

Economic Analysis of Per Acre Carp Fish Farm Production in Khyber Pakhtunkhwa, Pakistan

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Abstract

The research conducted on Economic analysis of Carp Fish Farming in the selected Districts of KP. The prime aim of research was to investigate average cost and revenue of a per unit fish farm and to observe the sensitivity of output to the key factors of production. To analyze the Marginal impact of the inputs, Multiple Linear Regression model was used. A sample of 60 fish farms were selected and the operators/owners were interviewed by using the lottery method from four districts i.e. Dera Ismail Khan, Kohat, Swabi and Mardan. The whole sample is further categorized according to the area occupied by fish farm in small, Medium and Large farms. The study revealed that the sensitivity of output to Farm area was 3.76 on all farms, which was quite more than output sensitivity to Number of Fingerlings and capital (i.e. 0.92 and 1.92), Capital also comprises the charges of fingerlings bought. The study revealed that farm area is an important determinant and can play key role in boosting the fish production. During the whole study it was observed that Per acre one time investment required for carp fish farm is Rs. 1,24,000/-, while average per unit operating cost is Rs.38,000/- whereas the average annual return is Rs.1,10,370/- The study concluded that this enterprise is financially beneficial business which gives per year profit of Rs. 72,370/- and plays a crucial role in earning a respectable livelihood, fulfilling the basic needs at low cost and eradicating poverty by job creation in particular and of KP in general.

Keywords: Carp fish, Per Unit Fixed Cost, Operating Cost, Revenue, Profit, Marginal Analysis etc.

1. Introduction

Aquaculture is one of the highest emergent industries in food fabrication. The share of fish production is increasing in provision of nutrition, employment, and increase in income of the farmers, export, foreign reserves and economic stability in the long run (Yung C. Shang 1986). Pakistan is gifted with a widespread system of fisheries resources; Coastline of 1100 km along the Arabian Sea supports a large variety of fish species with economic value and food supplements. Pakistan fisheries are classified in to three groups; that is, Marine, Inland and fish farms. Pakistan marine fisheries contributes about 70% of the total fish output, share of inland fisheries is 22 percent while 8 percent of the total is contributed by the fish farms (N.N Mamon, 2011). Pakistan is an agriculture based country where agriculture plays a key role in the economy. Agriculture not only fulfills food and nutrition requirements but also a source of income for fish farmers (H. Sarfraz, T. Nazia, I. Javaid 2005). These are the major contributors to the Gross National Product (GNP) in Pakistan. Because of rapid increase in population and demand for food, it is utmost important to study the profitability of this industry. This research study will primarily focus with the intention to seek following objectives:

- To identify the Key determinants influencing the productivity of Farmed fish;
- To know the contribution of different species in total revenue of per acre fish farm;
- To explore the per acre net profit earned by the farm operators;
- To observe the sensitivity of output of fish and to validate the marginal impact of key factors with the help of multiple linear Regression model;

This study will not only support the researchers in further research in the area of carp fish farming but it also permits the reader to be updated with per acre fixed cost (cost of land, digging of pond, construction of room, purchase of fish catching material etc.), variable cost (feed, manure, fries, etc.) and the profitability of a fish farm and it will stimulate the farm owners to contribute in the expansion of fish farming sector.

2. Literature Review

The cost items contain fixed cost (rent of land, payment to staff, rate of decline in the value of assets, imputed value

