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Techno-economic Analysis of Carp Farming Practices in Krishnagiri District, Tamil Nadu, India

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Authors' Contributions

This work was carried out in collaboration between all authors. Author PC designed the study, wrote the protocol and supervised the work. Authors TU and MR performed the statistical analysis. Author SHS involved in primary data collection and literature searches. Author TU wrote the first draft of the manuscript. Author PC edited the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aquaculture represents the most efficient and sustainable way to guarantee that there is enough protein to feed the world with increasing population. Since carp farming is a promising enterprise, study on the economics and technical bottlenecks on regional basis is highly necessary. Kaveripattinam block of Krishnagiri district was selected purposively because of its rich inland resource endowments. The study was conducted to understand the technical and economic viability of carp culture (Integrated and backyard) and to identify the operational constraints in farming practice. Totally, 31 carp farmers were randomly selected and information based on the specified objectives was collected using a structured interview schedule. Descriptive statistics, costing and Garette ranking techniques were used for analysis. The study revealed that the experience in farming activity lie with a mean of 4.77 years and small farms occupied the major share (81%). Among the reported, three species combination was adopted by 67.74% of the farmers. The economics of carp culture was calculated through estimation of Cost A, Cost B and Cost C with an

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average output of 586.75 kg/ha/yr and a net income of Rs. 23,623.35/ha @ Rs. 75/kg on an average. Among the variable inputs, seed cost accounted the major share (16.11%) followed by feed (13.58%). Non availability of credit (59.15), lack of quality seed (63.25) and improper guidance (69.00) were perceived as major resource, production and management constraints, respectively. Other constraints include uncertainty in demand, competition and absence of government institutions for marketing.

Keywords: Techno-economic survey; carp farming; constraints; recommendations.

1. INTRODUCTION

Fisheries in India is a very important economic activity and a flourishing sector with varied resources and potentials. Only after the Indian Independence, fisheries together with agriculture have been recognized as an important sector. Besides meeting the domestic needs, the dependence of people on fisheries activities for their livelihood and foreign exchange earnings amply justifies the importance of the sector on the country's economy and in livelihood security. Aquaculture represents the most efficient and sustainable way to guarantee that there is enough protein to feed a world whose population is increasing for which it requires high capital inputs, technical knowhow and ownership of or access to land/water resources [1]. The main opportunities for aquaculture development are the large local market demand for fish, the availability of skilled technicians to manage commercial operations, local feedstuffs that can be used in the production of pellet feeds. On the other hand, the main constraints behind the aquaculture development are lack of capital investment, restricted availability of suitable sites for farming, issues around the importation of feed ingredients, lack of infrastructure to support aquaculture and absence of technology transfer programs. The highest priority for action is the development of a local cost-effective aqua feed production unit. Other priorities include the need for a system to provide farmers with information and training, the need to develop and demonstrate successful and commercially profitable production system models, and the need to develop and implement a coordinated plan to support government policy. Since carp farming, a promising enterprise is gaining momentum, study on the economics and technical bottlenecks of fish culture on regional basis is highly necessary. In this line, the present work was undertaken to study the socio-economic profile of carp farmers, to analyze the technical and economic viability of carp culture (Integrated and backyard), to identify the operational constraints in farming practice and to suggest suitable policy measures to overcome the hurdles faced by the fish farmers of the study area in Kaveripattinam block of Krishnagiri district, Tamil Nadu.

2. MATERIALS AND METHODS

2.1 Study Area

The Kaveripattinam block (Fig. 1) comprises of 151 farms (51.381 ha), Tanks (560.65 ha) and small, medium and large reservoirs [2]. More than 90% of the lands are fed with canal water from Krishnagiri dam and the main cropping pattern is paddy and coconut. Apart from agriculture, the farmers are also involved in livestock farming and fisheries activities like composite fish culture, seed rearing, catfish farming (*Clarias gariepinus*) and tilapia farming. Pertaining to pisciculture, carp farming has been largely adopted in multipurpose small ponds under extensive method with farm made feed (Integrated and Backyard).

