ECONOMIC ANALYSIS OF FISH FARMING IN BEHERA GOVERNORATE OF EGYPT

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Abstract

This paper examines the economic analysis of fish farming in Behera Governorate of Egypt. Sample survey of 15 farmers representing the fish farming community in the area was used. The study was conducted from May 2004 to July 2005 covering one production season. The study result revealed that the average age of fish operators was 43 years, majority are married (62.5%), fairly level of education (80%) and majority with rented land ownership (93.3%) and tilapia represented over 85% of total fish harvested. High prices of fish feed; declining fish prices and lack of finance were found out to be the top ranking serious constraints facing fish farmers in that area. Feed costs per kg of fish were LE 3.87, representing 58.9% of the production costs. The break-even analysis showed average production costs of LE 6.57 per kilogram of fish while the sales price is LE 7.5 /kg. The analysis of the rate of returns on operational costs revealed an average of 19 % in the production season. Correlation matrix showed that there is high positive relationship between the level of income generated and feed costs, other costs, quantity of fish seeds, cost of fuel, cost of extra labor, permanent staff salary and cost of transportation except cost of fertilizer. Results from the exponential production function model which gave the better fit also revealed that quantity of fish seeds is a notable and significant factors ($P<0.01$) contributing to the fish farming enterprise in the study area. The study therefore suggests that there is need for the establishment of producers' union or association that will assist the fish farmers to increase the availability of commercial inputs, improved marketing distribution channels, creation of conductive environment for fish farming sustainability through credit facilities and public enlightenment program on investment in fish farming activities in the study area.

Keywords*: Behera, economic indicators, Production function, Correlation matrix, Exponential model, Productivity.*

INTRODUCTION

Egypt's fishery sector has been a vital part of the national culture and economy since recorded time. With rich water bodies, lakes, rivers, coastal lagoons and open sea, catches of fish, and increasingly their culture, has been a key ingredient in national food supply and potential export earnings. Most remarkably, in the face of continued population growth and increasing resource pressures, Egypt has managed to increase its domestically produced per capita supply. This is largely due to the substantial growth of aquaculture, at 445,000mt amounting to more then 51% of national production in 2003 (GE/WFC, 2005).

Egypt faces significant challenges in fisheries, with increasing limits to wild catches, constraints to further growth in aquaculture, and challenges in developing value and meeting needs of low income consumers. With rising global demand, imports will be more difficult to source, and Egypt's future needs will have to be met by domestic production. There is generally very limited scope for increasing production from capture fisheries, and the required growth in production will need to come mainly through aquaculture which it is projected will need to double in size over the next 10-15 years if current per capita consumption of fish is to be sustained. Stimulated by such demands, aquaculture has seen remarkable growth, with production increasing from 35,000t in 1992 to 445,000t in 2003, an annual average growth rate of 26%. Valued at some $ 0.5bn at first sale, this represents more than 51% of the national fisheries production, compared with just 17% in 1992 (GE/WFC, 2005).

According to Sadek *et al.,* (2006), seven finfish (tilapia, Mullet spp, Carp spp., Catfish; Bayad; Sea bream and sea bass, besides three crustacean species; *Macrobrachium rosenbergii*, *Paneus semisulcatus* and *P. japonicus*) are playing an important role in the aquaculture production. Aquaculture sector employs about 164,000 people, representing 3.07 percent of employment in agriculture and additional 20,000 people in supporting services and industries (Shehadeh, and Feidi, 1996).

Fisheries (and aquaculture) in Egypt is an important component of the agricultural sector and a significant source of animal protein. Fisheries contribution to agriculture production was 7.34% of agricultural production and 20.9 % of total livestock and poultry production by value in 2002 (MoALR, 2002).