of land, construction cost. material cost etc.) and variable costs Includes cost of fries, feed cost, labour cost, water charges etc. The profit shows the efficiency of any business. Profit is obtained by subtracting total cost from the total revenue. It was concluded that Fish farming is a profitable business and much can be obtained if the investor have the knowledge about the primary investment required for starting this business and the expected return (Extension Bulletin 2000). Young (1986) Profitable production of fish is actually motivated by the profit which is the difference between revenue and cost. Cost of production primarily based on the use of fish farming technology & the inputs used during the process whereas the revenue depends upon the total output and price of the fish. To evaluate the acceptability of fish farming business, cost (required for the construction of Fish farm, design of Pond, and running cost), level of output and the market price of the output for economic analysis are important determinants. (Young 1986). Tanjil, Islam (2014) conducted a research based on the information gathered from 30 fish farmers which were randomly selected from two districts. It was observed during the study that the output of fish and development of pond occupy major part of the total cost. It was also observed that more than 70 % are the small farmers who just contribute less than 40% of the total fish production. Large farms were major contributors to the total output which were only 30 % of the total respondents. Gamal, Ahmed and Kareem, (2008) A study was carried out in Bahera district of Egypt for which a sample of 15 fish farmers were interviewed. They revealed that cost of feed is the prime component of the total cost. Majority of the farmers are poor and due to the lack of adequate finance they are facing many problems in meeting the feeding cost and other cost. There were direct relationship observed between all factors of production like level of income labour cost, input cost, cost of the fingerlings, transportation and fuel cost. It was also analyzed that productivity of fish farming is strongly influenced by the quantity of fingerlings. March (1991) Concluded in a report which were conducted about the Economics of Tilapia and Catfish, that farmed fish is in competition with the fresh water fish. If the fish product is transported in the market at high prices then the value of the farmed fish will be high and the farmers will enjoy a high revenue but if the fresh water fish is offered at low price then farmed fish will have low demand in the market which is a discouraging situation for the fish farmers. It was argued in the report that it is not possible for the farmers to produce the farmed fish at low price for the poorest segment of the society due to its high cost of production. Ludwig and Lochmann (2007) argued that increasing number of fingerlings have led to decrease the level of output, while total output of zooplankton remained un change by lower stocking densities, leading to improved larval fish growth (Fox & Flowers 1990; Qin et al. 1994). Rees and Cook (1983) found that ponds with original cross breed larvae had the highest existence rate, while ponds with highest number of fries having a lower survival rate. The study revealed that weight of the product decreased with the increased number of fries and that total yield increased with low release of fries. Brumbaugh (2010) revealed that mass release of the fries may be a key factor of growth. According to the study of (Fox & Flowers, 1990; Qin et al., 1994; Huang & Chiu, 1997), showed that with increasing number of fingerlings of various kind of species the growth of the individual specie decreases. Salehi (2007) carried out a research in three provinces and analyzed that Fish farming is an advantageous business which boost the average revenue of a farm by 12% in 2001. The economic investigation of carp fish farming has been recognized by Pillay (1990) and Salehi (2004) in the area where proper technique of farming were used and there was greater demand for the fish product. The results showed that the structure of cost depends on the accessibility of good quality of inputs, Farm supervision, temperature, area of the farm etc. Rusydi and Lampe (1990) and Salehi (1999 and 2004) indicated that the amount paid for the purchase of inputs and feed are the main sources of cost for establishing a fish farm. They observed that the farmers were using agriculture waste as supply of food & manure for fish output in district Gulian, whereas in Mazandaran the operator were using fish farming as a primary source and the price the inputs were high, as a result their output is 50% higher than the average. Abdel (1993) reported that the total output increased but weight of the Fish declined with release of more fries in pond. Kestmont (1995) revealed that the weight of fish in Poly Culture farming may be high in contrast weight of the body in Mono Culture farming because of the natural interaction among the species. Hassan, Sayed and Ibrahim (2008) concluded that with the application of Farm Yard Manure the productivity of fish can be increased. Manuring should be used properly such that it should be cost effective and having no negative impact on the quality of pond water as well as the growth of the fish (Bhakta *etal.* 2004). The dietary role of normal efficiency is clearly essential to optimize the dietary share by reducing the cost of feeding (Collins, 1999). A study was undertaken with an objective "to find the effects of releasing the fries in larger number in the pond, the use of Farm Yard Manure and supplementary food on the growth of Blue tilapia and grass carp nurtured in muddy ponds. Natural feed creatures generally comprise an extraordinary amount of protein (Hepher, 1989). The natural worth of protein in those natural food items is also very high (De Silva *etal.*, 2006). Improvement is inversely related to stocking rate (Lanarietal., 1989). He also explored that stocking rate negatively effect the quality of the product i.e. size and weight of Carp fish. He suggested that longer period may be requiring for catching the product. De Silva (2006) reported that, Nile tilapia nurtured better in poly-culture system in the absence of common carp, because these species strive for non organic feed.