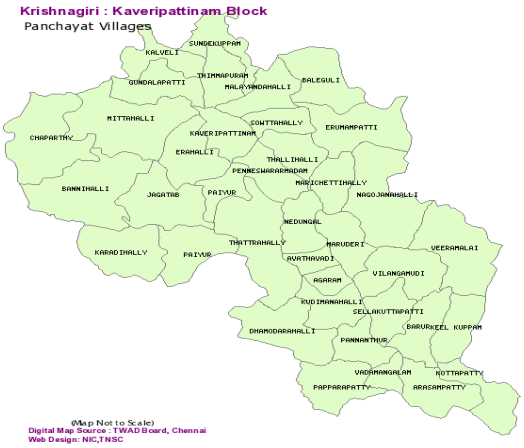

Fig 1. Block map

2.2 Sample Size

The study was conducted during May to October 2015 among the carp farmers of Kaveripattinam block, Krishnagiri district. The data were

collected from the random samples of 31 fish farmers. Based on the objectives of the study, the information pertaining to was collected by using a structured interview schedule and observation methods.

2.3 Tools of Analysis

Cost was ascertained annually by using different costing principles such as Cost 'A', Cost 'B' and Cost 'C' as shown below:

Cost A= comprises cash and kind expenses (paid out costs) actually incurred by the carp cultivators which includes expenses incurred for i) carp seed; ii) manure and fertilizer; iii) feed; iv) hired human labour; v) depreciation; vi) lease amount; vii) interest on working capital and viii) other expenses

Cost B = Cost A + Interest on fixed assets (excluding land) + Rental value of owned pond

Cost C = Cost B + Imputed value of family labour [3]

Apart from this, data on the socio-economic variables viz., age, education, experience, investment, number of crops per year, annual income, and on the constraints in the adoption of aquaculture practices were collected. The data were analyzed statistically for percentage, mean, and standard deviation. Garrett ranking technique was employed to identify the preference of the constraints faced by the farmers. For converting the scores assigned by the farmers towards the particular constraint, the percent position for each rank was worked out using the following formula

$$\text{Percent Position} = \frac{100\,(Rij - 0.05)}{Nj}$$

whereas,

Rij = Rank given for the i^{th} factor by j^{th} individual
Nj = Number of factors ranked by j^{th} individual

By referring to Garrett's table, the percent positions estimated were converted into scores. The scores of various respondents were added and the mean values were calculated and arranged in descending order. The factors with the highest mean value was considered to be the most important, followed by second, third and so on [4].

3. RESULTS AND DISCUSSION

3.1 Socio-economic Profile of Carp Farmers

The socio-economic profile of fish farmers in Kaveripattinam block is detailed in Table 1. The age of the carp farmer varied from 26 to 62 years with a mean of 45.39 years and co-efficient of variation (C.V) of 20.16%. The literacy level was measured on scoring pattern of five point rating scale viz., illiterate, schooling up to 5^{th}, 6^{th} to 10^{th}, 11^{th} to 12^{th} and graduate with a score of 1,2,3,4 and 5, respectively. It was found that 45% of the farmers had schooling from 6^{th} to 12^{th} and 39% towards graduation (mean – 3.94, S.D – 0.93 and C.V – 23.60%). With respect to the experience in farming activity, it lies between 3 to 13 years with a mean of 4.77 years which indicates the scope for technical intervention in aquaculture in Krishnagiri block besides the vast fishery resource potential. On the other hand, the annual income was recorded as Rs. 0.73 lakhs, varying from Rs. 0.25 to 2.5 lakhs, as the farmers are undertaking carp farming as secondary occupation that too of integrated in practice.