Fish Consumption: Fish is a component of the traditional Egyptian diet and a source of animal protein. Per caput consumption from local production has increased from 7 to 12.4 kg indicating an increased production in the sector, with particular reference to the year under review. Fisheries imports estimated records showed that the gab between market demand and fisheries production increased from 121,925 mt 1995 to 221,000 mt in 2004. Therefore, per caput consumption from local fishery production and imports increased from 9.1 to 15.6 kg respectively (see annexure1).

Production and production areas: Egypt has the earliest recorded history of fish-farming in Africa, superseding even carp culture in the Far East. In 1994, it accounted for about 48% (by quantity) of total aquaculture production from Africa (FAO, 1996). Aquaculture production showed a remarkable increase during the last 10 years with more than 7 folds from 61,706 mt in 1995 to reach 471,534 mt in year 2004 (see annexure 2

Annexure 1: Average per capita fish consumption Kg/year from 1995 to 2004, (derived from GAFRD, 2004)

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Annexure 2: Fisheries versus aquaculture production from 1995 - 2004

(derived from GAFRD 2004)

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The Egyptian aquaculture activities are more concentrated in sub-regions of the Nile delta, where the water resources are available and non-agricultural lands. The total area under pond culture in 1995, excluding illegal enclosures in coastal lakes, was about 160,066 feddans (67,228 ha). Private farms accounted for 89% while government farms accounted for the remaining 11%. About 69% of total pond area consisted of unlicensed farms. While in 2004 land used for aquaculture was 207,507 feddans (81,153 ha). State owned farm area size represents 8.2% and, private farms represent 91.8%. Unlicensed fish farms represent 44.5% of total land used for fish farming in the same year (GAFRD 1995:2004).

Production systems and practices: The systems have been described in detail by Balarin (1986) and (Sadek 1984, and Sadek *et al*., 2006). Extensive and semi-intensive production systems are the most dominant forms of fish farming in the country. Level of nutritional inputs varied from use of only fertilizers to use of high quality extruded feed according to production system practiced in the farm. Records show that contribution of fish farming production was only 14% in 1994 and increased to 54% in 2004. Moreso, from the actual major culture systems, earthen ponds production rank in the first with 85% of the aquaculture production, while cage culture follow by 10.7%, common carp paddy filled come next with 3.8% of the total and at lastly 0.5% for tilapia intensive culture production in tanks. The private sector is producing 98.5 % of the total aquaculture production, and the public sector contributes only with 1.5%. Meanwhile, the public sector is contributing more with the fry and fingerlings, extension support, artificial feeds and research support.

The technical efficiency is defined as the maximum output a producer can be attained, given some level of inputs and some set of available technologies. Allocative efficiency refers to the adjustment of inputs and outputs as a consequence of relative price changes. It shows the ability of the producer to combine inputs and outputs in optimal proportions given prevailing prices. Therefore, economic efficiency is a situation in which technical and allocative efficiency are combined (Battesse and Coelli, 1995).

This study aimed to examine the factors influencing the fish farming enterprise in Behera with a view to finding out what are the socio-economic characteristics of the farmers, identify, and determine various performance indicators of economic viability or profitability, correlation between the production variables and the total revenue, factors influencing profitability, and identifying problems militating against the fish farmers in the study area.

Area of Study

The area of study is Behera. It is one of the 26 Governorates (provinces) located in the north delta of Egypt. The population of the area is about 6.7 million with a total area of 10129.48 km2. Edku Lake is located in northern part of the province. Many people live on fishing from the lake and fish farming is very prominent. Majority of those farms are distributed around the lake. One of the main freshwater supplies to the lake is Khairy drainage canal and represents the main irrigation source for the majority of the fish farmers in Behera, http://ecb.jrc.it/natprof/egypt/newpage1.htm.

According to GAFRD, (2004), the sizes of fish farms which are located around Edku Lake in Behera are 13950 feddans (5859 ha). State farms are 2102, private owned farms are 2659, and leased farms from GAFRD are 9189 feddans. Behera fish farms produce 63191 tons during the period representing 13.4% of total fish production in Egypt.

