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VIABILITY OF CARP FISH FARMING: A CASE STUDY OF KP, PAKISTAN

Sir Buland Khan and Sheikh Raheel Manzoor

ABSTRACT

The study related to Economic viability of Carp Fish Farming and its impact on the living standard of the inhabitants in the selected Districts of KP. The main objective of the study were to analyze benefit of fish farmers, to see its viability by using NPV, BCR and IRR criteria and to estimate the MPPpa and MPPk. For this purpose a study of 60 fish farms i.e. 35 from Zone-I (Mardan & Charsada Districts), while 25 from Zone-II (Kohat and DI. Khan Districts) were selected by using purposive sampling technique. The study reveals that the output elasticity of pond area was 0.68 on all farms, which was relatively higher than the output elasticity of Capital (i.e.0.59), where capital also includes the cost of fries purchased. This model suggested that area under pond plays a vital role in the output of carp fish. The study concludes that this enterprise is a viable enterprise(Having NPV of +13991, BCR is 1.03 and IRR of 12.67% > 12%) and plays a vital role in poverty reduction , minimizing unemployment and changing the living standard of fish farmers in particular and of KP in general.

Key Words: Carp fish, NPV, BCR, IRR

INTRODUCTION

Pakistan is an agrarian economy. More than 60% of its population live in the rural areas and earn their livelihood from agriculture. Like other developing countries Pakistan also depends on agriculture. The farming is categorized in three groups viz; Crop Production, Dairy Farming and Fish Farming. All the three types of farming basically provide food, in addition to some important inputs to various agro-based industries. They are collectively known as the major contributors to Gross National Product (GNP) in Pakistan. Due to growing population and increase in the constructions of houses on agricultural lands, the intense need is felt to give a serious attention to fish farming. The production and consumption of fish not only fulfill the requirements of food and nutrition, but also it is a source of income for those who deal in the fish farming, this research study will focus on various issues related to the fish farming. The study seeks answers to the following research questions: commodities that have a high effect on currencies are mainly gold and oil (crude oil). The prices of gold have also observed volatilities e.g. the boom period was 1033 dollar an ounce in March 2007 and fell to 700 dollar an ounce in June in the same year.

- Is fish farming a profitable business?
- Is it a viable enterprise with both financial and economics point of view?
- How it changes the living standard of the people? And
- What is the contribution of the Government of Khyber Pakhtunkhwa (KP) in the development of this enterprise?

To seek answers to the above research questions a comprehensive research study was proposed to undertake. The main objectives of the study are:

- To test the viability of the carp fish enterprise by using the NPV, BCR, and IRR techniques;
- To ascertain the variations in output of fish and to determine the marginal physical products of various inputs by estimating a Regression Model;

This study will help the researcher for the conduction of further studies in the area of aquaculture, specifically inland fishery sector. This study enables the reader to understand about the per acre fixed cost(cost of land, construction of room, purchase of fish catching material etc.) and variable cost(feed, manure, fries, etc.) of a fish farm. It helps the reader about the profitability of carp fish farming and it will motivate the farmers towards the construction/ expansion and development of fish farming sector.

LITERATURE REVIEW

Number of Fries & its impact on Productivity:

Brumbaugh (2010) reported in his study that fish density may be an important determinant of growth or survival through competition for prey resources. According to the study of (Fox & Flowers, 1990; Qin et al., 1994; Huang & Chiu, 1997) larvae of different species, showed that with increasing density of larvae, individual growth decreases; however, these findings have been variable relative to the effects of larval fish density on percent survival and fish yield. Rees and Cook (1983) found that Georgia ponds stocked with original cross hybrid striped bass larvae at 38m-3 had the highest rate of survival (35.9% ± 6.4), while ponds stocked at 144 larvaem-3 produced the largest number of fingerlings at harvest (41m-3) but at a lower survival rate (28.4% ± 4.6) . Tank experiments with reciprocal hybrid striped bass revealed that individual TL and weight decreased with increased larval densities and that total yield increased with stocking density; however, the densities tested in these experiments were extremely high, ranging from 20,000-120,000 larvae·m-3 (Ludwig & Lochmann, 2007). Increased fish densities have led to reductions in preferred prey, while total zooplankton populations were unaffected by lower stocking densities, leading to improved larval fish growth (Fox & Flowers 1990; Qin et al. 1994).