Summary of Literature Review

Extensive literature summarizes that the key factors influencing the yield of Carp fish are Pond area, number of fries and capital. Farm area and output of fish moves in the same direction, larger area means sufficient amount of space will be there for the movement of fries, adequate amount of food will be there for the fries. The Fish will be in most demanding size and quality. If the fries are released in greater number the output will be low, the available space will be deficient for the increased number of fries which will adversely affect the size of the fish and output of fish will decline. Capital boosts the growth of fish farming sector. Capital in shape of Finance is required to cover the operational as well as fixed cost of this enterprise.

i) Hypotheses of the study

The hypothesis developed on the basis of the literature review are :

H₁: The marginal physical products of the key factors were high in this enterprise.

H₂: There is a significant space for the enhancement of profitability

H₃: Carp fish farming is not only a source of food but also a source of employment generation

MATERIAL AND METHODS

It is assumed that broad characteristics of the farmers are uniform in nature so a small sample size represents the whole. Therefore a sample of 60 carp fish farms were selected randomly from Peshawar valley and southern part of Peshawar valley with the help of the following formula

$$n_i = \frac{N_i n}{N}$$

n_i = Sample size of ith substratum

N_i = Total Number of Fish Farms in the ith sub Stratum

n = Sample Size (60)

N = Total Number of Fish Farms in the sample area (Selected Districts)

Table.1 Breakup of the Sample Size of the Sampled Farmer in the Study Area

	Selected districts of Peshawar Valley		Selected districts of southern part of Peshawar Valley		Grand Total
	Mardan	Swabi	D.I Khan	Kohat	
Total No: Of Fish Farms (N _i)	133	66	104	41	
Toatl	199		144		343
Sample size (n _i)	23	12	18	07	
Total Sample size	35		25		60

The survey was based on Primary as well as secondary data. A questionnaire was developed which was composed upon two parts. Part I contained questions about the socio Economic conditions of the fish farmers like literacy level, age, family size, occupation, level of income, house structure, basic facilities (like water, sanitation, electricity etc) and Part II included the questions related to Cost and revenue obtained by the fish farmers. Face to face interview was conducted and the information were recorded with the help of questionnaire. A list of Fish farmers in the selected area along with their accurate addresses were obtained from the Directorate of Fisheries. All the gathered information were transformed in to tables and then analyzed. Simple random sampling technique was used for the selection of fish farmers. All the Respondents were visited individually and required data was gathered. For the collection of data, Stratified Random Sampling and simple random sampling techniques were used. For this purpose four districts were selected. Mardan and Sawabi districts from Peshawar Valley and Kohat and DI Khan districts to the south of Peshawar valley on the basis of maximum number of CARP fish farms. The concentration of this study was on the analysis of carp fish farms (hot water fish farms) a sample size of 60 fish farms were and only selected from research area. For the sake of appraisal the sample size is further divided in to small, medium and large farmers. The selection was made according to the sample size of the farms. N₁ =29 represent small farmers having area under fish farms up to 2 acres. N₂ = 14 Medium farms having area from 2.1 acre to 6 acre. N₃ = 17, Large Farms having area more than 6 acres. Normally medium and large farms are located in D.I Khan District of Zone III For data analysis descriptive statistics and regression model was used

RESULT AND DISCUSSION

I. Socio Economic Profile

Literacy status of the Sampled Farmer.

The results show that 77% of the total Farm Manager were educated out of which 65% had education up to intermediate and 35% were graduates and above. The literacy level and education of the fish farmers indicated that for successful management and handling fish farming education up to intermediate level is necessary. Those who were illiterate were getting help from the educated farmers

Main Occupation of the Sampled Farmers

Most of the fish farmers adopted the fish farming as a secondary business and agriculture was their main occupation which is 37% of the sample respondent where as 12% of the total respondents show that fish farming is their primary business. The study revealed that most of the respondents were running fish farming side by side with agriculture

Family type of the Respondents

The result shows that 60 % respondents were living in joint family system while 40 % were living independently.