Fish farms are scattered around the lake in nine geographical locations. For ease of access to farms, the World Fish Center focused on farmers in four different locations namely; El-Khairy, Koum Belag, El-Garf and Kuwm Hassan with different category of farm sizes (feddan).

Figure 1: Map of Behera showing the study area represented with *'Black dot'*

RESEARCH METHODOLOGY

This research was based on cross sectional input and output data among the 15 fish farmers representing the fish community in Behera, Egypt. The survey interviews were conducted as part of efforts at getting information on the rate of 'dwindling' in fish farming operations in the study area. The study continued for one production season, started in May 2004 and ended up in July 2005. Twenty farms were selected based on stratified random sampling from four different locations, with respect to location and farm sizes. The study ended up with data from 15 farms. Five farms were dropped during the study due to a decline in giving data and difficulty in accessing the farms.

The data collected included: socio-economic characteristics (age, gender, marital status, educational level etc), production costs; cost of feed, cost of fish seed, other costs (maintenance, fertilizer, fuel, transport etc) and output data per the period under review.

Source of Data: This was sourced through the administration of structured questionnaire to the farmers and a constant monthly visit to be able to get facts and figures on the input and output data.

Secondary Source: This was sourced through journals, bulletins and past literature.

Analytical Techniques:

(1)**Descriptive statistics**: This involves the use of mean, frequency and percentages, bar chart, to identify:

(a) **Socio-economic characteristics** of the respondents in the study area vis-a viz: the age, educational level, farm size etc. and the problems militating against the fish farming in the area.

(b) **Economic indicators:** This involves identifying and determining the performance of the farmers with respect to efficiency in the usage of resources like farm land, quantity of fish produced, net revenue per feddan, feed cost per kg, break-even prices, break-even production and rate of returns on operational costs (Green, et al, 2002).

(2) **Correlation matrix:** This was also used to determine the relationship between the total income, feed cost, other costs, quantity of fish produced, cost of fertilizer, cost of fuel, cost of extra labor, permanent staff salary, and cost of transportation respectively (Olayemi, J.K, 1998).

(3) **Production function model**: This was used to determine the factors influencing the productivity of fish farming in the study area: The model as adopted by (Ahmed, et al, 1996 and Olayemi, J.K, 1998) is specified below:

$Yi = f(xi;\beta i)$……..implicit function (eqn1)

$Yi = \beta o + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \mu$…..explicit function (eqn2)

Thus, it can be written as:

$LnTINC = \beta o + \beta 1FCOST + \beta 2OCOST + \beta 3QFISH + \beta 4FSIZE + \beta 5AGE + \beta 6FQUALI + \beta 7PSYS + \mu$ ……exponential form (eqn3)

$LnTINC = \beta o + \beta 1lnFCOST + \beta 2lnOCOST + \beta 3lnQFISH + \beta 4lnFSIZE + \beta 5lnAGE + \beta 6lnFQUALI + \beta 7lnPSYS + \mu$ ……double log……. (eqn4)

Where:

βo…..$\beta 7$= production function parameters to be estimated

TINC= Total income (LE/production period)

FCOST=Feed costs (Kg/production period)

OCOST= Other costs (LE/production period)

QFISH=Quantity of fish (kg/production period)

FSIZE =Farm size (feddan/production period)

AGE= Age of farmers (years)

FQUALI= Farmers educational qualification (level)

PSYS=Production systems adopted

Ln= natural logarithm

μ= random error

However, two functional forms (double log and exponential model) were estimated and the one that meets the econometric and statistical criteria (positive parameters, number of significant parameters, F-value and Adjusted R2 value) was chosen as the better fit.

RESULTS AND DISCUSSIONS

Socio-economic characteristics

Results of Tables 1 shows that majority (46.7%) of the fish farmers fall within the age range (21-40) and (41-60) years respectively. Thus, the average age is 43 years. The implication of this is that, most farmers are still in their active age and therefore, there is tendency for more productivity in fish farming in the study area.

