

# Value Chain Dynamics of Freshwater Aquaculture: A Study from Peri-Urban Areas of National Capital Region, India

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## ABSTRACT

Fisheries and aquaculture are the critical sources of nutrition, livelihood, and income-making venture in many low-income and developing countries. In India, it acts as a major sector with huge export potential. Though the nation has created a significant market niche for fresh and processed fish products, the marketing sector is not exempted from intermediary people's exploitation. In the present study, attempts were made to compare the cost of production and net income of fish growers and processors and map various channels of peri-urban areas. A significant difference was observed in the cost of production of fish growers and processors ( $t = 5.630$ ,  $p < 0.05$ ), whereas no significant difference was observed in terms of net income ( $t = 1.453$ ,  $p = .171$ ). Three different marketing channels were identified among fish growers and fish processors. Producers' share in consumers' price was varied from 50.44 percent to 100 percent in different channels. The study further revealed that the marketed and marketable surplus availability of the produced fish (mean rank 11.25) is the primary element motivating the fish farmers to opt for value addition.

**Keywords:** Marketing channels, Marketing efficiency, Price spread and Postharvest Decision

## INTRODUCTION

India's agriculture and allied sectors face the most important challenge of how the farmers can escape from the vicarious circle of financial losses and make it a life-supporting profitable venture. Among many of the allied components of agriculture, fisheries are considered an important option for attaining economic viability and sustainability of the farming activities (Jayasankar, 2018). India's fisheries sector went through its loftiness during the blue revolution era and continues its superior position in the Indian agriculture sector with the largest volume in India's agricultural exports with 10.51 lakhs tonnes of fish and fish products in terms of quantity and Rs. 33,442 crores in economic value (NFDB, 2015). Simultaneously, the consumers' food preferences and consumption patterns have contributed to its increased demand. People are more cautious in selecting nutritionally rich and quality products in ready-to-eat or cook forms of fish-based products. The mounting demand for fish and fishery products is mostly met from aquaculture and culture-based capture fisheries in India's water bodies and ponds. Inland fish production has shown a remarkable increase from 0.22 million tons

in 1950-51 (Singh *et al.*, 2015) to about 3.4 million tons in 2014-2015 (NFDB, 2015).

As a means of additional income generation, processing, value addition, and innovations in fisheries' marketing have been suggested by many agencies working for farmer's welfare and development in this region. Since India's marketing system is very much fragmented and middlemen are the main agents, farmers and processors need to face many hurdles even after processing. In this present study, an attempt has been made to determine the different preferred marketing channels among the fish farmers and fish processors. A detailed economic analysis in terms of marketing efficiency, producers share in consumer price etc., also has been made. In the end, a qualitative analysis of the determinants of post-harvest decision-making among the fish processors was also studied and discussed.

## MATERIALS AND METHODS

The present study was conducted in peri-urban area of NCR. Haryana ranks 2<sup>nd</sup> in the country in per unit fish productivity of 5,800 kg/ha/per year during 2013-14,

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followed by Punjab (Economic Survey of Haryana, 2015) and situated in the peri-urban area of NCR. Karnal district has located a place with a more outstanding market and institutional accessibility concerning fisheries. Hence, the Karnal district of Haryana state was selected purposively as the study area for the present study. An inclusive list of fish farmers and fish processors of Karnal was collected with the help of experts from ICAR institutes like Krishi Vigyan Kendra (KVK) of National Dairy Research Institute (NDRI), Regional Station of Indian Agricultural Research Institute (IARI), Fisheries Department of Haryana state and progressive/ contact fish farmers in the Karnal region. The reliability and validity of the scale developed for identifying the motivating factors of post-harvest decision-making were tested with a sample selected from the recognized fish processors. Twenty respondents comprised of ten processors and ten fish growers were chosen randomly for the actual measurement of different variables like market channel identification, measurement of marketing efficiency in different identified channels, and the factors contributing to the post-harvest decision taking among the fish processors. For identifying different marketing channels, detailed personal interviews of intermediaries, market personnel, and discussion with fish farmers groups were also carried out. Data collection, detailed study, and interpretation were conducted from December 2014 to May 2015. Data collected were analyzed with the help of SPSS 20 and Excel Stat software to draw a valid conclusion. The comparison of the average cost of production and average net income of fish farmers and processors was made by employing students 't' test. In this region, the fish farmers were growing fish in the open ponds owned by them or the panchayath ponds taken by lease. The cost of production and profitability analysis was done by taking one hectare of the pond as a unit. For analyzing the marketing efficiency in different channels recognized in the study area Shepherd's (1972) marketing efficiency index and Acharya's marketing efficiency index (Acharya and Agarwal, 2001) were used.

