

Research Article

Economics of production and marketing of fish in Dang district of Nepal

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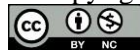
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ABSTRACT

A study was carried out to analyze the economics of fish production and marketing in Dang district of Nepal. Structured survey was done with 75 respondents (45 producers, 5 wholesalers, 10 retailers, and 15 consumers) in three different sites of Dang district (*viz.*: Lamahi Municipality, Rapti Rural Municipality and Gadhwara Rural Municipality). The initial investment, cost of production and returns, production function, price spread, and marketing margin, and ranking of production and marketing problems of fish were done by index ranking techniques. Financial analysis showed that the total initial investment per hectare of fish pond was found to be NRs. 968,394 with the annual production cost of NRs. 693,483. The total return was found to be NRs. 932,088 and net profit realized per hectare was NRs. 238,604. Out of total cost, about 73.70% was variable cost and the remaining 26.30% was fixed cost. Of the total variable cost, the cost of feed (58.63%) was significantly higher followed by the cost of fingerlings (12.94%), labor (11.37%), manure and fertilizer cost (8.33%) fuel/ energy (4.46%) and maintenance cost (4.27%), respectively. The benefit cost ratio (B/C ratio) was found to be 1.82 which implies that the fish enterprise was found to be profitable in the study area. The research also revealed that the producer's share was 78.17% with price spread of 71.57 and marketing efficiency of 90.81%. The value sum of the estimated parameters associated with all the inputs was 0.52 which indicates the decreasing return to scale. Lack of technological know-how and unavailability of inputs on time are the major production problems. Inefficient price information system and competition with the Indian fish are the major marketing problems. Thus, for sustainable production and marketing of fish government should focus primarily on technological dissemination and better pricing policy.

Keywords: Benefit cost ratio, fish, marketing, production function

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INTRODUCTION

Nepal has great potential for inland fisheries and possesses about 2.27% of the world's freshwater reserves (CBS, 2005). It has approximately 45,936 fishponds with 12,749 hectare water surface area and produces 62,735 tons of fish (MoALD, 2019). Fisheries and aquaculture contributes about 1.34% of the national gross domestic product (GDP) and 4.29% to agricultural gross domestic product (AGDP) (DoFD, 2017). As compared to the contribution in AGDP; investment in research sector is very low (Gairhe & Paudel, 2019). Nepal had expenses of NRs 430,568,423 to import only live fish in 2019 (TEPC, 2019).

An estimated 750,000 people are directly or indirectly involved in aquaculture activities nationally and the number is increasing (DoFD, 2017). Nepal has a diverse agro-ecological zone suitable for warm to cold water fisheries. Seven species of commercially valuable carps are being cultured in Nepal (Gurung, 2014) and these include three indigenous species: Rohu, Naini, Bhakur and four exotic species: Common carp, Silver carp, Bighead carp and Grass carp (Gurung *et al.*, 2005).

More than 90% of total fishponds centered in Terai regions of Nepal with 41,502 ponds and approximately 5% of the total area of the country is known to be occupied by different freshwater aquatic habitats (Bhandari, 1992). Dang district, having 600 commercial and small-scale fish producers with 672 ponds and 1 hatchery with 183 ha of total pond area has great potential for fish farming (DADO, 2017). In addition, being a fish block area under Prime Minister Agricultural Modernization Project (PMAMP), the number of ponds has increased to 1,285 with 4,689 kg/ha yield (MoALD, 2019). The demand of fish showed increasing trends due to people awareness about their health and nutrition. Therefore, adaptation of fish farming was found to be a sustainable way to meet the country demand in rather than importing and capture fisheries.

The cost of production and profitability of the fish farming differs due to locality, inputs price, and distance to market. Research by Sharma *et al.* (2018) reported that feed cost accounted 28 percent of the total cost of production followed by labor, fingerlings. So, this is focused to analyze the economics of fish production and marketing, production function, cost and return, benefit-cost ratio, and identify problems associated with fish production and marketing at Dang district of Nepal.

MATERIALS AND METHODS

Data collection and sources

Dang being a fish block area under Prime Minister Agriculture Modernization Project (PMAMP) is purposively selected for the study. A list of fish producers was obtained from Gadhawa Rural Municipality, Rapti Rural Municipality and Lamahi Municipality where about more than 45 families were involved in fish farming in each Municipality. From each municipality, 15 farmers were selected randomly and a total of 45 farmers were interviewed by a structured questionnaire. Besides, information was collected from traders (5 wholesalers and 10 retailers) and 15 consumers. Secondary information was also collected through a review of records, reports of the Ministry of Agriculture and Livestock Development (MoALD), Central Bureau of Statistics (CBS), District Agriculture Development Office

Data analysis technique

The collected data were tabulated, and the local units of measurements were standardized into the standard. Both descriptive and analytical methods were used to analyze the data. Information collected from the field survey and secondary sources were coded and entered on Statistical Package for Social Science (SPSS 20).