Tenurial Status of the Sampled Farmers

The study reveals that 93% of the total respondents are living in their own houses with the facilities of electricity. About the structure of the houses it is recorded that 62% respondents are living in Pacca houses, 16 % are living in semi Pacca while only 22% were living in Kacha houses.

Availability of Drinking water by Sampled Farmers

Almost all the respondents were having the drinking water facilities through hand pump, Tube wells and water supplied by the Municipal committee.

Average Family Size of the Sampled Farmers

It is also observed during the study that there were large family size of the respondents but the average family size is 9 in the selected districts. The male to female ratio is 1 : 1.25

Schooling of the Children of the Sampled Farmers

The study reflect that majority of the fish farmers are giving basic education to their children i.e.331 out of 534 which is 61% of the total children.

Groups of the Sampled Farmers

Fish farmers are broadly categorized in to small, and large farmers . The total operated area in the category of small Farms held by small farmers is 29.63 acre while large fish farmers are operating total area of 326.64 acres. Both small and large farm holding in the category of area owned is 356.27.

Annual income by Sampled Farmers as compared to any other Profession.

The result shows that the fish farmers were earning from this enterprise from 20,000/- to more than 80,000. The variation in income from fish farming is because of the economies of scale and proper caring which is the basic need of this enterprise.

II. Economic Analysis

Poly Culture Farming by Sampled Farmers

It is observed during the study that all the farmers were adopting the technique of Pond culture by using the mix culture of cultivation The important species which were used for culturing are Silver, Grass, Rahu, Mori and common carp with a ratio of 15 ,15, 40, 20, and 10 % respectively. The water resources of a pond are divided in to three broad layers and each species of carp is happy to live in his own environment. Grass and silver occupy the 30% of the water resources and like to live in the upper layer of the pond, Rahu is dominant over all other species and mostly live in the middle phase of the pond water which is 40% of the total whereas Mori and common carp are happy to live in the lower portion of the Pond.

Total Production of Fish by Sampled Farmers

The total area under fish farms in the sample area is 356.27 acres and total output is 386 metric tons, out of which 151 metric tons Rahu contributes alone. It is calculated that the average production is 1.083 metric ton.

Total Revenue by Sampled Farmers

Production of Rahu per acre is 430 kg which is 40 % of the total output, and which has a price of Rs. 120/- per Kg. therefore it adds Rs. 51600/- (Rs. 120 * 430) to the total revenue whereas the production of all others is 653 Kg and adds a revenue of Rs. 58770/-(90 * 653) with the rate of Rs. 90/Kg. The total revenue from one acre of fish farm Rs.1,10,370/-

Total Cost by Sampled Farmers

Total cost of per acre fish farm is decomposed in Fixed Cost and operational cost. The total fixed cost for the development of a farm is Rs. 1,24,000/- which includes the cost of land, labour cost , Material cost for construction of a room and fertilizer, farm yard manure. The detail distribution is as given in the table 2 below:

Table 2 Distribution of Cost by Sampled Farmers in the Study Area

Item	Cost
Land also includes Imputed value	43000
Cost of Man Power	25000
Material for the development of Pond	14000
Transportation Cost	9000
Other costs	33000
Total	124000

Whereas the operational cost is Rs. 38,000/-per acre which includes the cost of purchasing the fries, feed, Farm yard Manure, Labor charges, water charges etc. The detail of the variable cost is as given below.

Table 3 Distribution of Operational Cost Per Acre of the Sample Respondents of the Selected area

Cost Items	Rupees Acre
Cost of fingerlings	2500
Cost of The man Power/ Manager/ Operator	6000
Fertilizer	5000
Fish Feed	8000
Cost of Water used for irrigation purpose	2000
Cost of catching the Product	10,500/-
Miscellaneous	4000
Total	38,000/-

The size of the fingerlings released in the pond varies from farm to farm. It started from 1 inch to more than 3 inches. Majority of the trained farmers are of the view that greater will be the size of the fry greater will be the survival rate. Therefore 78% of the total is releasing the fry in the pond of the size 1.5 inches to 3 inches.

