International Journal of Environment and Climate Change

Volume 12, Issue 12, Page 1468-1475, 2022; Article no.IJECC.95890
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Economic Analysis of Inland Fish Production in Northern Dry Zone of Karnataka

Boniga Mohan Uday Raj [a#*], M. Y. Teggi [b†] and S. Y. Mukartal [c##]

[a] Department of Agricultural Economics, College of Agriculture, Rajendranagar, Professor Jayashankar Telangana State Agricultural University, Hyderabad-50003, India.
[b] Department of Agricultural Economics, College of Agriculture, Vijayapur, University of Agricultural Sciences, Dharwad – 580005, Karnataka, India.
[c] Department of Animal Science, College of Agriculture, Vijayapur, University of Agricultural Sciences, Dharwad – 580005, Karnataka, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2022/v12i121587

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/95890

Original Research Article

Received: 24/10/2022
Accepted: 29/12/2022
Published: 30/12/2022

ABSTRACT

Indian fisheries and aquaculture is an important sector of food production, providing nutritional security to the food basket, contributing to the agricultural exports and engaging about 14 million people in different activities. The present study was aimed to analyze economic and financial feasibility of inland fish production in Vijayapur and Bagalkote districts of northern dry zone of Karnataka. Primary data required for the study was collected from 60 sample farmers, 30 from each district in the study area for the year 2018-19. Financial feasibility tools (Pay Back Period, Net Present Values, Internal Rate of Returns and Benefit-Cost Ratio) were used to fulfill the specific

[#] Ph.D. Scholar;
[†] Associate Professor and Head;
[##] Assistant Professor and Head;
**Corresponding author: E-mail: udayrajmohan@gmail.com;*

objective. The total capital investment in inland fish farming of per pond was Rs.73309. The total cost involved for fish production was highest in Vijayapur district Rs.46782.28/pond/year compared to Bagalkote district Rs.38794.6/pond/year. The inland fish farming was financially feasible in both the districts as evidenced by Pay Back Period which is less than two years, net present value Rs.264047.50 in Vijayapur and Rs.246991.9 in Bagalkote districts, B:C ratio (1.84) in Vijayapur district, (1.92) in Bagalkote district and internal rate of returns higher than the opportunity cost of capital with 43 per cent and 45 per cent in Vijayapur and Bagalkote districts respectively.

Keywords: Inland fish farming; cost and returns; financial feasibility; benefit-cost ratio.

1. INTRODUCTION

The global production of fish, at around 160 million tons, is increasing due to growth in aquaculture. Climate change poses threats to both capture fisheries and aquaculture, but predictions of future production are uncertain. Changes in fish species' distribution and productivity can be attributed with high confidence to regional climate variability. Climate change may lead to increased production in some high-latitude regions, but decreased production in low-latitude regions. Fishing and climate change have strong interactions, with fishing making populations and ecosystems more sensitive to climate change. Inland fisheries are also threatened by changes in precipitation and water management. Extreme climate events are likely to have a major impact on future fisheries production. Reducing fishing mortality is the main way to reduce the impact of climate change [1]. Consumption of fish provides many health benefits such as healthy development of brain tissues and retina in children; lowers blood pressure, reduces blood clots, lowers blood fats and increases good cholesterol at the time of pregnancy it reduces the risk of delivering premature baby and strengthens the bones of mother [2].

India is one of the largest fish producing countries in the world and shares 7.58% to the global production. Contributing 1.24% to India's Gross Value Added (GVA) and 7.28% (2018-19) to the agricultural GVA, fisheries and aquaculture continue to be an important source of food, nutrition, income and livelihood to millions of people. Fisheries sector in India has shown impressive growth with an average annual growth rate of 10.88% during the year from 2014-15 to 2018-19. The fish production in India has registered an average annual growth of 7.53% from 2014-15 to 2018-19 and stood at an all-time high of 137.58 lakh metric tons during 2018-19 [3].

Karnataka is the 9th largest fish producing state in the country. It has 320km long coastline along with 27,000 sq.km continental shelf area, 5.65 lakh hectares of various inland water resources and has vast scope for fisheries development. The brackish water area of 8000 hectares also provides good scope for fish culture. There are about 9.61 lakh fishermen in the state of which 3.28Lakh fishermen in marine and 6.33Lakh fishermen are in Inland who are involved in various fisheries activities. During the year 2017-18, the total inland fish production of the state is 1.88Lakh tones.