Initial investment

Initial investment was calculated by summing the cost for pond digging and dike management, seepage, and drainage management, boring with motor/pump set and pipes, purchasing of equipment like wires and net, construction of stores, residence and quarters and miscellaneous expenses.

Total Cost

Total Cost was calculated by the addition of total variable cost and total fixed cost incurred in the production process.

$$TC = TFC + TVC$$

Where, TC= total cost, TFC = Total fixed cost, TVC = Total fixed cost

TFC= Land rent + Interest on long term loan +Depreciation

TVC (Rs.) = Cost of fingerlings (Rs.) + Cost of feed (Rs.) + Cost of labor (Rs.) + Cost of manure and fertilizers (Rs.) + Cost of lime (Rs.) + Energy and fuel cost (Rs.) + Maintenance cost (Rs.)

Benefit-cost ratio analysis

For benefit-cost analysis total variable cost and gross return from fish farming were used.

$$B/C \text{ ratio} = \text{Gross return} / \text{Variable cost.}$$

Gross margin analysis

Gross margin refers to the difference between the enterprise gross return and the variable cost incurred. It shows whether the variable cost incurred in the production process is covered by the return obtained by selling the product.

Gross margin = Gross return – Variable cost

Gross Return = Price × Total quantity sold

Variable cost = Cost incurred for variable inputs

Production Function

Production function represents the relationship between inputs used and the output produced. The production function is a technical relationship between factor inputs and output (Koutsoyiannis, 1977). Cobb and Douglas provided with the formula that attempts to calculate the maximum amount of the output that can be generated from a certain number of the inputs (Cobb & Douglas, 1928). In this study Cobb -Douglas production function was employed as done by Xu & Jeffrey (1998). The specification of the function in logarithmic terms is given below:

$$Y = AX_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6}$$

$\ln Y = \ln A + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6$

Where,

Y = Gross/Total return (Rs /ha),

A = Constant or Intercept of the function,

X1 = Labor cost (Rs /ha),

X2 = Feed cost (Rs. /ha),

X3 = Fingerlings cost (Rs/ha),

X4 = Fertilizers and manure cost (Rs/ha),

X5 = Fuel and energy cost (Rs/ha),

X6 = Maintenance cost

$\beta_1 \beta_2 \dots \beta_6$ = Coefficient of respective variables,

ln = Natural logarithm

Price spread and marketing margin

Simply, the price spread is the total marketing margin. A lower price spread indicates more efficient marketing and vice versa. Marketing margin was estimated by subtracting the buying price of each intermediary by their selling price (Acharya & Agarwal, 2001).

Price spread = Retailer's price (Pr) - farm gate price (Pf)

Producer's share

Producer's share is the percentage of the retail price received by the producer and calculated as:

$P_s = (P_f / P_r) \times 100$ Where, P_s = producer's share, P_f = farm gate price, P_r = retailer's price

Marketing efficiency

Marketing efficiency can be estimated by using the following formula:

$E = O/I * 100$

Where,

E = marketing efficiency

O = output of the marketing system

I = cost of marketing including margin of intermediaries.

Higher the value of 'E' higher will be the marketing efficiency and vice versa. A higher value of 'E' is in favor of the producer or desired by farmers.

Problem of production and marketing

Severity of problem (S_p) was calculated as $S_p = \sum f_x / N$

Where, S_p = Severity of problem f = frequency of response X = Value of response category N = Total number of fish farms

The highest value indicates the most severe problem and severity goes on decreasing with descending S_p value.

RESULTS AND DISCUSSION

Socio demographic and farm conditions

The study area was dominated by the Janajati group (51.1%) followed by Brahmin/ Chhetri (46.7 %) and Muslim 2.2%. Fish farming was the primary occupation of 62.22% respondents, 24.45% of respondents opt for crop cultivation followed by services 11.11% and poultry

farming 2.22%. About 17.78% had primary education, 24.44% had secondary education, 22.22 percent had higher secondary education and 35.56% had university-level education. The average pond size of the respondents was 1.3 hectare.

