwumba and Okoh, 2010). Adewumi and Olaleye (2011) pointed out that *Clarias gariepinus* and *Clarias heterobranchusbidorsalis* are the most cultured fish in Nigeria. *Clarias gariepinus*is regarded as an excellent aquaculture species because it grows fast and feeds on a variety of agricultural by-products, it is hardy and can tolerate extreme temperature, easy to produce in captivity with high annual production and good feed conversion rate (Ikpozia *et al*., 2021)

Fish is of prime importance as it has remained a major source of protein which is rich in essential-amino acids for both rural and urban poor households among animal protein foods produced and consumed in Nigeria (Agbabiaka *et al*., 2012). Catfish production is important to the Nigerian economy. It serves as a source of income, reduces the rate of unemployment in the economy and increases the Gross Domestic Product (GDP) (Emokaro *et al.*, 2010). According to Olagunju *et al.* (2007), it requires less space, time, and money, and has a higher feed conversion rate. The demand for catfish in Nigeria is unprecedented so much that no matter the quantity supplied into the market, it would be consumed by ready buyers. This is so because of its low caloric value, low carbohydrate and high protein content, low fat, quick and easy to prepare, and above all, it tastes good.

One major challenge currently confronting Nigeria's agriculture is the problem of low productivity in production resulting from inefficient use of resources (Njoku, 2000). Several studies have shown that resources (such as land, water, nutrients, feed and energy) are not efficiently utilized by fish farmers in Nigeria (Adekoya and Miller 2004; Njoku PC, 2000; Nwuba and Onuoha, 2006). The efficient allocation of resources at the farm levels will lead to rise in gross national product (GNP) and per capital income. Scarcity of resources has led to production economists to think about the reallocation of existing resources to have more output with given level of input combinations or to produce a prescribed level of output with the minimum cost without changing the production technology (Anwarul-huq and Fatimah, 2010). Because of the economic importance of catfish in terms of income generation to farmers, there is a valid economic reason to boost its production and increase its level of contribution to the farmer's income. Nigeria, like many other developing countries suffers from protein deficiency compounded as a result of rapid population growth, low productivity in the agricultural sector, rural urban migration, and decline in productivity of the livestock sub-sector (Agbabiaka *et al*., 2012).

Nevertheless, in spite of this effort of Government, fish production has remained low in the country. This has been attributed to inadequate supplies from the fish farmers which may not be unconnected with low efficiency of resource use fish farming in Nigeria. The large dependence on imported fish, has adversely affected Nigeria economy; and mostly foreign reserves (Adekoya and Miller, 2004). Moreover, the rapid increase in population of the world has resulted in a huge increase in demand, for animal protein. To solve the country's high demand for fish, Nigeria must turn to maximize the available limited resources (e.g. inland water, land) to increase supply and to also considerably reduce the price of fish, making it available to the masses, thus reducing malnutrition. Ultimately, it is hoped that the study will help to bridge the gap between resources availability and efficient utilization in fish production in Oyo State. The study was aimed at achieving the following research objectives;

i) described the socio-economic characteristics of catfish farmers in the study area.

ii) determined cost and returns structure in catfish production in the study area.
iii) estimated the elasticity of factor and return to scale in catfish production in the study area.
iv) examined the resource use efficiency in catfish farming.

Materials and Methods

Description of the study area

The study was conducted in three Local Government Areas in Oyo State namely Ido, Akinyele and Oyo west Local Government Areas. The choices of these Local Governments were made because of the reasonable number of catfish famers in the areas. Oyo State is located in the South Western part of Nigeria. The State has a Latitude of 7.8526 and a Longitude of 3.9313. It is bounded on the South by Ogun State, on the North by Kwara State in the West it is partly bounded by Ogun State and partly by the Republic of Benin, while on the East by Osun State. Ido is a Local Government Area in Oyo State, Nigeria. It has an area of 986 km^2 and a population of 103,261 at the 2006 census. Oyo west local Government Area in Oyo State has an area of 526 km^2 and a population of 136,236 at the 2006 census. Akinyele Local Government Area in Oyo State was created in 1976. It occupies a land area of 464.892 km^2 with a population density of 516 persons/km^2. The 2010 estimated population for the local government is 239,745.

Data collection

For this study, data were collected from primary sources. The Primary data collection was through questionnaire administration to collect information such as socio-economic characteristics, costs, outputs, and profits by personal interview with the fish farmers. Multi staged sampling involving 3 stages were used to select 105 catfish farmers in Oyo State: Three Local Government Areas were purposively selected in Oyo State (Ido, Akinyele and Oyo west LGAs) the purposive selection in stage one was done based on high concentration of fish farmers in these LGAs. In stage two, one Fish farm settlement was selected in each of the Local Governments to make a total of 3 settlements. In stage three, 32 catfish farmers were randomly selected in each farm settlement to make a total of 96 Fish farmers.