Profitability of Carp Farming:

Salehi (2007) conducted a study the result obtained from the three main provinces quite clearly demonstrate that carp farming is a profitable activity with an average of 12% rate of farm income in 2001. The economic viability of carp culture has been noted by Pillay (1990) and Salehi (2004) in areas where there is a market for carp and appropriate technologies are used too. The results of the survey showed that the various producer provinces have different cost structures, depending on availability and quality of inputs, farm management, climate, area of farms and other factors. In 2001, feed and fertilizer, seed and labor and salary are the major input costs in Iran, however Rusydi and Lampe

(1990) and Salehi (1999 and 2004) indicated that the basic inputs of feed and seed constitute the principal cost of operating a carp farm. In Guilan, where carp culture is older and farmers have smaller farms and may manage ponds on an ad hoc basis, they usually use agricultural wastes as feed and fertilizer, but in Mazandaran the price of feed and fertilizer was higher than elsewhere, consequence 50% production more than the average.

Optimal Fertilization:

Hassan, Sayed and Ibrahim (2008) conducted a research and conclude that optimal fertilization is a management protocol to enhance biological productivity using organic fertilizer. Also, fertilization rate is the amount of organic matter that can be cost-effective and utilized in pond ecosystem without having any harmful effect on water quality as well as on fish growth (Bhakta et al., 2004). Therefore, the nutritional role of natural productivity is obviously important to maximize the nutritional contribution in order to reduce feeding cost (Collins, 1999). The objective of the present study is to evaluate the effects of stocking densities, organic fertilizer and supplementary diet on the growth performance of Blue tilapia and grass carp reared in earthen ponds. Natural forage organisms usually contain a high proportion of protein, with most averaging 50-60% protein on a dry matter basis (Hepher, 1989). The biological value of the protein in those natural food items is also high as amino acid profiles closely resemble requirements of the consuming species (De Silva et al., 2006). Weekly gain is inversely related to stocking rate, as already noted by Lanari et al., (1989). He further investigated that regardless of fertilizer and supplemental feeding, body weight, length and depth were negatively related to the increasing stocking density of grass carp. However, total fish yield at harvesting increased these results data may lead us to recommended that, lower stocking densities of grass Carp with tilapia up to the marketable size is suitable of the short rearing period with using supplementary feed otherwise higher stocking densities should be need longer time during the culture season of fish. Abdel-Wares (1993) reported that, final body weight of Nile tilapia decreased with increasing stocking density but the total yield increased. Kestmont (1995) in his study the growth and yield of each species may be high in poly-culture than in monoculture because of positive interactions among species. De Silva (2006) reported that, Nile tilapia grew better in poly-culture system with no common carp, probably because these species compete for artificial feed. This could explain the superiority of grass carp yield in treatments which achieved rabbit manure as organic fertilizer.

Relationship of Capital with Fish Productivity:

Kudi, Bako and Atala (2008) in their research considered both durable and nondurable capital items used in fish production. The durable capital items used by the fish producers in the area are the fish ponds, while the non durable capital items were the feeds and fingerlings/juveniles that farmers purchase from the open market. The study revealed that, there are two kinds of feed available to farmers; foreign or imported feeds and the local feeds made by local feed mills within the country. The study shows that majority (86%) of the fish farmers used foreign feeds, while 14% used local feeds. The results revealed that majority (43.2%) of the farmers preferred culturing Juveniles, while 18.2% preferred culturing fingerlings and 38.6% used both. Capital in the form of money needed to finance all production activities is also another important resource. The results showed that 93.2% of the fish farmers relying on personal savings to finance their production activities, while 4.5% of the farmers used group funds and 2.3% used other sources to finance their fish production.

Summary of Literature Review:

Extensive literature summarizes that there are three important factors which can influence the productivity of Carp fish i.e. Pond area, number of fries and capital.

i) Pond area has direct relationship with production, greater is the pond area, greater will be the space available for the fries to move, sufficient amount of food they will have and by this way greater will be the size of the product, greater will be the quality and quantity of fish.

ii) On other hand production has negatively related to the number of fries. Greater is the number of fries, the available space will insufficient for the increased number of fries. There is over utilization of the resources which will negatively affect the size of the product and growth of fish farming will decline.

iii) While capital plays a very important role in the enhancement of any enterprise therefore there is positive impact of capital on the production of fish and for the growth of fish farming sector. Capital in the form of money is needed to purchase the necessary inputs for the production purposes.