The total inland fish production in Karnataka was 1,58,568 Mts. Shivamogga, Mandya and Bellary are top three fish producing districts about 17,443 Mts, 12,924 Mts and 10,388 Mts respectively. Karnataka contributes about (4.64 %) to total fish production in India. The Northern Dry Zone of Karnataka comprises of Koppal, Gadag, Dharwad, Belagavi, Vijayapur, Bagalkote, Bellary, Davangere and Raichur districts. Among these districts Vijayapur was the third highest (4,744 Mts) and Bagalkote was the third lowest (3,349 Mts) in fish production [4].

The objectives of the study were to estimate the cost structures and assess the financial feasibility of investment in the inland fisheries in Northern Dry Zone of Karnataka.

2. METHODOLOGY

This study was conducted in Northern Dry Zone of Karnataka. Northern Dry Zone consists of nine districts viz., Bellary, Raichur, Vijayapur, Davangere, Belagavi, Koppal, Bagalkote, Dharwad, and Gadag districts. Out of which Vijayapur and Bagalkote districts were selected purposively based on researcher convenience and by looking into third highest and third lowest fish production districts respectively for the period of 2018-19. The list of inland fish farmers was collected from Fisheries Research and Information Center, Bhutnal, Vijayapur and

Fishery Department office in the respective districts. From selected districts, sixty fish growers 30 each were selected. Thus sample size consists of 60 respondents. The data were collected by survey method with the help of well-structured and pre tested schedule.

2.1 Analytical Tools

2.1.1 Financial feasibility analysis

To evaluate the financial feasibilities of investment in inland fisheries, the standard tests viz. undiscounted cash flow measure a) payback period and discounted cash flow measures a) Net present worth, b) Benefit – cost ratio and c) internal rate of return were employed. In the study cash flow for ten years were considered at the discount rate of 12 per cent.

2.1.1.1 Net Present Value (NPV)

The present value represents the discounted value of the net cash inflows from the project. In the present study, discount rate of 12 per cent was used as an opportunity cost of capital. It can be obtained by

$$NPV=\sum_{i=1}^{n} Y_n (1+r)^{-n} -1$$

Where,

Y_n = the net cash inflows in the year n
r = discount rate
I = Initial investment

The decision rule associated with the Net Present Value is, the project will be accepted if its value is positive and reject if its value is negative (if the net present value is zero, it is a matter of indifference).

2.1.1.2 Benefit Cost Ratio (BCR)

The Benefit Cost Ratio (BCR) was worked out by using following formula

$$BCR = \frac{\sum \text{Discounted cash inflow}}{\sum \text{Discounted cash outflow}}$$

It measures the present value of returns per rupee of investment and it is a relative measure. The decision rule is that, accept the project, when BCR is greater than one, reject it when BCR is less than one and if BCR is zero, decision would be indifferent. Similar measures were used by Malgwi et al. [5].

2.1.1.3 Internal Rate of Return (IRR)

The rate at which the Net Present Value of the project is equal to zero is Internal Rate of Return (IRR) of the project. The net cash inflows were discounted to determine the present orth following the interpolation technique. The method of interpolation followed is as under:

$$IRR = \left[\text{Lower discount rate}\right] + \left[\text{Difference between two discount rates}\right] \times \left[\frac{\text{Present worth of net cash flow at lower discount rate}}{\text{Absolute difference between the present worths of net cash flows at the two discount rates}}\right]$$

Internal Rate of Return is a relative measure. To accept the project, the calculated IRR should be greater than the prevailing opportunity cost of capital.

2.1.1.4 Pay Back Period (PBP)

Payback period represents the length of time required for the stream of cash proceeds produced by the investment to be equal to the original cash outlay *i.e.* the time required for the project to pay for itself. In the present study, payback period was calculated by dividing the initial investment with average net cash inflow.

$$Payback\ period = \frac{Initial\ investment}{Average\ annual\ net\ cash\ inflow}$$

According to the payback criterion, the shorter the payback period, the more desirable is the project.

3. RESULTS AND DISCUSSION

3.1 Capital Investment in the Fish Pond

The construction cost of fish pond, the expenditure on tarpaulin, temporary farm building/shed, electric motor/ pumpset, pipe line and different equipments purchased specially for fish production were considered as a capital investment. It is the one time fixed investment incurred in the inland fish farming and the maintenance of these was made for every three years. Thus after every three years, 10 per cent of the total investment is involved in the total cost assessment as the repairs and maintenance is involved.