It also revealed that the average size of the farm among the farmers is 23 feddans. Meanwhile, majority of the fish farmers farm sizes fall within 11-20 feddans (62.5%) and the least farm sizes are 1-10feddans and 61-70 feddans (6.7%) respectively. The average size therefore suggests good economic returns to the farmers if efficiently used.

Furthermore, Table 1 indicates that tilapia and mullet form the major species combination (68.8%) of the farmers in the study area. This informs the most preferable fish species of the consumers in the area. The job status of the majority of (66.7%) is mainly farming while other jobs categories are engineering, trading, etc with (6.7%). The majority being farmers will no doubt bring more concentration to the fish farming systems in the study area as a way of enhancing fish farming productivity. Table also shows that majority (40.0%) of the fish farmers are between no schooling and medium schooling. These results might smell danger to the adoption of new technology/innovation by the farmers thereby reducing the expected productivity of fish farming in the area.

The results from table revealed that most farmers are married. The implication is that this figure is expected to enhance the use of more family labor in the fish farming operations thereby leading to reduction in the use of hired labor among in the study area. It also revealed that most farm managers (86.7%) are not specialists in fishery management. There is no doubt that this percentage (86.7%) might translate to imminent doom to fish farming sustainability in the study area. This figure might also not be unconnected to the level of education of the fish farmers which fall between no school and medium schooling.

The table indicates that majority of the farmers 93.3 percent in the study area rented the land from government (GAFRD) for their fish farming activities. This implication of this is that it might have impact on the level of efficiency and the level of dedication to farm profitability based on the fear of uncertainty by the government policy on the usage of the land vis-a vis, revocation, review of land rent fee, tax imposition etc on the rented land.

Moreso, majority with (50%) got credit facilities to finance their farming operations while some with (31.3%) used self finance and credit facilities. The availability of credit facility to farmers is expected to boost fish productivity if it is utilized judiciously.

The table also indicates the number of dependents on the fish farmers in the study area. It revealed that majority of the fish farmers number of dependents with the highest proportion (68.8%) is 1-20 members. This result implies that even though, the lowest range has the highest value, it is still an indication that the use of family labor would be used intensively. Therefore, if serious commitment is shown from the family labor, it is expected to lead to higher productivity in fish farming in the area. The large family size recorded in the area is to further show case that majority are married.

Table 1. Socio-economic characteristics of the respondents

Parameters	Range / Classification	Frequency	Percent (%)	Cumulative percentage
Age of respondents	21-40	7	43.7	46.7
	41-60	7	43.7	93.3
	61-80	1	6.7	100.0
	Total	**15**	**100.00**	
	Mean ± SD 42.67 ± 13.793			
Farm Size (feddan)	1-10	1	6.7	6.7
	11-20	10	66.7	73.3
	21-30	1	6.7	80.0
	51-60	2	13.3	93.3
	61-70	1	6.7	100.0
	Total	**15**	**100.0**	
	Mean ± SD 23.53 ± 18.5082			
Species combination	Tilapia only	2	13.3	13.3
	Tilapia & Mullet	11	73.3	86.7
	Tilapia, Mullet& Others.	2	13.3	100.0
	Total	**15**	**100**	
Job Status	Farmer	10	66.7	66.7
	Engineer	1	6.7	73.3
	Trader	1	6.7	80.0
	Householder	1	6.7	86.7
	Employer	1	6.7	93.3
	Accountant	1	6.7	100.0
	Total	**15**	**100**	
Qualification	No schooling	6	40	40
	Medium schooling	6	40	80
	High school	3	20	100.0
	Total	**15**	**100**	
Marital status	Single	1	6.7	6.7
	Married	14	93.3	100.0
	Total	**15**	**100**	**100.0**
Farm managers skill	Not specialist	13	86.7	86.7
	Specialist	2	100.0	100
	15	**100.0**		**15**
Land ownership	Rented	14	93.3	93.3
	Owned	1	6.7	100.0
	Total	**15**	**100**	
Source of finance	Self finance	2	13.3	13.3
	Access to credit	8	53.3	66.7
	Self finance & credit	5	33.3	100.0
Number of Dependents	1-20	11	73.3	73.3
	21-40	2	13.3	86.7
	41-40	1	6.7	93.3
	81-100	1	6.7	100.0
	Total	**15**	**100**	

