# An Economic Analysis of Indian Major Carp Production in Cauvery Delta Zone, Tamil Nadu

**Kunguma Kannika M[1], Vignesh K[3], Revathi K[2]*, Senthil Kumar V[3]**

*[1]PG and Research Department of Zoology, Ethiraj College for Women, Chennai*

*[2]Meenakshi Academy of Higher Education and Research, Chennai*

*[3] Department of Fisheries Economics, Fisheries College and Research Institute Tamil Nadu Fisheries University, Thoothukudi*

***Corresponding author: reva63@rediffmail.com**

**Author[1]: Kannikamaharajan14@gmail.com**

## ABSTRACT

Inland fisheries sector, aquaculture is poised to play a pivotal role in increasing fish production ensuring food security and enhancing the growth in state economy. The study was carried out in the Cauvery Delta Zone, Tamil Nadu, because of availability of effective inland water resources comprising of reservoirs, high quantity of Indian Major Carp (IMC) production and availability of farms. Sample size for this study was 75 and simple random technique was used to select the respondents. Collected information was tabulated and analyzed by multiple regression to study the function of variable factors in total production. Cost and returns for IMC production was also calculated to know the profitability of business. Result revealed that, total cost, total income and net income were ₹ 2,93,716.56, ₹ 3,39,229.45 and ₹ 45,512.89, respectively. Benefit Cost Ratio (BCR) on total cost and total variable cost were estimated for the IMC fish production at 1.15 and 2.32, respectively. Efficiency ratio for fixed cost, variable cost and total cost were 43.53, 43.05 and 86.58, respectively. Profit margin for IMC production business was 13.41%. In this regard, the present study indicates that the IMC production was the profitable business in the study area.

**Keywords:** Indian Major Carp, Production, Profit margin, Aquaculture

## INTRODUCTION

Indian fisheries and aquaculture are an important food production sector that provides nutritional stability, as well as support for livelihoods and gainful employment for over 14 million people and contributes to agricultural exports. The total fish production during 2017-18 is estimated to be 12.60 million metric tonnes, of which nearly 65% is from inland sector and about 50% of the total production is from culture fisheries, and constitutes about 6.3% of the global fish production. A three-tiered carp culture system was practiced in India, namely, nursery, rearing and grow-out production systems [4]. The Indian Major Carps (IMC), namely, Catla, Rohu and Mrigal contribute to the majority of the national carp production. Polyculture of IMC was practiced in fertilized ponds in India. In Tamil Nadu, IMC farming contributed nearly 90% to the total freshwater aquaculture production and possesses 3.83 lakhs hectare (ha) of effective inland water resources comprising of reservoirs, major irrigation tanks, minor irrigation tanks, short seasonal tanks and ponds, rivers, backwaters and derelict water bodies. Inland fish production from the present study area was estimated around 10,006 tonnes which was considered to be a significant contribution in Tamil Nadu fish production. However, present study area has capacity to produce more IMC production due to availability of water resources, lack of details for expenditure and profitability of IMC production business in the study area still persist. Considering these facts, the present study would attempt to examine the status and economics of IMC production.

## DATA AND METHODOLOGY

The study was carried out in the Cauvery Delta Zone because it has the richest inland fishery resources and significance level of IMC carp production due to the presence of irrigation channels, major and minor tanks with a rich fish biodiversity consisting mostly of carps and other varieties such as Cat fish, Murrels, Tilapia etc. It lies in the eastern part of Tamil Nadu The which covers an extent of 3169 $mi^2$ (8210 $km^2$) and is bounded by the Bay of Bengal on the east and the Palk straight on the south, Trichy district on the west, Perambalur, Ariyalur districts on the north west, Cuddalore district on the north and Puddukkottai district on the south west. The sample size for this study was 75 IMC seed rearing farmers in those districts. The respondents were selected by using simple random sampling procedure. The overall distribution of respondents in Cauvery Delta region is presented in Table 1.

**Table 1 Fisheries profile of Cauvery Delta Zone**

| | |
|---|---|
| Total catchment area ($km^2$) | 81,155 |
| Area of FFDA farmer ponds (ha) | 400 |
| Number of FFDA farmers (nos.) | 500 |
| Inland aquaculture area (ha) | 2,400 |
| Inland fish production (tonnes) | 10,006 |
| Fishing villages (nos.) | 60 |
| Inland fishermen (nos.) | 5,000 |

***Source:*** *State Fisheries Department, Tamil Nadu*

FFDA - Fish Farmer's Development Agency

## Cost and returns of IMC carp production

The analysis of the economic performance of production methods was assessed by working out the fixed cost, operating cost, gross benefits and net returns.