Hypotheses of the study:

The following are the hypotheses of the study:

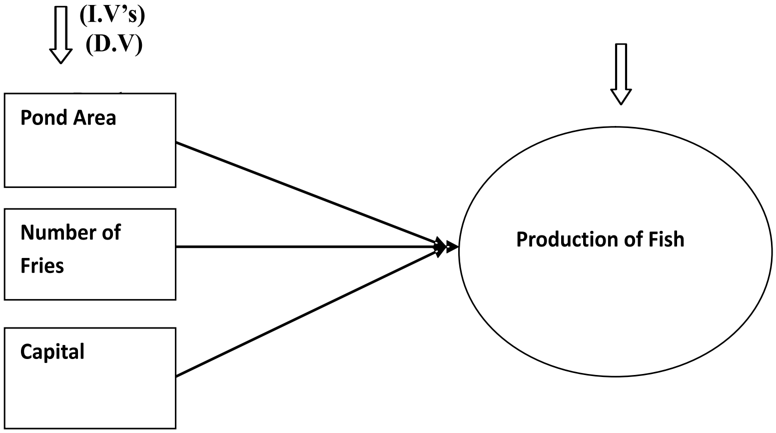
H1: *The marginal physical products of various inputs were high in fish farming.*

H2: *There is a significant room for the improvement of economic profit or net returns of carp fish*

H3 : *Carp fish farm was a viable enterprise*

CONCEPTUAL FRAME WORK

Following is the conceptual framework of this study namely, PNC Model



METHODOLOGY

Population and Sampling:

There were 394 fish farmers in the study area which were further subdivided in to two zones, there were 199 fish farmers in Zone-I while there were 145 fish farmers in Zone-III. It was assumed that the general characteristics of all the farmers are homogeneous and a small portion of the total represents the whole. Therefore 60 fish farmers of the total were selected by using the following formula

$$ni \quad \frac{Nin}{N}$$

ni =Sample size of ith substratum

Ni = 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)

The breakup of the sample size was as follows:

Zone No/ Districts	Total Number of Fish Farms (Ni)	Sample (ni)
ZONE I		
i) Mardan	133	28
ii) Sawabi	66	10
Sub Total	**249**	**38**
ZONE II		
i) D.I. Khan	104	16
ii). Kohat	41	06
Sub Total	**145**	**22**
Grand Total	**394**	**60**

Data Collection Instrument:

An interview schedule pertaining to the information related to the fish farmers and farms was scheduled. It was ensured that information related to all relevant variables which fulfill the requirements of the objectives obtained. After incorporating all the omissions and commissions, the interview schedule was finalized. For the selection of respondents (Fish farm operators) simple random sampling technique (using the lottery method) was used. All the carp fish farm operators were visited personally and relevant data was collected through interview method, using the interview schedule.

Data Collection Procedure:

For the distribution and selection of sample, a combination of stratified Random Sampling and simple random sampling techniques was used. As a first stage the whole province was divided into three zones from the location point of view of the Hatcheries. For the purpose of this study, these zones may Zone–I, i.e. “Peshawar Valley”, including Mardan, Sawabi, Charsadda and Nowshera districts, Zone-II, i.e. all districts to North of Peshawar valley including Chitral, Dir, Malakand, Swat, Bunir, Mansehra and Harripur districts. Zone-III comprised of districts on the south of Peshawar Valley that is Kohat, Bannu, Lakki Marwat, Dera Ismail Khan and Federally Administered Tribal Area (FATA). Fish from type of water point of view was divided in to two groups Viz. Hot water fish or cold water fish. The focus of this study was on the analysis of carp fish (Which is a hot water fish). It was therefore proposed that Zone 1 and Zone 3 were included in the study area, because generally fish in zone II is assumed to be cold “water fish”. These zones will be considered two different strata of the target area. And two districts from each stratum were selected in these districts purposively on the basis of maximum number of the CARP fish farms. A list of all Hatcheries in the selected districts was prepared with the help of Fishery Department. This list is served as the sampling frame. Sample size was 60 fish farms which were distributed among various sub strata (Selected Districts) proportionately.