Figure 2: shows the ranking of problems militating against the fish productivity in the study area. Among the listed problems, feed prices were considered the most serious problem indicated with the highest frequency, followed by the declining fish price, Lack of finance, fluctuation. Others are; fish price fluctuation, government legislation, fish fry prices, high taxes, reliable and quality fish fry, availability of skilled labor among others. (e.g contingencies) respectively. This research findings from the study area is also supported by the results reported by Othman and Sadek (2004) which found out that fish feed prices continued to rise on the yearly basis from LE 800 per ton in 1992 to LE 1800 in 2003 and the attendance dwindling in the prices of tilapia from 1995 to 2002. Moreso, Izzat (2004) also reported in his findings the fluctuation in tilapia fish prices and that the instability was a function of seasonality changes. This fact also corroborates the findings from the present study in the study area.

Figure 2: problems of fish farmers by ranking in study area (year 2004 - 2005)

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Figure 3 explicitly describe the trend of distribution of the break-even prices of individual fish farmers with respect to costs of production and output sales. It thus depicts a farmer running a business above the least costs as well as profit below the optimum level with a given level of technology. The implication of this is to give an idea of the particular enterprise that is deviating from the normal optimal level of least costs and profit level and such farm is expected to shut down a business or dis-continue from a business. This also elucidates the concept of economic theory which postulates that a firm is expected to shut down when it fails to meet the total variable costs of production. In case of farm No. 8, level of input was similar to other farms but output was very poor, thus reflected on break-even prices.

Figure 3: Distribution of farmers by break-even prices LE/kg (production costs and output sales)

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Table 2 shows the average summary of performance indicators of fish farmers selected for the study in Behera Governorate during the production season. The results revealed that an average farmer incurred a total sum of LE 16051 as operational costs (OC) per feddan. An average quantity of fish produced in kilogram is about 2635 per feddan and the average fish sales value (revenue) of LE 18869 was realized per feddan. The same scenario holds for Net profit per an average fish farm estimated to be LE 2819 /feddan. It further shows the analysis of costs involved in producing a market weight of fish to be LE 6.6 /kg and the expected price for fish to be sold for a maximum profit to be made as LE 7.5 /kg. The average rate of returns to variable costs of 19% was realized, which is an indication that the fish farming is profitable and worthwhile in the study area thereby confirms the economic viability of the enterprise.

However, despite the average profitability of the fish farmers, the table still identifies a non-performing farm with respect to the performance indicators enumerated. For example, a farm No.8, showed a negative net profit per feddan and negative rate of returns to variable costs among others though, could be attributed to bad management systems which resulted into high morbidity/mortality and therefore lead to high production cost. Therefore, the table serves as a bench mark and caution to farmers on when and how to cut down the usage of variable inputs in the production process.

Table 2. Summary performance indicator of fish farm selected for the study in Behera Governorate during production season 2004-2005.