Table 1 shows the capital invested per fish pond (30×30 m) in the study area. In Vijayapur district, the establishment cost of fish pond was Rs.40000 which account for 37.08 per cent, followed by cost of tarpaulin of Rs.12000 (15.93%), pipeline cost of Rs.4500 (5.97%), cost of nets amounted to Rs.800 (1.06 %) and for farm building Rs. 7000 (9.29%). The total investment cost was Rs. 75336.

In Bagalkote district, the values for various costs incurred in investment in fish pond were as follows, for establishment of fish pond was Rs. 37300 (40.29%), tarpaulin Rs. 12000 (16.96%), pipeline Rs. 4500 (6.36%), nets Rs. 768 (1.09%) and for farm building Rs. 7000 (9.90%). The total investment costs Rs. 70742.

For the pooled data of both Vijayapur and Bagalkote districts, the total investment was Rs.73039. Among all the items of investment, the share of expenditure on construction of fish pond was the highest (Rs.38650) which accounted for 52.92 per cent. The other items of costs included cost of tarpaulin (16.43%), pipeline (6.16%), electric motor (or) pumpset (13.84%), nets (1.07%) and for farm building accounted for 9.29 per cent of the investment cost.

3.2 Cost of Production of Inland Fish in the Study Area

The per annum total cost incurred per pond in the study area was Rs.42788.44, of which the variable cost accounted for 37.83 per cent and total fixed cost (Rs.26,602.48/ pond/year) accounted for 62.17 per cent of the total cost.

The district wise results on cost incurred for inland fish production in Vijayapur and Bagalkote district are presented in Table 2. The total cost incurred in fish production in Vijayapur district was Rs.46,782.28/pond/year, of which the total variable cost was Rs.18,873.36/pond/year and accounted for 40.15 per cent of the total cost, while the total fixed cost (Rs.27,998.92/pond/year) accounted for 59.85 per cent of the total cost. Similarly, in Bagalkote district, total cost involved for fish production was Rs.38,794.60/pond/year, for which total variable costs (Rs.13,588.56/pond/year) accounted for 35.03 per cent of total cost and total fixed cost (Rs.25,206.04/pond/year) accounted for higher proportion (64.97 %) of total cost.

Table 1. Capital Investment in Fish Pond (30×30 m)

(Rs./pond)

SN	Particulars	Vijayapur	Bagalkote	Overall
1	Establishment of fish pond	40000 (37.08)	37300 (40.29)	38650 (52.92
2	Tarpaulin	12000 (15.93)	12000 (16.96)	12000 (16.43)
3	Pipe line	4500 (5.97)	4500 (6.36)	4500 (6.16)
4	Motor/ Pumpset	11036 (14.65)	9174 (12.97)	10105 (13.84)
5	Nets	800 (1.06)	768 (1.09)	784 (1.07)
6	Farm building	7000 (9.29)	7000 (9.90)	7000 (9.29)
	Total	75336 (100)	70742 (100)	73039 (100)

Note: Figures in parentheses indicate percentage to the total

Table 2. Cost of production of inland fish in the study area (pond/year)

(Rs. /Pond/year)

Sl. No	Particulars	Vijayapur (n=30)	%	Bagalkote (n=30)	%	Overall (N=60)	%
I	**Variable Cost**						
1	Fingerlings	3500.00	7.48	3000.00	7.73	3250.00	7.60
2	Fish feed	4550.00	9.73	3725.00	9.60	4137.50	9.67
3	Fertilizer	930.00	1.99	700.00	1.80	815.00	1.90
4	Lime	528.00	1.13	800.00	2.06	664.00	1.55
5	Hired labour	4198.00	8.97	2083.00	5.37	3140.50	7.34
6	Imputed value of family labour	1886.00	4.03	1074.00	2.77	1480.00	3.46
7	Miscellaneous*	1800.00	3.85	1200.00	3.09	1500.00	3.51
8	Interest on working capital @ 8%	1391.36	2.97	1006.56	2.59	1198.96	2.80
	Sub total	18783.36	40.15	13588.56	35.03	16185.96	37.83
II	**Fixed Cost**						
1	Rental value of land	17000.00	36.34	15100.00	38.92	16050.00	37.51
2	Land revenue	75.00	0.16	75.00	0.19	75.00	0.18
3	Depreciation	1883.60	4.03	1542.00	3.97	1712.80	4.00
4	Interest on fixed capital @ 12%	9040.32	19.32	8489.04	21.88	8764.68	20.48
	Sub total	27998.92	59.85	25206.04	64.97	26602.48	62.17
	Total cost of production (I+II)	46782.28	100.00	38794.60	100.00	42788.44	100.00

**includes water cost, transportation charges etc*

Among the variable cost items, the major share of Rs.4137.50 (9.67 %) was accounted by cost of fish feed followed by cost of fingerlings (Rs. 3250.00 and 7.60 %) and labour (7.34 %). Among the fixed cost items, the major share was from rental value of land which accounts cost of 37.51 per cent followed by interest on fixed cost 17 per cent of the total cost. Tara et al. [6] were also found same results as the largest cost item was feed which accounted for 28 per cent of the total cost.