The operating cost (OC) was thus calculated as follows:

Operating cost /year = Cost of (Pond preparation + Manuring + Stocking + Pumping + Feeding + Sampling + Marketing + Harvesting + Watch and ward + Medicines and pesticides + Hatchery operating)

The Fixed cost (FC) was calculated as sum of depreciation of (motors, aerators, buildings, nets and bore well) interest on capital cost, repairs and maintenance and insurance.

The gross revenue is estimated as follows:

$$\text{GR per year} = \sum_{i=1}^{n} \text{qi pi}$$

where,

$q_i$ is the quantity of sold in nos. of the $i_{th}$ variety

$p_i$ is the price per lakh of seed of the $i_{th}$ variety

Net profit is the profit obtained after deducting operating expenses and fixed cost from the gross income earned per year [2].

## Production function analysis

The functional relationship between the inputs used and the output obtained was analyzed using the production function analysis.

In this study, a multiple linear form production function was specified as follows.

$Y = a + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7X7 + b8X8 + b9X9+e$

where,

Y = Total Returns of carp seed

A = Constant term
X1 = Pond preparation
X2 = Manuring
X3 = Brooders/seed
X4 = Feed
X5 = Pumping
X6 = Marketing
X7 = Medicines
X8 = Pesticides
X9 = Hatchery operations

b1, b2, b3, b4, b5, b6, b7, b8, b9, b10, b11 are co-efficient and e = error term

## Ratio Analysis

### Fixed cost ratio

Fixed cost ratio is the proportion of fixed expenses to the gross income of IMC production [5].

$$\text{Fixed cost ratio} = \frac{\text{Fixed cost}}{\text{Gross returns}} \times 100$$

### Gross return ratio

Gross return ratio is the total cost of the IMC production to the gross return [5].

$$\text{Gross return ratio} = \frac{\text{Total cost}}{\text{Gross returns}} \times 100$$

### Operating cost ratio

Operating cost ratio relates variable costs to gross income. The gross income is the sum total of value by multiplying the quantities of different species/groups with respective price [1].

$$\text{Operating cost ratio} = \frac{\text{Operating cost}}{\text{Gross returns}} \times 100$$

### Profit margin ratio

$$\text{Profit margin (\%)} = \frac{\text{Net Returns (NI)}}{\text{Total Returns (TR)}} \times 100$$

It is a closely related indicator of economic performance, which expresses the net profit as a percentage to the total revenue. A ratio of more than 10% can be considered as good business.

### Benefit cost ratio

$$\text{Benefit Cost Ratio (BCR)} = \frac{\text{Total Returns (TR)}}{\text{Total Cost (TC)}}$$

If the benefit cost ratio is greater than 1, the aquaculture production is profitable and if it is exactly 1, it means the aquaculture is at breakeven, i.e., neither making profit nor loss. When the ratio is less than 1, the project is operating at a loss.

## RESULT AND DISCUSSION

Cost and returns for IMC production was calculated and discussed below. Capital cost details for IMC production given in the Table 2. Cost of land was the major expenditure item in the capital costs ( ₹ 10,14,462) and it's contributes at 73.69%. Average capital cost for IMC production was ₹ 13,76,648. Among the items of fixed cost, interest on capital accounted for about 55.93% followed by permanent labor (36.58%), depreciation (6.11%) and repairs and maintenance (1.38%) to the total fixed cost (Table 3). Interest on capital and permanent labor accounted for 28.12% and 18.39%, respectively to the total cost.

**Table 2 Details of capital investment**

| Item | Amount ( ₹ ) | Percentage in Total capital cost |
|---|---|---|
| Land | 10,14,462 | 73.69 |
| Pond construction | 45,757 | 3.32 |
| Bore well / open well | 43,492 | 3.16 |
| Packing shed | 24,991 | 1.82 |
| Feed room | 14,921 | 1.08 |
| Watchman shed | 2,981 | 0.22 |
| Pump house | 4,444 | 0.32 |
| Farm house / rest room | 48,148 | 3.50 |
| Pump / Motor / Oil engines | 23,598 | 1.71 |
| Inlet / outlet pipes | 9,453 | 0.69 |
| Nets | 9,312 | 0.68 |
| Hapas | 494 | 0.04 |
| Refrigerator | 53 | 0.00 |
| Vehicle | 70,688 | 5.13 |
| Weighing balances | 531 | 0.04 |
| Oxygen cylinder assembly | 803 | 0.06 |
| Drums / tins / Baskets etc | 44 | 0.00 |
| Fencing | 5,457 | 0.40 |
| Electrical installations | 14,233 | 1.03 |
| Generator | 42,787 | 3.11 |
| **Total capital cost** | **13,76,648** | **100** |

Among the items of variable cost, expenditure on stocking accounted for about 34.06% followed by feeding (20.53%), pond preparation (17.03%), pumping (8.50%), manuring (7.47%)

and temporary labors (6.76%) to the total variable cost. Stocking and feeding accounted for 16.93% and 10.21%, respectively of the total cost. Pond preparation and pumping costs was worked out to 8.47% and 4.22%, respectively while medicines and pesticides had the least share in the total cost.