Farm Number	1	2**	3	4	5	6	7	8	9	10	11	12	13	14	15**	Mean
Farm Size (Fed)	11	13	20	26	13	7	14	14	57	64	16	11	14	20	53	23.5
Operational costs per fed (LE)	22992	20000	14095	20857	29743	15063	16296	15810	16524	13818	12175	9654	8822	10581	13954	16026
Fish yield Kg/Fed	3766	3808	2650	3203	5306	2456	2622	980	2607	2293	2531	1586	1443	1570	2709	2635
Sales revenue per fed (LE)*	25702	29612	17575	24579	34553	18789	18139	5651	18628	16948	16674	12313	12182	11687	20007	18869
Net Profit LE/Fed/Year	2710	9612	3480	3722	4810	3726	1843	-10159	2104	3130	4499	2659	3361	1106	6052	2844
Feed cost LE/Kg	4.04	3.54	3.21	4.72	4.24	3.28	3.71	10.97	4.33	3.65	1.91	2.76	2.77	2.93	2.03	3.87
Breakeven price (LE)	6.11	5.25	5.32	6.51	5.61	6.13	6.21	16.13	6.34	6.03	4.81	6.09	6.11	6.74	5.15	6.57
Average Sales Prices (LE/Kg)	7.18	7.27	6.98	8.08	7.00	8.22	7.44	6.20	7.68	7.78	7.01	8.44	8.44	8.00	6.78	7.50
Breakeven production Kg/Fed/Year	3200	2750	2019	2582	4247	1831	2191	2551	2151	1776	1737	1144	1045	1322	2057	2174
Rate of return on operation cost	12%	48%	25%	18%	16%	25%	11%	-64%	13%	23%	37%	28%	38%	10%	43%	19%

* Sales revenue = (Fish sales + fingerlings sales) – sales commission

** Farm revenue include fingerlings sales,

1 feddan=4200m^2, 2.38feddan=1hectare (10,000m^2)

1USD=5.75 EGP (LE) (Egyptian pound)

Correlation Matrix

Table 3 of correlation matrix revealed that there is high positive correlation between feed costs, other costs and quantity of fish seeds, cost of fuel, cost of extra labor, staff salary and cost of transportation and level of income with 0.89, 0.86, 0.99, 0.89, 0.88, 0.94, and 0.81 respectively and the correlations are all significant at 0.01 level ($P<0.01$) and the cost of fertilizer is only significant at $P<0.05$ level but is relatively positive correlated with the level of income. This figure tends to show the relative relationship of each of these variables to the level of income level. The implication of this is to assist the farmers in the farm budget planning and expunge any variable that does not have any bearing to the level of income generation potential of an enterprise.

Table 3. Correlation matrix of total income level and other operational costs

	Tincome	Fcost	ocost	Qfish	Cfert	cfuel	cextlabor	pstfsalar	ctransp
Tincome	1								
Fcost	0.89**	1							
ocost	0.869**	0.828**	1						
Qfish	0.998**	0.898**	0.877**	1					
cfert	0.517*	0.123	0.353	0.506	1				
cfuel	0.891**	0.712**	0.745**	0.893**	0.741**	1			
cextlabor	0.885**	0.84**	0.817**	0.866**	0.298	0.694**	1		
pstfsalar	0.941**	0.824**	0.897**	0.944**	0.59**	0.915**	0.747**	1	
ctransp	0.817**	0.779**	0.733**	0.827**	0.387	0.693**	0.594**	0.879**	1

*** correlation is significant at the 0.01 level (2 tailed)*

** correlation is significant at the 0.05 level (2 tailed)*

Source: Field Survey, 2005

Note: Tincome=total income, Fcost=feed cost, Ocost=other costs, Qfish=quantity of fish produced, cfuel=cost of fuel, cextlabor=cost of extra labour, pstsalar=permanent staff salary, ctransp=cost of miscellaneous transportation

Production Function Model

The results of exponential production function models (table 4) estimate showed four parameters to be positive compare to double log with three parameters. The table revealed that only constant term and quantity of fish seeds are significant factors contributing to fish farming enterprise in Behera with 1 percent and 5 –percent levels of significant respectively. These show that a unit increase in these variables will lead to a percentage increase in the dependent variable (Income level) assuming all other factors are held constant. For example, a unit increase in quantity of fish seeds will lead to 4.643 x 10-5 percent increase in total income. These findings give an insight into would-be investors in fish farming in the area even though; fish seeds are an indispensable variable resource in fish farming enterprise. Moreso, parameter estimated like quantity of fish, farm size and age of respondents were found to be positive indicating a positive increase with a unit increase in the factors, though not significant at any probability level. This fact also supports the findings of Ahmed et al. (1996) which concluded that stocking density and pond size are the factors that significantly influenced tilapia output in small water bodies in Bangladesh.