DATA INTERPRETATION AND ANALYSIS

Analytical Procedure:

i) The observed data was classified and tabulated in appropriate tabular form. The percentages and averages were calculated and their significance was tested, using the following “t” statistics.

$$t \quad \frac{\bar{x}}{s/\sqrt{n}}$$

ii) The viability of the fish farming was examined by the following appraisal criteria which was introduced by Joel Dean in his research (1951)

$$NPV = \sum_{t=0}^{n} \frac{Bt - Ct}{(1+r)^t}$$

$$BCR = \sum \frac{Bt}{(1+r)^t} \Big/ \sum \frac{Ct}{(1+r)^t}$$

$$IRR = (lower\ Discount\ rate) + (Differenence\ b/w\ the\ two\ rates)\left(\frac{NPV\ at\ lower\ discount\ rate}{|Difference\ b/w\ the\ two\ NPVs|}\right)$$

Where

Ct = Discounted cost

Bt = Discounted benefit

r = Social discounted rate

t = Time period (t = 0, 1, 2, 3, 4…….)

iii) Econometric Models:

Models for output of carp fish for small and large fish farms were developed. It is assumed that all other factors remaining unchanged, the main determinants of Carp fish production “QF” were the farm area (in acres) “FA”, number of fries “NF” and total consumable inputs and capital assets “KCA”. To determine the degree of influence of each determinant on the production of Carp Fish, the following linear production function was estimated, for the estimation of the parameters the ordinary least square method of estimation was used.

$$QF = \beta_0 + \beta_1 FA + \beta_2 NF + \beta_3 KCA + Ui \text{ ----------------- [}$$

In addition to this Linear Regression Model for the estimation of output elasticities of two major inputs land “L” and Capital “K”, the Cobb- Douglas Production function of the type

$$Q = AP^{\alpha} K^{\beta} e^{ui} \text{ ---[ ]}$$

was used. Where “Q” was the output of Carp fish, the parameters “A” showed the impact of annuation. The greater the value of “A” the more advance is the technology. The Parameters “α“ and “β” are the output elasticities of inputs “P” and “K” respectively. The sum of these output elasticities helped in the identification of stage of return to scale.

iv) The Marginal Physical Products (MPPs) of these major inputs will be calculated by differentiating the estimated Cobb-Douglas Production function as follows:

$$MPPP = \frac{\partial}{\partial P}\left(AP^{\alpha} K^{\beta}\right)$$

And

$$MPPK = \frac{\partial}{\partial K}\left(AP^{\alpha} K^{\beta}\right)$$

For the exact numerical values of MPP's the average values of P and K were substituted in the differentiated function.

In order to test the technological difference between small and large fish farms and the significance of the equality of parameter estimates of the estimated production function for different farm sizes, the following CHOW F Ratio was used.

$$F^* = \frac{\sum e^2 p - (\sum e_1^2 + \sum e_2^2)/K}{\sum e_1^2 + \sum e_2^2 / n_1 + n_2 - 2k}$$

Where

$\sum e^2 p$ = Sum of Square of pooled residuals

$\sum e_1^2$ = Sumof squares of large farm residuals

$\sum e_2^2$ = Sumof Square of small farm residuals

n_1 = sample size of large farms

n_2 = Sample Size of small farms

K = Number of parameters

Estimation of the Models:

The linear production function (Eq.I) contains single equation and it was assumed that there was no autocorrelation between the residual terms Ut and Ut-1, no Hetroscadesity and no Multicolinearity among the explanatory variables; hence the Ordinary Least Squares (OLS) method was used for the estimation of parameters "βi". It was also assumed that the parameter estimates posses the "BLU" (Best, Linear, Unbiased) properties. In case of Cobb-Douglas production (Eq.II), it was first converted to the log-linear form as follows:

$$LnQ = Ln\,A + \alpha\,Ln\,P + \beta\,Ln\,K + Ui \text{---------------------------III}$$

and then it was estimated applying the OLS method with its usual assumption and BLU properties.