The results revealed that, total cost involved in inland fish production in Vijayapur was more as compared to Bagalkote district; this is mainly because of quality of inputs and source of availability of inputs to the farmer was superior to the Bagalkote district farmers. Hence, the price of inputs was more in Vijayapur district. The results obtained as of total cost were in conformity with the results reported Brijesh et al. [7] and Harish [8].

3.3 Cost and Returns of the Inland Fish Farming

Cost and returns obtained from the inland fish farming in Vijayapur and Bagalkote districts are shown in Table 3. The total cost of production of inland fish per (30×30 m) pond in Vijayapur and Bagalkote districts were Rs. 46782.28 and Rs. 38794.60 respectively. The total cost of production on an average accounts of Rs. 42788.44.

The yield of inland fish in Vijayapur and Bagalkote districts were 1575 kgs and 1400 kgs respectively. The overall yield is 1487.50 kgs. The analysis of total returns form fish production indicates that the total returns obtained per pond (30x30m) per year in Vijayapur district was Rs.1,02,375 while it was Rs.91,000 per pond (30x30m) per year in Bagalkote district. On an average Rs. 96687.50 per pond per year was obtained from fish production. Fish production in the study area was found to be profitable as indicated by per pond net returns. Net returns in Vijayapur district was Rs. 55592.72/pond/ year and in Bagalkote district was Rs. 52205.4/pond/year. The average net returns were Rs. 53899.06/pond/year. Similar results were obtained by Sreenivas and Fauzie, 2016 [9] in terms of obtaining positive net returns.

The total cost involved for production for 1 kg of fish in Vijayapur district was Rs. 29.70 and in Bagalkote district was Rs.27.71. On an average total cost involved for production of one kg of fish was Rs.28.76.

The total yield obtained was highest in Vijayapur district (1575 kg/pond/year) compared to Bagalkote district (1400kg/pond/year). Thus, it clearly indicates that net returns and yield obtained in Vijayapur was more compared to Bagalkote district. This could be due to usage of good quality fingerlings, level of input application, management and care by the farmers towards fish production in Vijayapur district.

3.4 Financial Feasibility of Investment in Inland Fish Farming

The financial feasibility of investment in inland fish farming was assessed using most appropriate tools such as undiscounted measure like Pay Back Period (PBP), discounted measures as Net Present Values (NPV), Benefit-Cost Ratio (BCR) and Internal Rate of Returns (IRR) and the results were presented in Table 4.

The Pay Back Period for the establishment and maintaining of inland fish pond was lower in Bagalkote district (1.82 years) as compared to Vijayapur district (1.91 years) and this was due to higher net returns because of proper care and management followed at the fingerling stages of rearing. The recovery period of investment was less than 2 years rewarding the producer to earn sufficient income and the following years generates additional revenue.

Table 3. Cost and Returns realized in inland fish farming

Sl. No.	Particulars	Vijayapur (n=30)	Bagalkote (n=30)	Overall (N=60)
1	Total cost (Rs./Pond)	46782.28	38794.60	42788.44
2	Yield (kg/Pond)	1575	1400	1487.50
3	Price per Kg (Rs.)	65	65	65
4	Total returns (Rs./Pond)	102375.00	91000.00	96687.50
5	Net returns (Rs./Pond)	55592.72	52205.40	53899.06
6	Cost of production (per kg)	**29.70**	**27.71**	**28.76**

Table 4. Financial feasibility of investment in Inland fish farming

SN	Particulars	Vijayapur	Bagalkote
I	**Undiscounted measure**		
1	Pay Back Period (years)	1.91	1.82
II	**Discounted measure**		
1	NPV (₹/pond)	264047.5	246991.9
2	B:C Ratio	1.84	1.92
3	IRR (%)	43	45

Note: Discount rate @ 12% for the period of 10 years.

The per pond Net Present Values at 12 per cent discount rate for 10 years period in the inland fish farming is worked out to be Rs. 264047.5 and Rs 246991.9 in Vijayapur and Bagalkote respectively. The higher net present value in Vijayapur may be due to the continuous high net returns obtained during the economic life.