Meanwhile, the adjusted R2 of about 97 percent implies that 97 percent of the total variation in dependent variable (endogenous variable) is being explained by the explanatory variables. Similarly, the F-value of 30.814 being significant is also an indication that the model has a good fit to justify the factors influencing the fish farming operations in the study area. The values of the parameter estimates of the exponential equation showed an elasticity of production. The summation of the parameter estimates ($\beta 1 + \beta 2 + \ldots\ldots\ldots\beta 7$) gives a value of -0.07860598 (-7.2 x 10-2) indicating that farmers are operating in stage III of production frontier. This result therefore suggests the need to reduce the quantity of variable inputs being employed in the production process in order to be operating at stage II which is the economic and rational stage, according to economic theory postulation. However, this result might not be unconnected to the problem encountered with the farm number eight as indicated in the table of performance indicators of fish farms.

Table 4. Estimated production function and output per average of 23 feddans per production period

Functional form-Exponential model	Constant	Fcost	Ocost	Qfish	Fsize	Age	Fquali	Psys
Estimated parameters	11.822**	-4.55E-06	-7.828E-06	4.643E-05	7.252E-03	5.607E-03	-3.495E-02	-5.649E-02
T-ratio	(19.847)	(-1.998)	(-2.122)	(4.286)**	(.415)	(.723)	(-.352)	(-.521)
R^2	96.9%							
Adjusted R^2	93.7%							
F-value	30.814**							
Functional form-double-log	Constant	Fcost	Ocost	Qfish	Fsize	Age	Fquali	Psys
Estimated parameters	5.467	-0.199	-0.380	1.248	0.332	-5.833E-02	-7.376E-02	-7.291E-02
T-ratio	(3.217)	(-1.693)	(-1.864)	(10.035)**	(1.899)	(-.418)	(-.916)	(-.811)
R^2	99.4%							
Adjusted R^2	98.7%							
F-value	154.595**							

Source: Field Survey, 2005
*** significant at 1-percent ,* significant at 5-percent*
Feddan=4200m^2 , 2.38feddan=1ha.
Other costs-(payment for land rentage, fuel, electricity,etc)

CONCLUSION AND RECOMMENDATIONS

This study therefore concluded that, despite problems and challenges militating against farmers, the fish farm business is still economically viable and attractive to who so wish to invest in the area with particular reference to an average rate of returns on operational cost found to be 18 percent .

Also, the study revealed that the average age of farmers in the study area was 43 years, fairly educated; majority are married and most of the land used for fish farm activities in the area were rented from GAFRD. Feed prices were ranked the most serious problems militating against the fish farming enterprise in the study area, followed by lack of finance resources. There is high positive correlation between the feed costs, other costs, quantity of fish seeds, cost of fuel, labor, cost of transportation and income level being generated by farmers. Similarly, quantity of fish seeds was found to be a very strong factor influencing the productivity of fish farming in the study area.

The research policy thrust is to advise the government to encourage extension services so that new techniques would be adopted in the area. There is also a need for government to subsidize some of the commercial inputs and encourage the establishment of producers' union that will assist the

farmers to purchase inputs in bulk and increase the availability of inputs to farmers and improved marketing distribution channels. Other areas of concern are creation of enlightenment on the establishment of fish farms with conducive environment and technical support facilities. These among others are recommended in order to meet the protein dietary demand of the teeming population bearing in mind that fish is the cheapest source of animal protein readily available to the populace.

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