Table 1. Socio-economic profile of fish farmers

S. no.	Variables	Values (n=31)
1	Age (years)	45.39±9.15
		26-62
		20.16
2	Literacy level (scores)	3.94±0.93
		3-5
		23.60
3	Experience in fish farming (years)	4.77±1.89
		3-13
		39.62
4	Annual income (Rs. in lakhs)	0.73±0.48
		0.25-2.5
		65.75

(The values in first, second and third rows indicate mean and S.D, range and C.V, respectively)

3.2 Farm Details

The randomly selected farms were classified as small (<0.5 ha), medium (0.5–1.0 ha) and large (>1.0 ha) with an average farm size of 0.083 ha, 0.616 ha and 1.443 ha, respectively. Among the reported, small farms occupied the major share (81%) followed by medium (13%) and large (6%) as in Table 2.

3.3 Composition of Fish Species

Composite carp culture is being adopted with a species range of two to six. Catla, Rohu and Mrigal were commonly cultivated by 61.3% of the farmers, followed by Catla and Rohu species by 9.7% of the farmers. Considering the species composition, three species combination was adopted by majority of the farmers (67.74%), followed by two (16.13%), four (12.90%), and six (3.23%) species (Table 3).

3.4 Technical Details

Fish culture in Krishnagiri district has been practiced in an extensive method. It was observed that the most of the carp farming practices were taken up as a single tier household enterprise with an average culture period of seven months and 60% survival (Table 4). The economic viability of integrated fish farming practiced by the farmers of Assam in North-Eastern part of India following extensive farming practices using low input technology was evaluated. The study revealed that integrated pig-fish farming with 6 species composition of fish namely catla, rohu, mrigal, silver carp, common carp and grass carp was the most extensively used farming system and was the most profitable enterprise followed by horti-pig-fish, poultry-fish and horti-fish farming [5]. Stocking of carps was about 45% higher than the advocated level of stocking. Farm made feed composed of rice bran, Ground Nut Oil Cake (GNOC) and Tapioca floor was generally used wherein the protein requirement of the feed was not taken into account. Also, the feeding was carried out without calculation of the total biomass of the ecosystem. Hence, the farmers were liable to pay more money for feeding the fish. The FCR was about to be 2.5 in the surveyed farms.

Table 2. Details of sample farms *(n=31)*

Farm category	Area range (ha)	No. of farms	Total area (ha)	Average area (ha)	% to total number of farms
Small	<0.5	25	2.071	0.083	81
Medium	0.5 – 1.0	4	2.465	0.616	13
Large	>1.0	2	2.886	1.443	6

Table 3. Distribution of species in sample farms

Species composition	No. of farmers	% to total
2	5	16.13
3	21	67.74
4	4	12.90
6	1	3.23
Total	**31**	**100.00**

Table 4. Technical parameters observed in the sample farms

Parameters	Observed practices
Application of organic fertilizers	Cow dung, Poultry manure
Application of inorganic fertilizers	Urea, Super PO_4 and Potash
Use of aquaculture facilities like aerators, pumps etc.	Being used
Labour	Family labour
Water exchange	3-4 times per year
Disease outbreak	Observed due to parasitic incidence
Mortality	40%
DO problem	Observed
Type of stocking and harvest	Single stocking and single harvest
Survival rate	60%
Application of probiotics	Not adopted
Total no. of days to get marketable size	7 Months
Harvest	Complete/ Total harvest
Type of culture	Composite fish culture (Single tier system)
Type of feed	Farm made feed