Table 4 Categorization of Sampled Fish Farmers in the Study Area

Farm Size	Numbers	%
Small	29	48
Medium	14	23
Large	17	29
Total	60	100

Harvesting Period

Normally the harvesting season starts from the month of October and continue to February. Only few of the growers were catching the fish in March and he was earning more than other farmers.

Price Per KG

The price of fish varies from specie to specie. The demand for Rahu fish is higher than any other specie. Due to the game value of Rahu, it is charged 120/- per kg where as the price of other species are Rs. 90/- . The average price is calculated Rs. 105 per Kg.

Analytical procedureAnalytical Models:

To determine the degree of sensitivity of output to each factor following Multiple linear regression model was used for small, medium and large farms independently It is assumed that all other factors remaining unchanged

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + U_i$$

Where Yi represents the total output of Fish

X₁= Represents the total number of Fries

X₂=Represents the Farm area

X₃= Represents the total consumable inputs and Capital assets

ii) Estimation of the Models

The linear production function contains single equation to observe the sensitivity of the dependent variable. It was assumed that there is no violation of the OLS assumptions hence the Ordinary Least Squares(OLS) method was used for the estimation of parameters “βi”.

To do necessary comparison among small Medium, and large farms three different multiple Linear Regression Models were used with the help of SPSS. To establish, the overall effect of key inputs on the production of carp fish jointly in all farm sizes, a pooled function was also estimated.

Table 5 Regression Analysis of Different Factors with Fish Production in the Study Area

	Small	Medium	Large	Pooled
B ₁ FishProduction	3.61 1.31 Significant	3.81 1.14 Significant	3.97 1.85 Significant	3.76 1.12 Significant
B ₂ Farm Area	0.91 0.07 Significant	0.96 0.13 Significant	0.99 0.44 Significant	0.95 0.44 Significant
B ₃ Consumable Inputs and Capital Assets	1.92 0.93 Significant	2.04 1.07 Insignificant	2.76 1.00 Significant	2.83 0.99 Significant
R ²	0.74	.78	0.78	0.76
Adjusted R ²	0.72	0.76	0.74	0.72

The results in table 5 shows that Fish Production in small size is almost all the factors fulfill both the economic as well as the statistical criteria and the expected relationship among the variables is obtained. The Change in production of fish due to per unit change in area of Pond is 3.97, 3.80, 3.61, on Large, medium and small farms respectively. Where as in case of all farms it is 3.76. The impact of per unit change in number of fish seed (fries) is 0.95 on all farms. The result reveals that the variation in production due to marginal change in Capital “KCA” is 2.83 on all farms. So all the results concluded that size of farm and capital play key role in the increasing of fish production which positively increase the income of the fish farmer which latter on affect positively all activities of the fish farmers. R² also explained that all variables highly link with the fish production and considered that the model is good fit in this situation.

CONCLUSIONS AND RECOMMENDATIONS

All the explanatory variables are directly related with the output of fish which means that the value of output can be increased by the values of these coefficients

The results indicate that carp fish farming is not only financially beneficial for the farmers, but it also improve the economic and socio economic condition of the farmers. The study: identifies costs, returns and marginal impact of inputs used in fish farming. Keeping in view the findings of the study, the following policy recommendations should be made: Fish Farmers should be facilitated and adequate information should be given to enhance per acre output of Fish; Adequate preparation & Training platform for farmers should be steered; Measures must be taken for the easily availability of feed and other required materials at low cost. By this technique poor farmers can be attracted to start fish farming with little investment; The weather of KP province is hot in summer but there is no cold storage facility where the fish product can be stored for transporting the product to next destination. Therefore it is strongly suggested that the provision of a cold storage facility must be provided for the fish farmers; The farmers have very little approach to International Market. This sector can be developed if Government helps the fish farmers to reach the international market for the sale of their product.

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