For the sake of comparison among different farm sizes (Viz. small. medium, and large) three different functions in linear and Cobb- Douglas forms were estimated with the help of Statistical Package for Social Sciences (SPSS) package.

To ascertain, the overall influence of explanatory variables on the output of carp fish collectively in all farm sizes, a pooled function was also estimated. The summary of results is presented in the following tables 1, and 2, respectively.

Table 1: Estimated Linear production functions for Carp Fish by farm size

a) Small Farms

$$Q_F = 3.61\, F_A + 0.91 N_F + 1.92\, KCa$$
$$(1.31) \quad (0.07) \quad (0.93)$$
$$R^2 = 0.74 \quad \text{F- Ratio} = 88.58 \quad \Sigma\, e^2 i = 66.83$$

	Co efficient 1	Co efficient 2	Co efficient 3	R^2	R^2 Adj	F-Ratio	$\sum e^2 i$
B_i	3.61	.91	1.92	0.74	.72		
S.E	(1.31)	(.07)	(.93)				
	significant	significant	insignificant			88.83	66.83

b) Medium Farms

$$Q_F = 3.81\, F_A + 0.96 N_F + 2.04\, KCa$$
$$(1.14) \quad (0.13) \quad (1.07)$$
$$R^2 = 0.79 \quad \text{F- Ratio} = 89.14 \quad \Sigma\, ei^2 = 67.5$$

	Co efficient 1	Co efficient 2	Co efficient 3	R^2	R^2 Adj	F-Ratio	$\sum e^2 i$
B_i	3.81	.96	2.04	0.79	.76		
S.E	(1.14)	(.13)	(1.07)				
	significant	significant	significant			99.15	60.11

c) Large Farms

$$Q_F = 3.97\, F_A + 0.99 N_F + 2.76\, KCa$$
$$(1.85) \quad (0.44) \quad (1.00)$$
$$R^2 = 0.78 \quad \text{F- Ratio} = 88.96 \quad \Sigma\, ei^2 = 60.11$$

	Co efficient 1	Co efficient 2	Co efficient 3	R^2	R^2 Adj	F-Ratio	$\sum e^2 i$
B_i	3.97	.99	2.76	0.78	.76	88.96	
S.E	(1.85)	(.44)	(1.00)				
	significant	significant	significant			99.15	60.11

d) All Farms

$$Q_F = 3.76\,F_A + 0.95N_F + 2.83\,KCa$$
$$(1.12) \quad (0.84) \quad (0.99)$$
$$R^2 = 0.76 \quad F\text{- Ratio} = 99.15 \quad \Sigma\, ei^2 = 64.16$$

	Co efficient 1	Co efficient 2	Co efficient 3	R^2	R^2 Adj	F-Ratio	$\sum e^2 i$
B_i	3.76	.95	2.83	0.76	.74		
S.E	(1.12)	(.84)	(.99)				
	significant	significant	significant			99.15	64.16

Source: Field survey

Note: Figures in parenthesis are the respective standard errors

Table 2: Estimated Cobb Douglas production by Farm size

a) Small Farms

$Q = 8.13\ P^{.63}\ K^{.61}$

$R^2 = 0.85$ F-ratio= 115.53

b) Medium Farms

$Q = 9.00\ P^{.71}\ K^{.69}$

$R^2 = 0.91$ F- Ratio = 107.14

c) Large Farms

$Q = 9.18\ P^{.73}\ K^{.64}$

$R^2 = 0.88$ F- Ratio = 109.12

d) All Farms

$Q = 9.65P^{.68}\ K^{.59}$

$R^2 = 0.88$ F-Ratio= 109.12

Source: Field survey.

Evaluation / Tests of the Model:

The table no: 1 reveals that almost all the standard errors of the parameter estimates were less than the half values of the estimators, which implies that the estimated parameters were statistically significant. This conclusion is supported by respective "t" ratios with 5% level of significance.

The co-efficient of multiple determinations "R^2"of all estimated models were greater than 50%, therefore the fits were good. The pooled model of linear production function (Eq: I) showed that 76% variations in the production of Carp fish were explained by the explanatory variables, which implies that the regressors of the model were the important determinants.

The calculated values of F-Ratios in all cases were very high, which suggested that the estimated production functions were overall statistically significant.