3.5 Economics of Carp Culture

Economic efficiency is a combination of technical and allocate efficiencies [6]. The economics of carp culture was calculated through estimation of Cost A, Cost B and Cost C as shown in Table 5. Carp yield relies on the use of quantity of variable inputs like seed, manure, feed, fertilizers, labour etc. Inflation rate has been increased gradually and cost of ingredients and fertilizer are also increased which affect the cost of production or the profit in fish culture practices. Among the variable inputs, seed cost accounted for 16.11%, followed by feed (13.58%), manure (5.44%), pond preparation (4.9%) and fertilizer (2.31%) to the average per ha Cost C. While interest on working capital accounted for 7.69%, interest on fixed capital was estimated as 4.91% to the average per ha Cost C. Implicit cost on family labour and depreciation were found to be 10.51% and 5.25%, respectively in the study region. Cost A was accounted for 56.76% to average per ha Cost C. The number of crops varied from one to three per year. The average output was 586.75 kg/ha/yr and the carps were sold @ Rs. 75/kg on an average. The net income was worked out to Rs. 23,623.35/ha in the traditional based integrated system of carp culture. Average figures per hectare reported by the Thanjavur carp farmers were 888.11 kg annual yields, Rs 19,961 (US$ 665.37) gross income, Rs 9,397 (US$ 313.23) total cost, and Rs 10,564 (US$ 352.13) net income [7]. Shivakumar et al. [8] compared the production and economics of three types of fish culture methods namely commercial feed based culture system, conventional feed based culture system and extensive method without feed. He found that highest production was recorded for commercial feed based culture system (3500 kg/ha/crop) when compared to other two systems i.e. 2500 kg/ha/crop for conventional feed based culture system & 1200 kg/ha/crop for extensive method without feed. The report also stated that more gross income was realised for commercial feed based system with an amount of Rs. 2.10 lakhs and the lowest was accounted for extensive method without feed (Rs. 0.72 lakhs) which clearly shows that the profit is more in commercial feed based system.

3.6 Marketing Channel

Four types of marketing channel were commonly observed wherein Channel I was adopted frequently in the study region.

Channel I : Farmer / Producer → Wholesaler → Retailer → Consumer (40%)
Channel II : Farmer / Producer → Retailer → Consumer (25%)
Channel III : Farmer / Producer → Wholesaler → Vendor → Consumer (15%)
Channel IV : Farmer / Producer → Consumer (20%)

Table 5. Economics of carp culture in sample farms

Particulars	Average cost (Rs./ha/yr)	% to cost C
Ploughing	1173.49	1.88
Leveling	1193.05	1.91
Liming	423.76	0.68
Water filling	270.56	0.43
Manure		
i) Cow dung manure	1385.38	2.22
ii) Goat manure	1717.87	2.75
iii) Other organic manure	293.37	0.47
Fertilizer		
i) Urea	559.56	0.90
ii) Super PO_4	439.90	0.70
iii) Potash	441.36	0.71
Feed		
i) GNOC	4495.14	7.20
ii) Rice bran	2525.62	4.04
iii) Other feed	1460.35	2.34
Seed	10059.46	16.11
Medicine	932.28	1.49
Depreciation	3276.34	5.25
Interest on working capital @ 9.5%	4800.85	7.69
Cost A	**35448.34**	56.76
Interest on fixed cost @ 11.5%	3064.86	4.91
Rental value of owned ponds	17377.50	27.82
Cost B	**55890.7**	89.49
Family labour	6563.96	10.51
Cost C	**62454.66**	100
Gross income	86078.01	
Yield	586.75	
Net income		
Cost A	50629.67	-
Cost B	30187.31	-
Cost C	23623.35	-

3.7 Constraints Analysis

The shortlisted constraints in farming practices categorized as resource, production and

management were analysed for its order of merit (Tables 6, 7,8 and 9).

Majority of the farmers revealed that non availability of credit was the main constraint (59.15) followed by seasonal water supply (58.45) as shown in Table 6. The farmers informed that insufficient farm area, inadequate transport facility, labour problem and environmental factors were the other inhibiting factors faced by the carp farmers. Study on block-wise and constraint analysis in Uttar Pradesh revealed that lack of finance was the most deterrent factor and prices of inputs like seed, feed, manure fertilizers, harvesting charges and rental value of leased ponds was perceived as the third most important problem by all the respondents [9].

The results (Table 7) revealed that non-availability of adequate quality seed (63.25) was observed as the major constraint as the farmers have to depend only on the seeds of government seed production centres based at Krishnagiri Dam and Hogainakkal. Additionally, the farmers felt that lack of technically skilled personnel for guiding them in fish culture (57.2), availability of commercial fish feed at high price (56.25) and disease outbreak (51.55) as major constraints. Pandey and Dewan [9] shared that assured supply of quality seed at the time of stocking was considered as the most important problem to the farmers. Nandeesha et al. [10] conducted a study in the feed management of major carps in India, with special reference to practices adopted in Tamil Nadu. The results showed that carp farming has gained popularity, particularly in areas such as Thanjavur District where water is not a major constraint; farmers have begun to realize the benefits of feeding floating pellets. However, availability and delivery to farmers are major constraints hindering the expansion of pellet feed-based carp culture.