The IRR worked out for Bagalkote was higher (45 %) compared to Vijayapur (43 %). The IRR values of both the districts realized to be higher than the opportunity cost of capital *i.e.,* the lending interest rate (12 %) of banks for the long-term loans, indicates the higher average earning power of amount invested in inland fish farming.

The benefit-cost ratio at 12 per cent discount rate was worked out to be 1.84 and 1.92 in Vijayapur and Bagalkote districts, respectively. As the BCR values were more than unity, the investment made in both the districts in inland fish farming should be considered as profitable enterprise. Moreover, among both the districts, the BCR of Bagalkote was slightly higher than the Vijayapur which revealed that investment made in the inland fish farming in Bagalkote was relatively more attractive than Vijayapur. The study results were in conformity with Tara et al. [6] and Devi et al. [10] who studied on economics of fish production at Chitwan District of Nepal and Imphal-west district of Manipur respectively where the BC ratio was found to be more than 1 (1.63).

The foregoing results showed that BC Ratio was greater than unity, net present value was positive and IRR was higher than the existing interest rate of banks i.e., 12 per cent. The investment in inland fish farming would be recovered in less than 2 years in both the districts. Thus, the results of this study justified the farmers' investment in inland fish farming. All these measures were clearly disclosed that the investment in inland fish farming is a profitable and feasible enterprise. The financial feasibility results of the present study were in conformity with the study on economics of inland fish production in Karnataka [11].

4. CONCLUSION

The total capital investment in inland fish farming of 30x30m pond was highest in Vijayapur district (Rs.75336) compared to Bagalkote district (Rs.70742). The total cost involved for fish production in 30x30m pond was found to be higher in Vijayapur district (Rs.46782.28/pond/ year) than in Bagalkote district (Rs.38794.6/ pond/year). For the pooled data of both Vijayapur and Bagalkote district it was Rs.42788.44/pond/ year. The inland fish production activity was found to be a feasible occupation in study area as indicated by the results of financial feasibility analysis *viz.,* pay back period which is less than two years in both districts, Vijayapur (1.91) and Bagalkote (1.82), net present value of Rs.264047.50 in Vijayapur and Rs.246991.9 in Bagalkote districts, with corresponding B:C ratio of 1.84 and 1.92.

It is concluded that inland fish farming could be taken as subsidiary occupation by farmers that create additional revenue and increase their annual income. To increase the production, need based training have to provide to the inland fish farm farmers to develop skills in fish production. Extension agencies should approach inland fish farmers and inform them about subsidies, schemes and regarding training facilities. Incentives in terms of good quality fingerlings, provision of fishnets and other equipment at subsidized rate would encourages the rural youth to take up inland fisheries.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Brander, K. M. Global fish production and climate change. PNAS. 2007;104(50): 19709-19714.
2. Nashila R, Shekaran M. Consumer behavior about seafood and seafood safety. International Journal of Current

Advanced Research. 2018;7(1):8727-8736.
3. NFDB 2020. About Indian fisheries. Available:www.nfdb.gov.in/about-indian-fisheries (Accessed on 16 October 2020).
4. Anonymous. Inland fish production, Government of Karnataka, 2017-18. 2017;1-2.
5. Malgwi CJ, Mailumo SS, Akpoko JG. Comparative estimation of the costs and returns of integrated fish-based farming systems in Kduna Metrolis Nigeria. Asian Res. J. of Agri. 2017;6(3):1-9.
6. Tara S, Shivachandra D, Rishiram K, Kamala G, Jeevan L. Economics of fish production at Chitwan District of Nepal. Journal of Agriculture and Natural Resources. 2018;1(1):21-31.
7. Brijesh K, Biradar RS, Biswajit D, Sharma R. Economics of fish production in Bharatpur district, Rajasthan, India. Fishery Technology. 2013;50(2):180-184.
8. Harish KHR. An economic analysis of production, consumption and marketing of fish in North Karnataka. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, Karnataka, India; 2019.
9. Sreenivas, Fauzie AK. Income generating activity through community based fish farming: A case study in Chikkaballapur district, Karnataka, India. Int. J. of Fisheries and Aquatic Studies. 2016;4 (1):435-437.
10. Devi SZ, Singh NR, Anandkumar N, Laxmi TH. Fish production in Manipur- An economic analysis. Journal of Crop and Weed. 2014;10(2):19-23.
11. Kumar R, Umesh KB, Rajeesh E. Economics of inland fish production in Karnataka. Journal of Rural Development. 2007 26:121-136.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/95890