**Table 3 Cost details of IMC production**

| Items | Fixed cost (₹ / acre) | Percentage on | |
|---|---|---|---|
| | | Fixed cost | Total cost |
| **Details of fixed Cost** | | | |
| Depreciation cost | 9017.19 | 6.11 | 3.07 |
| Interest on capital cost | 82598.86 | 55.93 | 28.12 |
| Repairs and maintenance | 2040.56 | 1.38 | 0.69 |
| Permanent labour | 54021.16 | 36.58 | 18.39 |
| **Total Fixed cost** | **147677.77** | **100** | **50.28** |
| **Details of variable cost** | | | |
| Pond Preparation | 24874.78 | 17.03 | 8.47 |
| Manuring | 10906.53 | 7.47 | 3.71 |
| Seed | 49735.45 | 34.06 | 16.93 |
| Feeding | 29982.36 | 20.53 | 10.21 |
| Pumping | 12405.64 | 8.50 | 4.22 |
| Medicines | 1525.57 | 1.04 | 0.52 |
| Pesticides | 1497.35 | 1.03 | 0.51 |
| Temporary labour | 9876.54 | 6.76 | 3.36 |
| Marketing | 2610.23 | 1.79 | 0.89 |
| Harvesting | 2624.34 | 1.80 | 0.89 |
| **Total Variable cost** | **146038.79** | **100** | **49.72** |

## Production function analysis for IMC seed rearing

The multiple linear regression models were used and the estimated function for the carp seed producing farmers is presented below:

$$Y1= 81054.590 + 0.117X1^{NS} - 0.012X2^{NS} - 0.248X3NS + 1.037X4^{*}$$

(20814.798) (0.591) (0.540) (1.124) (1.944)

$$+0.107X5^{*} – 0.067X7^{*} + 0.024X8^{NS} + 0.025X9^{NS} + 0.027X10^{NS}$$

(0.536) (1.788) (1.162) (0.574) (9.109)

Where,

($Y_1$ – Total returns of IMC seed rearing , X1-Pond preparation, X2- Manuring, X3-Seed, X4- Feed, X5- Pumping, X6-Harvesting, X7- Marketing, X8-Temporary labours, X9-Medicines and X10- Pesticides)

$R^2 = 0.978$

F value = 287.817

N = 75

(Figures in parentheses indicate standard error)

* Significant at 5 % level

NS = Not Significant

The R-square value was 0.978 on quantity terms indicating that the estimated regression equation explained 97% of the variations in total returns of IMC production were explained by the cost of various inputs used. The partial regression co-efficient of feeding, pumping and harvesting expenses were positive and significant at p = 0.05. The regression co-efficient of other independent variables were not significant in the estimated function IMC production.

Based on the multiple- linear regression analysis, feeding, pumping and harvesting expenses influence the total returns. The result revealed that reduction of feeding, pumping and harvesting expenses will increase the total returns and net returns.

**Table 4. Economics details of IMC carp farming**

| | |
|---|---|
| Total Fixed cost ( ₹ ) | 147677.77 |
| Total Variable cost ( ₹ ) | 146038.79 |
| Total cost ( ₹ ) | 2,93,716.56 |
| Total Income ( ₹ ) | 3,39,229.45 |
| Net income ( ₹ ) | 45,512.89 |
| Benefit cost ratio on variable cost | 2.32 |
| Benefit cost ratio on total cost | 1.15 |
| Profit margin | 13.41 |
| Fixed cost ratio | 43.53 |
| Variable cost ratio | 43.05 |
| Total cost ratio | 86.58 |

Total cost, total income and net income were ₹ 2,93,716.56, ₹ 3,39,229.45 and ₹ 45,512.89, respectively (Table 4). Benefit cost ratio on total cost and total variable cost were estimated at 1.15 and 2.32, respectively. [3] indicated that the pond fish farming was an economically viable enterprise with the benefit cost-ratio ranging from 2.22 to 4.44. In the present study explains that the profit margin for IMC production business was 13.41%. Efficiency ratio for fixed cost, variable cost and total cost were 43.53, 43.05 and 86.58, respectively. The present study indicates that the IMC production was a profitable business in the study area.

## Conclusion and Policy Recommendation

The study showed that IMC production was profitable venture in this region. The net income obtained from IMC production was higher than that obtained in carp production. It also helps to improve the regional development and strengthening of predominantly agrarian economy in the Cauvery Delta zone (CDZ) which would make farm business profitable and sustainable. So, this study recommends that the IMC production should be increase at State as well as national level, and accelerate to attain growth rate in GDP by fish culture in India because IMC production is profitable business. It also will help to improve the socio-economic status of fish farmers.

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