Improper guidance was the first and foremost management constraint for the farmers with a mean score of 69. The other constraints include predation by birds/animals followed by pilfering and social problems (Table 8). Theft and poaching were considered as major inhibiting factors in case of village panchayat ponds [9].

Table 6. Resource constraints analysis of carp farming

S. No.	Resource constraints	Respondents		
		Sum of score	Mean Score	Order of merit
1	Temperature fluctuation during peak winter and summer months and other environmental factors	1048	52.40	V
2	Non-availability of credit	1183	59.15	I
3	Labor problem	1029	51.45	VI
4	Seasonal water supply	1169	58.45	II
5	Fluctuation in hardness of ground water	893	44.65	VII
6	Inadequate transport facility	1081	54.05	IV
7	Insufficient farm area	1168	58.40	III

Table 7. Production constraints analysis of carp farming

S. No	Production constraints	Respondents		
		Sum of score	Mean score	Order of merit
1	Disease outbreak	1031	51.55	IV
2	Mortality & less survival rate	1026	51.30	V
3	High price of commercial fish feed	1125	56.25	III
4	Absence of technically skilled personnel	1144	57.20	II
5	High cost towards land rent	1025	51.25	VI
6	Absence of facilities for genetic improvement & research in farms	855	42.75	IX
7	Lack of quality seed	1265	63.25	I
8	Absence of government support	925	46.25	VII
9	Poor water quality	897	44.85	VIII
10	Poor genetic resources	692	34.60	X

Table 8. Management constraints analysis of carp farming

S. no.	Management constraints	Respondents		
		Sum of score	Mean score	Order of merit
1	Pilfering & social problems	620	31	III
2	Predation of fishes by birds & other animals	1000	50	II
3	Improper guidance	1380	69	I

Table 9. Marketing constraints analysis of carp farming

S. no.	Marketing constraints	Respondents		
		Sum of score	Mean score	Order of merit
1	Lack of fish market for selling the produce	435	87	I
2	Location of farms in interior areas	375	75	II
3	Lack of timely selling of the produce	295	59	III

Lack of fish market for selling the produce was found to be major marketing constraint with the score value of 87 followed by location of farms in interior areas (75) and lack of timely selling of the produce (59) as depicted in Table 9.

The other constraints faced by the farmers were the uncertainty in demand, competition, and absence of Government institutions for marketing. Similar constraints like lack of infrastructures like road, cold storage and transportation facilities and lack of extension support were considered as the problems in the study carried out by Pandey and Dewan [9].

4. POLICY RECOMMENDATIONS

- Supply of quality fish seeds produced in bio-secured method should be ensured by the regional fisheries departments and research stations
- The government should enforce BMPs in all fish farms for quality fish production and safe environment
- Existence of block level Fisheries extension officers to guide the farmers in fish farming should be made.
- Mini fish feed mill could be established wherein locally available agricultural farm wastes can be effectively utilized for low cost feed production under PPP mode
- Farm inputs like seed, feed, fertilizers should be supplied and credit facility be enabled through societies as practiced in primary agricultural co-operative societies in each union for fish farmers.

5. CONCLUSION

Carp farming in Krishnagiri district finds its expansion due to good source of water. The study revealed that lack of scientific knowledge on fish farming, high feed and seed cost and poor technical skills are the reasons for realizing a low income of Rs. 23,623.35/ha. Empowering fish farmers on scientific fish farming through training and extending institutional support through supply of quality seed and farm inputs would help the farmers in rational decision of resource use and enhanced income and fish production. The price of fish could also be enhanced by adopting live fish marketing and direct marketing. In this line, the government institutions namely fisheries departments, fisheries research institutes and banks should address the requirements and bottlenecks to promote carp farming as a highly profitable enterprise in the locality.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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