Cost and return analysis

Initial investment

The initial investment for fish production is shown in Table 1. The study reveals that farmers need NRs. 968,394 for establishing a fish farms in one hectare. Among different component, construction of fishpond accounts for 47.60% of the initial investment.

Table 1: Initial investment for fish production

S.N.	Initial investment cost	Cost (NRs/ha)	Percentage
1	Pond construction	459603.5	47.6
2	Aerator	62000	6.42
3	Plastic pipes	12532.39	1.2
4	Motor and pump	41188.75	4.2
5	Fishing net	28639.78	2.95
6	Miscellaneous(fencing, guard quarters, storage house, medicine, mixed cropping)	364429.6	37.63
Total		968394	100.00

Source: Field Survey, 2018

Cost of fish production

The cost of fish production in the study area is shown in the Table 2. The total variable cost was about 73.7% of the total cost. Among the variable cost, feed cost solely accounts for 58.63%. Fingerlings (12.9%) was the second large cost item followed by labor (11.3%), manure and fertilizer (8.3%) fuel and energy (4.5%) and maintenance cost (4.27%), respectively. Study by Oluwemimo & Damilola (2013) found 78% variable cost of the total cost of production and Akinyle (2011) found 74% variable cost of the total cost of production in Nigeria while the feed cost accounts 24.72% of the variable cost. Similarly, Olasunkanmi (2012) found that variable cost accounted for 86.68% of the total cost of production and feed cost incur 34% of the total variable cost.

Table 2: Total cost and returns of fish production per year

S.N.	Variables	Cost (NRs/ha)	Percentage
1	Fingerlings	66,109.7	12.94
2	Feed	299,607	58.63
3	Energy/fuel	22,786.9	4.46
4	Maintenance	21,847	4.27
5	Labor	58,110	11.37
6	Fertilizer	42,586.3	8.33
Total Variable Cost		511,046.6	100.00
Fixed Cost		182,436	
Total Cost		693,483.1	
Gross Return		932,088	
Gross Margin		421,041	
B:C ratio		1.82	

Source: Field Survey, 2018

Awoyemi & Ajiboye (2011) also reported feed cost as the largest cost item with 17.7% contribution to the total variable cost of production. The study found the gross margin of fish production per hectare to be NRs 421,041 and B:C ratio was 1.82. Analysis of the gross margin of fish production per hectare and B:C ratio implied that fish farming was a lucrative

business in the Dang district. Olaoye *et al.* (2013) in Nigeria found a B:C ratio of 1.69 in fish farming.

Production function analysis

A Cobb-Douglas production function was estimated and presented (Table 3). Out of six factors included in the study, two variables: fingerlings and feed cost have a significant positive impact on fish production. The result implies that 1% increase in fingerling increases fish production by 0.35% and 1% increase in feed increases fish production by 0.25%. Additionally, the value sum of the estimated parameters associated with all the inputs is 0.52 which indicates a decreasing return to scale. This implies that 1% increase in these all production input variables leads to 0.52% increase in income from fish production. The coefficient of multiple determinations (R^2) of the model was 0.67 for fish production. It indicates that about 67% of the variation in gross return was caused by the explanatory variables. Interpret the F-value with its significance. A study by Sharma *et al.* (2018) also found fingerlings cost significant with fish production in Chitwan district. Akinyele (2011) found the coefficient of production as 0.78 which implies that production occurs in the second stage of the production function. Similar findings were obtained by Olagunju *et al.* (2007). Adewuyi *et al.* (2010) result also revealed that fish output was significantly determined by the cost of feed and the fingerlings.

Table 3: Estimates of Cobb- Douglas production function for fish production in the study area

Factors	Coefficient	Standard error	t-value	P-value
Fingerlings (Sizes)	0.351**	0.154	2.277	0.029
Feed (Qtl/ha)	0.245**	0.106	2.316	0.026
Manure and fertilizer (Qtl/ha)	-0.204	0.104	-1.956	0.058
Energy/fuel (Kw/hw/ltr)	0.21	0.37	0.571	0.571
Maintenance (Activity per hr)	-0.007	0.30	-0.818	0.818
Human Labor (Activity per day)	-0.010	0.26	0.709	0.709
Constant	8.661*	1.500	5.742	0.000
Other Statistics				
Multiple R	0.608			
R Square	0.670			
Adjusted R Square	0.61			
Standard Error	0.92			
F-Value	13.72			
Return to scale	0.52			
Number of observations	45			