Analysis of the Models:

The results of the estimated production function (Table-I) indicate that the signs and magnitudes of the parameter estimates were consistent and according to the expectations. The rates of change in the production of carp fish farm with respect to change in pond area were 3.61, 3.80, and 3.97 on small, medium and large farms respectively. It was 3.76 in case of all farms (pooled function). The impact of per unit change in the total number of fries on the production of carp fish was 0.95 on all farms. Table -1 reveals that the rate of change in output due to the change in input "capital" "KCA" is 2.83 on all farms. The results of the linear production show that the influence of total area of ponds was relatively higher than the influence of fries and capital.

The results of estimated Cobb-Douglas production function (presented in table 2) were also according to the expectation on the economic priory basis. The output elasticity of pond area was 0.68 on all farms, which was relatively higher than the output elasticity of Capital (i.e. 0.59), where capital also includes the cost of fries purchased. This model also suggested that area under ponds plays a vital role in the output of carp fish.

Since the sum of output elasticity of the key inputs (i.e. $\alpha + \beta$ or 0.68+.059 = 1.27) was greater than unity. Hence it implies that there were increasing returns to scale on all farms. The stage of increasing returns to scale means that there was a significant room to enhance the output by employing additional units of key inputs.

It is important to note that no significant difference was found between the output elasticity on small, medium and large farms.

The Chow F-Ratio suggested that the structural/ technological differences between the small, medium and large farms were not statistically significant. From the co efficient "A" of the estimated Cobb-Douglas production functions, for small, medium and large farms i.e. 8.13, 9.00, and 9.18 respectively. It can be concluded that there was no technological gap between three farm sizes. In other words the small, medium and large farmers operated their farm at the same production lines, all being in the stage of increasing returns to scale having provision for improvement of efficiency in the production of carp fish.

Marginal Physical Products of the Key Inputs:

By Marginal Physical Product (MPP), we mean the addition of Carp fish output to the total level of output by the marginal or an additional unit of input. The MPP's of various inputs were calculated using the following partial differentiation formula with respect to each input.

$$MPPp = \partial / \partial p(\underline{Q}) = \partial / \partial P(AP^{\alpha} K^{\beta} e^{w})$$

$$MPPk = \partial / \partial K(\underline{Q}) = \partial / \partial K(AP^{\alpha} K^{\beta} e^{w})$$

Using the above estimated production function, the mean values of pond area “P” and capital “K” were substituted in different partial derivatives and the numerical Values of Marginal Physical Products (VMPP) of both the key inputs were calculated and presented in the following tables-3

Table 3: Values of Marginal Physical Products of the key inputs by farm size

Key Inputs	**Farm Size**			
	Small Farm	**Medium Farms**	**Large Farms**	**All Farm**
i) Pond Area”P”	4.03	3.94	2.06	3.05
ii) Capital “K”	2.16	2.67	3.73	3.04

Source: Calculations were based on table -2

The table reveals that in case of all farms, the marginal physical products of both the key inputs were more or less the same. But the results on different farm sizes were very interesting, the VMPPs of Pond “P” diminishes as the farm size increases the corresponding values on small, medium and large farms were 4.03, 3.94, and 2.06 respectively. On the other hand the VMPPs of Capital input “K” increased with an increase in the farm size. The relevant figures recorded on small, medium and large farms were 2.16, 2.67 and 3.73 respectively.

It was observed that the VMPPp and Farm size were inversely related, but the VMPPk were directly related to the size of the farm. This implies that when the size of pond is small then one additional unit of pond area might add more to the total output of carp fish as compared to the one additional unit of capital. Contrarily in case of large size of pond one additional unit of capital (purchase of fries, feed, and labour etc) might add more to the total output of carp fish than the contribution of additional unit of pond area. From the observed VMPPs, it is concluded that the efficiency of land use might be enhanced by increasing the area of pond land on the small and medium farms, on the other hand, it could be improved by increasing the amount of capital on large the farms.