A Likert-like summated rating scale was adopted for measuring the motivating factors for the post-harvest decision-making among processors (Likert, 1932). Construction of this scale involved the following steps, defining the construct (which one can able to measure the magnitude. Here the construct was motivating factors for processing among the fish growers), identification and operationalization of dimensions under the construct (three different dimensions identified were market-related factors,

income-related factors, and consumers preference related factors), finally collection and development of items (these are the statements representing each dimension of the construct under study). Items were collected and developed based on the literature review, consultation with the experts from Agricultural Extension, Agricultural Economics and Post Harvest Technology Divisions of IARI, and the field experience. The selection of the items was in line with the criteria suggested by Edward (1969). Items were analyzed with the help of experts and a group of 40 respondents during the study. Selected items for the scale were primarily given to the respondents for rating in 3 point continuum. A scoring pattern of 1 to 3 was adopted for the continuum, starting from least important to most important. A reverse scoring pattern was adopted in negative statements. On the basis of the total score, upper and lower 25 percent of the subjects were selected as a referent group for calculating 't' value. Items or statements were chosen on the basis of a higher 't' value over a cut-off point of 1.75.

## RESULTS AND DISCUSSION

Net income and cost of production of fish per hectare were analyzed in both the fish processors group and fish producers group. It is evident from Table 1 that, the total cost of production of fish/ha and total cost of production cum value addition of fish in terms of cutting, cleaning, packing, storing, and giving place utility these are the major form of value addition done by the fish growers in peri-urban region of NCR) differed significantly ( $t = 5.630$ ,  $p < 0.05$ ) among fish producers and fish processors. The total cost of production of fish/ha was about Rs.  $117397.50 \pm 2619.83$  and total cost of production cum value addition of fish/ha was about Rs.  $172561.30 \pm 9441.22$ . The average net income of fish processors was Rs.  $332088.70 \pm 39332.28/$  ha and that for producers was Rs.  $269302.50 \pm 17874.72/$  ha. Analysis of fish processors and producers' average income did not show a statistically significant difference ( $t = 1.453$ ,  $p = .171$ ). From these results, it is evident that even if there is a difference in fish processors and producers' net return, value addition in fish considered under this study did not make a huge difference in net return. Similar results were observed in the findings of Newsad (2005) and Ghorai *et al.* (2014). Value addition and processing of fish would make a huge difference in the income of fish farmers if they were supported with all technologies to make value-added products provided a high demand for the processed food.