Analytical technique

Descriptive statistics was used to describe the socio-economic characteristics of the catfish farmers. This involved the use of measures of central tendency such as mean, frequency distribution and percentages. Budgetary technique was used to determine the gross margin and profitability of catfish enterprises.

This involves the costs and returns analysis:

$$GM=TR-TVC \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$$TR=PQ \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where: GM =gross margin (in Naira); TR = total Revenue (in Naira); TVC = total variable costs (in Naira) of production; P = unit price of output (in Naira); Q = total quantity of output (kg)

Variable costs (VC) which were included in the analysis are expenditures on labour, feed, fingerlings, housing material, pond preparation, transportation, electricity, fuel, water, repair and maintenance, veterinary services and other costs. The estimation of resource use efficiency parameters were done using Cobb-Douglass production function:

$$\ln Q = b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 \quad \ldots\ldots\ldots\ldots(3)$$

Where: ln = logarithm to base; Q=output (kg); X_1= fingerlings (number); X_2 =feed (kg); X_3 = fuel (litres); X_4= labour (mandays)

Resource use efficiency analysis was used to examine the efficient use of input in catfish farming in the study area. In order to ascertain whether resources were efficiently utilized, the marginal value product (MVP) of fingerlings, fertilizer, feed, labour and drugs were computed and then compared with their input prices.Resource use efficiency was determined using the following:

$$r = MVP/MFC \quad \ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Where: r = efficiency ratio; MFC= marginal factor cost (market price of each input); MVP = Marginal value product; $MVP = MPP_{Xi}.P_y$

$$MPP_{Xi} = b * \frac{\bar{y}}{\bar{x}}$$

The decision criteria were as follow:
r =1, resource is efficiently utilized; r >1, resource is under-utilized; r<1, resource is over-utilized

Result and Discussion

Socio-economic characteristics of catfish farmers in the study area

The socioeconomic characteristics of catfish farmers are presented in Table 1. The study revealed that 45.8% of the catfish farmers were within the age range of 31-40 years with mean age of 39 years. This implied that, more than one-third of the catfish farmers are still strong and active and they can participate actively in farming activities. The age distribution is expected to have positive influence on the respondent's participation in catfish production, which invariably means better efficiency in production. This result is also in line with the findings of Obeta and Nwabo (1999) which observed that youth constitute the majority of the farmers, and younger farmers are more flexible to new ideas and risk; hence they are expected to adopt innovations more readily than older farmers. Also, 94.8% of the catfish farmers were male and 5.2% were female. This implied that more men were engaged in catfish production than women in the study area. This may be attributed to the fact that women are more involved in processing and marketing. Hence, if more women are encouraged to go into the production of catfish, output of catfish will increase by an appreciable amount. The result further revealed that 67.8% of catfish farmers had tertiary education, while 26% of them had secondary education. This indicated that the farmers' educational level is high. This finding is at variance with Amaza (2000), education has a positive and significant impact on farmers" efficiency in production. Thus, literacy level will greatly influence the decision making and adoption of innovation by farmers, which may bring about increase in productivity.

Furthermore, 56.3% of the farmers had household size that ranged from 2-5 persons with an average household size of 4 persons per family. The process of gaining knowledge and skills is termed experience. It is a measure of the period an individual farmer was involved in catfish production. The more numbers of years of production by catfish farmers, the more knowledge and skills gained. Farming experience is another important socio-economic factor that can bring about increase in productivity. The result showed that the mean years of experience is 8 years which implied that catfish farmers in the study area had vast experience in their production.

Table 1: Distribution of catfish farmers by socioeconomic characteristics

Characteristics	Frequency	Percentage
Age of farmers		
< 30	18	18.8
31-40	44	45.8
41-50	23	24.0
51-60	5	5.2
Above 60	6	6.3
Mean	39	
Gender		
Male	91	94.8
Female	5	5.2
Education Level		
No formal education	5	5.2
Primary	1	1.0
Secondary	25	26.0
Tertiary	65	67.8
Household size		
<2	20	20.8
2-5	54	56.3
5-10	22	22.9
Mean	4	
Years of Farming experience		
1-5	42	43.8
6-10	32	33.3
11-15	13	13.5
16-20	5	5.2
>20	4	4.2
Mean	8.06	

Source: Field survey, 2017

Table 2: Cost and returns of catfish production

Parameter	Inputs	Amount (₦)	%
VC	Fingerlings	112,494.85	5.68
	Feed	1,428,996.80	72.21
	Pond preparation	237,972.00	12.02
	Housing material	12,345.38	0.62
	Labour	92,659.79	4.68
	Water	11,625.00	0.59
	Veterinary services	11,416.25	0.58
	Electricity	22,632.14	1.14
	Repair and maintenance	10,518.18	0.53
	Transportation	9,619.59	0.49
	Fuel	17,700.00	0.90
	Other costs	11,038.46	0.56
TVC		1,979,017.98	100
TR		3,324,668.04	
Gross Margin		1,345,650.06	

VC = Variable costs**; TVC** = Total variable cost; **TR** = Total revenue

Source: Field survey, 2017

Table 3: Estimated Cobb-Douglas Production Function for Catfish Farmers.