The Net Present Value (NPV) Criterion:

The Notion "Money has a time value" plays an important role in the determination whether a project is worth to accept or reject. The NPV though an absolute measure of project worth, however it is very frequently used in the accept – reject decision making. In this case the undiscounted net benefits (Total revenue minus total cost) i.e. Bt-Ct were multiplied by the discounting factor for each year and the discounted cash flow was summed over all years of project life. The following formula was used:

$$NPV = \sum_{t=0}^{n} \frac{Bt - Ct}{(1+r)^t}$$

The observed value calculated by the above expression was Rs. 13991.41. Since NPV of the Carp Fish Farming was positive and was a handsome amount in discounted term, Hence the Carp Fish Farming in the Khyber Pukhtoonkhwa Province was a viable Project.

The Benefit Cost Ratio Criteria:

The viability of the carp fish farming was also tested using the Benefit Cost Ratio(BCR) criterion.

Internal Rate of Return:

For examining the viability of the sector another effective technique of Internal Rate of Return was used. For computing IRR the NPV's at different discounted factors were calculated and the selected two discounted rates (12.5 % & 13. %) at which the NPV's (9019.011 and -16439.8) were obtained. The IRR is then calculated using the following formula:

$$\left[IRR = (\text{lower Discount rate}) + (\text{Difference between the two rates}) \left(\frac{NPV \text{ at lower discount rate}}{|\text{Difference between the two NPVs}|} \right) \right]$$

IRR = 12.5+.5(9019.1)/(9019.15-(-16439.8)

IRR = 12.5 +.5(9019.1/25458

IRR = 12.67

IRR = $12.67 \geq 12\%$

The formula used for the Benefit – Cost Ratio was as follows:

$$BCR = \sum \frac{Bt}{(1+r)^t} \Big/ \sum \frac{Ct}{(1+r)^t}$$

BCR= 410612.55 / 396621 = 1.03

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BCR= 410612.55 / 396621 = 1.03

For calculating the benefit cost ratio the discounted total revenue was divided by discounted total cost. The result which is obtained is 1.03 which is greater than unity (i.e.1.03 > 1). Therefore it is concluded that the fish farming sector is beneficial and worth to accept. That is fish farming sector is a viable project.BCR is a relative measure of a project worth. BCR=1.03 means that if a fish farmer invests one unit of money (e.g. Rs. one million) as a result the farms operator will get 1.03 units(Say Rs. 1.03 millions).

The result shows that IRR of the enterprise was 12.67 % which is compared with the Social discount rate of 12%. Since IRR is greater than the Opportunity Cost of Capital, hence the enterprise was a profitable and it is beneficial for the fish farmers. All of the three techniques which were used for the acceptability of the enterprise clearly showed positive sign about the continuity of the enterprise. NPV, BCR and IRR resulted the Carp Fish Farming under canal water is viable and beneficial project in the province of KP.

CONCLUSIONS, SUGGESTIONS & RECOMMENDATIONS.

Benefits based on the value of the indicators in this study, fish production is financially and economically Viable and beneficial. The Fish farming sector improves the quality of life, create jobs and enhance income of the farmers. Previous studies were conducted about the profitability of Aquaculture but Viability of carp fish farming in the selected districts of KP is still questionable. This study analyzes the Carp fish farming and profitability of fish farm in the selected districts of KP and sensitivity of the Fish productivity to the factors of production. Specifically the study: identifies costs & returns and marginal physical productivity of inputs use in fish farming

Keeping in view the findings of the study, the following policy recommendations should be made:

1) Adequate training program for fish farmers should be conducted.
2) Most of the fish farmers belong to poor family they have little access to finance. Therefore, government should help the farmers by providing them adequate finance where needed.

3) The Fishery sector should help the farmers to purchase inputs and sale the product.
4) As the weather of KP is tough but there is no proper storage facility. This sector may be developing if the government provides proper storage facilities to the farmers.
5) The other segment of Carp Fish farming is fish farming irrigated by tube well. More and more people can be attracted if proper finance should be made for the installation of Tube well or dug well and if electricity is provided on subsidized rate.

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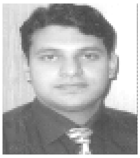
Sir Buland Khan: Ph.D Research Scholar. Deputy Controller of Examinations, Students Facilitation Officer and In Charge Accounts Section, University College for Boys, University of Peshawar.
E-mail: sbkhan64@gmail.com



Sheikh Raheel Manzoor: Asistant Professor, TRACK, Peshawar.
E-mail: raheel_manzoor2000@yahoo.com