**Table 1: Average net income and average production cost of fish processors and fish producers**

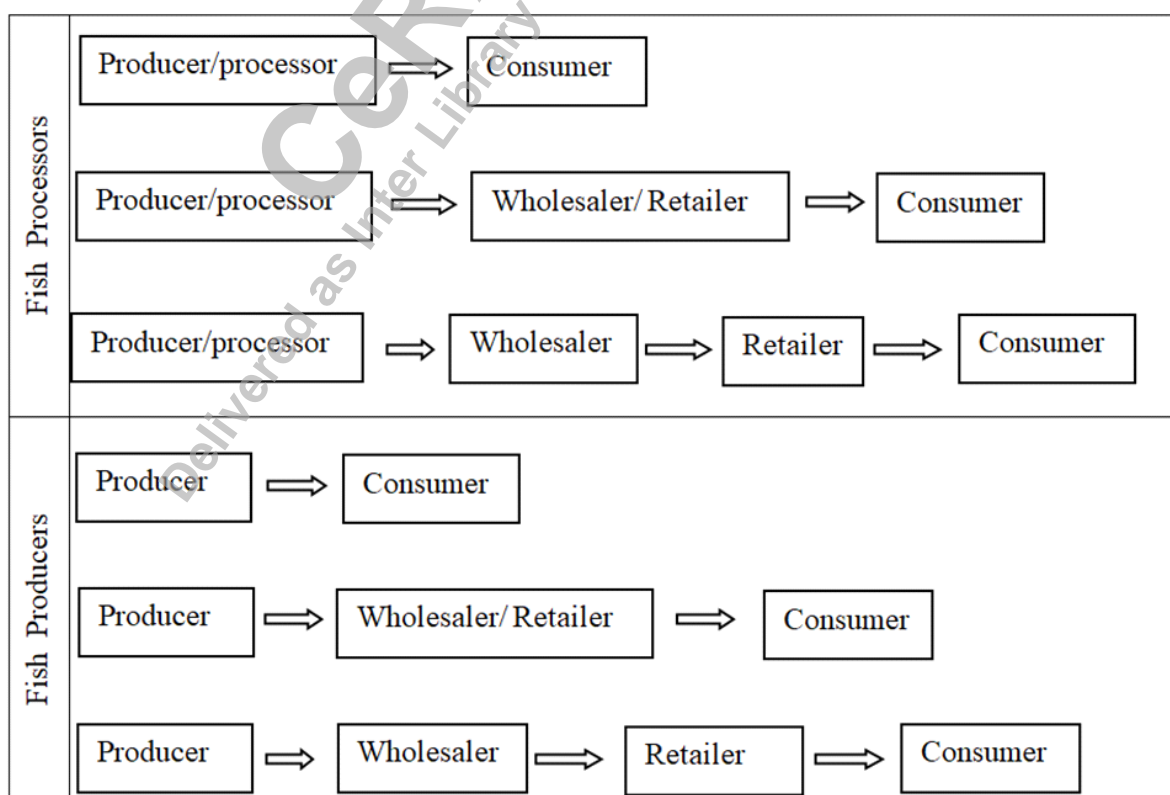
Cost/Returns (Rs/ha)	Respondents	Mean	Std. error of mean	Levene's Test for Equality of Variances	t-test
				F(Prob. F)	t, DF(Prob. t)
Total cost	Processor	172561.30	9441.22	6.435 (p=.021)	5.630, 10.37 (p<0.001)
	Producer	117397.50	2619.83		
Net returns	Processor	332088.70	39332.28	12.396 (p=.002)	1.453, 12.56 (p=.171)
	Producers	269302.50	17874.72		

\*DF=Degrees of freedom; F=Value of the F-statistic; t= Value of the t statistic; p = probability

Consumers' preference revealed that the demand for fish in raw form or cleaned and value-added form was more or less the same. Ganesh Kumar *et al.* (2008) showed that the fish marketing and processing system is inferior and highly inefficient in India compared to fish production achievements.

Detailed interviews conducted among the processors, producers, and market intermediaries in the study area (Karnal) revealed that there were three well-established marketing channels for value-added fish and fish as such (Figure 1). As the number of middlemen increases, some remarkable difference was found in the market margin and price spread among these channels.

The respondents under fish processors also held the title of a producer too. They were cultivating fish by themselves and making value addition to it. Three channels identified among them were as follows; channel I producer/processor - consumer or direct marketing channel, channel II producer/processor - wholesaler/retailer - consumer with one intermediary between processor and consumers, and channel III, producer/processor – wholesaler – retailer - consumer with two intermediaries (Figure 1). These intermediaries may come from Delhi and some other urban areas. Similarly, among fish producers also three different channels were identified as Channel I (producer-consumer), Channel II (producer



**Figure 1: Existing marketing channels identified among fish processors and producers**

- wholesaler/retailer - consumer), and Channel III (producer – wholesaler – retailer - consumer). Similar results were observed in the studies of Devi *et al.* (2014). According to them, the channels identified were Dealers - Small retailers - Consumers and Dealers - Large retailers - Consumers. The marketing costs and margins were also found to be less in direct selling channels because of the reduced length. Hossain *et al.* (2015) and Aswathy *et al.* (2014) were also indicated the same.