Parameter	Coefficient	Standard Error	T
Stock Size (X_1)	0.24^{***}	0.07	3.39
Fuel (X_2)	0.12^{***}	0.04	2.70
Labour (X_3)	0.36^{**}	0.15	2.36
Feed(X_4)	0.16^{**}	0.08	2.07
Constant	3.04^{***}	0.76	3.99

Source: Field survey, 2017

Costs and returns of catfish production

The result in Table 2 showed the costs and returns of catfish farming during the 2017 production season in the study area. The total cost of variable inputs used (feed, fingerlings, pond preparation, housing materials, labour, water, veterinary services, electricity, repair and maintenance, transportation, fuel and other costs) were estimated to be ₦1,979,017.98. The total revenue generated was ₦3,324,668.04. The Gross margin (difference between total revenue and total variable cost of production) was ₦1,345,650.06. This showed that catfish production is a profitable enterprise in the study area.

Resource use efficiency in catfish production

Resource use efficiency analysis was used to ascertain whether resources were efficiently utilized. This was achieved by computing the marginal value product (MVP) of fingerlings, fertilizer, feed, labour and fuel and then compared them with their input prices. The results are presented in Tables 4 and 5. MVP is the marginal value product, MFC is the marginal factor cost (cost of the one unit of inputs used) r represents the efficiency ratio. r = 1 implies efficient use of resources, r > 1 implies under-utilization of the resources; while r < 1 implies over utilization of the resources. From the Tables 4 and 5, the r (efficiency ratio) of fingerlings; fuel and labour are greater than 1 while feed has r less than 1. The result indicated that quantity of fingerlings, fuel and labour used were underutilized. However, the findings showed that amount of feed used was over utilized since the efficiency estimate for feed is less than one. The finding of this study implied that increasing the usage of fingerlings, fuel and labour would improve the efficiency of these inputs.

Table 4: Marginal physical product (MPP) and Marginal value product (MVP) used in catfish production

Input	MPP	MVP
Fingerlings	0.1972	124.099
Fuel	2.3999	1510.281
Labour	7.056	4440.411
Feed	0.126	79.356

Source: Field survey, 2017

Table 5: Resource use efficiency in catfish production in the study area

Input	MVP	MFC (₦)	r = (MVP/ MFC)	Decision
Fingerlings	124.099	17.79	6.976	Under utilized
Fuel	1510.281	145	10.416	Under utilized
Labour	4440.411	610.54	7.273	Under utilized
Feed	79.356	220	0.361	Over utilized

Source: Field survey, 2017

Table 6: Elasticities of production of inputs and returns to scale in catfish production

Variable	Production Elasticities
Fingerlings	0.24
Fuel	0.12
Labour	0.36
Feed	0.16
Return to Scale	0.89

Source: Field survey, 2017

Elasticity of production and returns to scale in catfish production

The results presented in Table 6 showed the elasticities of production of the inputs used in catfish production. The estimated input elasticity of production for fingerlings, fuel, labour and feed are less than one, indicating that output of

catfish grows less than proportionately with any increase in these inputs. The returns-to-scale estimate (0.89) obtained from the summation of the coefficients of the estimated input elasticities is less than one (0.89), indicating decreasing returns to scale. This means that output increases less than proportionately with any increase in inputs. This showed that if all the inputs included in the production function model are increased equally by 1 percent, catfish output will increase by a lesser amount of 0.89 percent.

Conclusion

Catfish production was found to be a profitable enterprise in the study area because it recorded a gross margin of ₦1,345,650.06. The result of this study revealed that resources were not efficiently used by the catfish farmers in the study area. Feed was over-utilized (0.36) while Labour, fingerlings, and fuel were under-utilized (7.27, 6.98 and 10.42, respectively). Since catfish production in the study area has been shown to be very profitable and has huge potential for income generation, it is recommended that farmers should go into catfish production to make more income. In addition, Feed was found to be the variable that accounted for the highest cost of production and it was over-utilized. Attempt at reducing feed cost will lead to greater Net farm income and subsequently the overall profitability of the enterprise. Catfish farmers should be encouraged by extension agents through technical training on production techniques or practices that will improve their productivity especially in those areas of inefficiency and underutilization of inputs.

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