Note: * and ** indicates significant at 1 and 5 percent level of significance respectively

Marketing Channel

Marketing channel is a process, and it involves step by step passing of commodity from producer to consumer. It starts with the producer and ends with the consumer. Farmers themselves either sell their fish from the production site or send it to local markets. In the study area, four different marketing channels were found which are as follows:

Producer-Marketing/Supplier-Retailer-Consumer

Producer-Wholesaler-Retailer-Consumer

Producer-Retailer-Consumer

Producer-Consumer

Fish is generally marketed through a middleman/contractor if there is a huge production (Karki, 2016; Mishra & Kunwar, 2014). Most fisheries and aquaculture production in Nepal is consumed mostly by the domestic market (Labh *et al.*, 2017). The marketing channel of fish in Nepal has not been systematic (Karki, 2016) and varies from place to place. There is a long marketing channel and marketing problems are lack of transportation, fish diseases, lack of financial facilities, frequent strikes, fish theft, lack of research about fish marketing, unhygienic storing condition, lack of specialized fish marketing manpower and lack of adequate marketing infrastructure (Kumari, 2015). Domestic fish markets development in Nepal will play a very crucial role in the development of the fisheries sector (Husen, 2019).

Price Spread and marketing margin

Price spread simply shows the difference between producers' price and retailers' price whereas the marketing margin represents the difference between two successive stages of the marketing channel. The result showed that producers' share of retailers' price was 78.17%. The marketing efficiency index was 90.81%.

Table 4: Marketing Margin, Marketing Efficiency, Price Spreads, Producers share

Description	Buying Price (NRs/kg)	Marketing Cost (NRs/kg)	Selling Price (NRs/kg)	Marketing Margin (NRs/kg)	Marketing Efficiency (%)	Price spread (NRs)	Producers share (%)
Farm gate			256.43		90.81	71.57	78.17
Middleman	200	30	280	50			
Wholesaler	205.12	10	315	99.18			
Retailer	244.23	10	328	83.7			

Source: Field Survey, 2018

Production and Marketing Problems

Various factors hindering the fish production and marketing were index and ranked (Table 5) and (Table 6). The study showed that lack of technical knowledge was found to be the major problem followed by shortage of labor, timely unavailability of inputs, fingerlings unavailable at the time of need and shortage of water respectively. Gurung *et al.* (2010) also reported that lack of sustainable fingerling supply is one of the major problems of fish farmers. Shortage of fingerlings supply, disease problems, lack of human resources, lack of marketing infrastructure, are the major problem faced by the fish farmers (Karki, 2016).

Table 5: Ranking of major problems of fish farmers in the study area

Production problems	Index	Rank
Lack of technical knowledge	0.74	I
Labor shortage	0.61	II
Unavailability of inputs	0.60	III
Unavailability of fingerlings	0.56	IV
Water shortage	0.49	V

Source: Field Survey, 2018

The study revealed that inefficiency in price information system was found to be the major problem followed by Compete with Indian fish, lower price, not established market and distance to the market respectively. Husen (2019) also mentioned the lack of a specialized fish market as a major problem in the marketing of fish in Nepal. Rai *et al.* (2008) also reported that competition with Indian fish as a major marketing problem for the fish farming population in Nepal as Indian fish traders are well established and fishes from India are also

supplied consistently.

Table 6: Ranking of major marketing problems in the study area

Marketing problems	Index	Rank
Inefficient price information system	0.68	I
Competition with Indian fish	0.65	II
Poor price	0.63	III
Lack of market	0.60	IV
Distance to the market	0.422	V

Source: Field Survey, 2018

CONCLUSION

Fish farming was found to be a lucrative agribusiness in the study area. Among all the variable cost, feed cost was the major cost associated with this business. Fingerlings and cost of feed were the major factors with significant positive impact on fish production. Lack of technical knowledge, shortage of labor, timely unavailability of inputs, fingerlings unavailable at the time of need and shortage of water were the production problems and inefficiency in price information system difficulty to compete with Indian fish, lower price, lack of established market and distance to the market were the major marketing problems in the study area. Since fish farming is a profitable business, its production and productivity should be enhanced which not only increases employment but also increase national income. Similarly, training on fish production and marketing should be provided to fish farmers to increase their income, engagement as well as food security.

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Authors' Contributions

SP was the lead investigator and the initiator of the study also responsible for literature search and write-up. KA, and SS were responsible for the literature review and data collection. SG, AB, and JL provided critical feedback on the research design, data collection and edit manuscript. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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