From Table 2 it is well evident that fish producers were getting more net returns (Rs. 262752.5/ha) than the persons whoever were doing the value addition (Rs. 195071.2/ha), inclusive of all marketing cost. Marketing channel analysis showed that in both the group (fish processor and fish producer) channel I (direct selling channel) was the most efficient channel with 100 percent of producers share in consumer's price. In channel II of fish processors, producers' share in consumers' price was about 60.78 percent. In this channel about 40 percent of consumer price was taken up by the intermediaries. Channel III was identified with the lowest percentage of producers share in consumers' price (50.44%). In the case of fish producers, channel II has been giving 73.72 percent producers share in consumers' price, whereas channel III gave only 54.56 percent share. Similar findings were also reported by Goswami *et al.* (2013) that fish farming is an

economically viable enterprise with the benefit-cost ratio ranging from 2.22 to 4.44 and producer's share in consumer's rupee ranges from 52 percent to 93 percent. The opportunity to take margin by the intermediaries or middlemen was found low in the fish producers' channel than the fish producer cum processor channel. Marketing efficiency by Shepherd's formula also indicated the same. This index was found in increasing order in channel I, channel II and channel III of the fish processor, which showed the opportunity of middlemen to make more profit when the length of the chain is increasing. But in the case of fish producers, it has been observed in decreasing order (Channel I - 55.24, Channel II -20.69, and Channel III - 20.5). It revealed the less opportunity of intermediaries to take much margin. These results were on par with the findings of Sathadhas *et al.* (2011) and Aswathy *et al.* (2014). Present study results were also comparable with earlier results (Gupta, 1984) wherein fishermen's share was reported uppermost (95%) in direct selling channel to consumers and lowest (27.9%) in channels involving multiple players and multi-locations. Another study by Ganesh Kumar *et al.* (2008) showed that marketing efficiencies in different marketing channels of fish varied from 34 percent to 74 percent, depending on the span and length of the market channel. As the present study also identified that the increased number of intermediaries reduced the marketing efficiency of the channel, findings

Table 2: Average price spread in different marketing channels of value-added fish and raw fish

S. No.	Particulars	Fish Processors (Rs. /ha)			Fish Producers (Rs. /ha)		
		Channel I	Channel II	Channel III	Channel I	Channel II	Channel III
1.	Cost of production	172561.3	172561.3	172561.3	117397.5	117397.5	117397.5
2.	Marketing cost of producer/processor	137017.5	137017.5	137017.5	6550.0	6550.0	6550.0
3.	Gross returns to producer/processor	504650.0	504650.0	504650.0	386700.0	386700.0	386700.0
4.	Net returns of Producer/processor (MM) (3-(1+2))	195071.2	195071.2	195071.2	262752.5	262752.5	262752.5
5.	MC of wholesaler	0.00	35120.0	35120.0	0.00	18790.0	18790.0
6.	MM of wholesaler (7-3+5)	0.00	140480.0	140480.0	0.00	119010.0	119010.0
7.	Gross price to wholesaler	0.00	830200.0	830200.0	0.00	524500.0	524500.0
8.	MC of retailer	0.00	0.00	22790.0	0.00	0.00	7610.0
9.	MM of retailer (10-7+8)	0.00	0.00	11550.0	0.00	0.00	176640.0
10.	Consumer price	504650.0	830200.0	1000350.0	368400.0	524500.0	708750.0
11.	Producers share in consumers price (3/10)*100	100.00%	60.78%	50.44%	100.00%	73.72	54.56%
12.	Marketing efficiency (Shepherd) [(V/TMC)-1]	2.68	3.82	4.13	55.24	20.69	20.5
13.	Marketing efficiency (Acharya) [Gross return of producer/(TMC+TMM)]	3.22	0.99	0.93	1.43	0.94	0.65

were on par with the previously stated results. But the study by Madugu and Edward (2011) revealed that processed fish marketing was profitable compared to the fresh fish market. According to Acharya's method, marketing efficiency indicated channel I was most efficient in terms of profit obtained by the producer cum processor. It was followed by channel II and channel III. The same case has been observed in the marketing channels of fish producers also. Fish marketing in India has received little attention from public agencies and is mainly handled by the private sector. As a result, there are many intermediaries in the marketing channels, especially in the freshwater fish sub-sector, thus reducing the share of fishers/aquaculturists in consumer rupee and contributing to the high retail prices (Ganesh Kumar *et al.*, 2010).

The profitability pattern of producers and processors obtained from the study results tossed a question in front of us. What motivates the processors to persist with processors' status, even after values addition in the inland fish marketing chain is less profitable. Respondents were asked to mark their preference in a 3 point continuum for the perceived importance of selected 13 factors for post-harvest decision-taking. These factors were compared using Friedman's two-way ANOVA. It can be inferred from the results ( $p < 0.05$ , Chi-Square = 66.772 and  $df = 12$ ), that the level of influence of different factors on the post-harvest decision making among fish processors has differed significantly. Since the fish processors were fish producers

too, marketed and marketable surplus availability of the fish (Mean Rank 11.25) with the producers was identified as the most critical factor in post-harvest decision-making (Table 3). They were selling value-added fish in their brand name, and the acceptance of these products and the credibility which has been obtained from the brand name, in turn, make more demand for their products. Because of the above-stated reason, processors identified branding and new look of products (Mean Rank 10.75) as the second most crucial factor which motivates them to undertake post-harvest operations of fish. Price of value-added food (Mean Rank 10.40) and increasing demand for fish products in urban areas (Mean Rank 9.90) were also important motivators identified by the fish processors. Consumer satisfaction and loyalty, labour availability, and rising disposable income in hand with mean ranks 7.10, 6.70, and 6.30 respectively have been identified as moderately important motivators (Table 3). Fish has been in high demand and gets a remunerable price all season in northern India. Since the fish farmers are not troubled by the lack of consumer markets, the reason to avoid distress sales has been given the lowest rank (Mean Rank 3.85) by the respondents. It was identified as the least important factor to motivate the processor to take post-harvest decisions. Similarly, market margin obtained due to elimination of middle man (Mean Rank 3.85) also rated as a least critical motivator to take post-harvest decisions. It is well evident from the market channels identified in the study area that many players and middlemen were also

**Table 3: Motivating factors for post-harvest decision making among fish processors based on mean ranks of Friedman's test**

S.No.	Factors	Mean Rank	Groups**		
1.	Marketed and marketable surplus availability	11.25	A		
2.	Branding and new look of products	10.75	A	B	
3.	Price of value-added food	10.40	A	B	
4.	Increasing food demand in urban areas	9.90	A	B	
5.	Consumer satisfaction and loyalty	7.10	A	B	C
6.	Labour availability	6.70	A	B	C
7.	Rising disposable income in hand	6.30	A	B	C
8.	Transportation facilities to market	5.75	A	B	C
9.	Changing consumer needs and choice	5.75	A	B	C
10.	To minimize wastage	5.45		B	C
11.	Competition from the market	3.95			C
12.	Market margin obtained due to elimination of middle man	3.85			C
13.	To avoid distress sale	3.85			C

\*\*Mean ranks having same letters are not significantly different

present in value-added fish marketing. It would not be possible to eliminate them since the production of fish was consistently high in the study area, and in the local market, they cannot be able to sell all the produce. Multiple pairwise comparisons using Nemenyi's procedure revealed that 13 motivating factors identified can be grouped into three different homogenous groups (since letter groupings are A, B, and C). But the effect of marketed and marketable surplus availability is identified as quite prominent for taking the post-harvest decisions by the fish farmers. Since fish is a high-value commodity with the assured market in the urban and peri-urban areas and with many intermediaries in the channel, competition from the market, market margins obtained, and distress sale were identified as the minor motivating factors for the post-harvest decisions making. The products' market availability and price are the two critical components in the sustainment of fish farming and processing, as identified by the previous studies (Ganesh Kumar *et al.*, 2008 and Ayyappan *et al.*, 2009).

### CONCLUSION

The inland fisheries sector in India needs to develop more in terms of processing and value addition to harness economic potentiality and reduce post-harvest losses. From this study results, it can be concluded that value addition in terms of cutting, cleaning, packing, etc., to create time and place utility could not produce much profit to the processors compared with fish producers ( $t = 1.453$ ,  $p = .171$ ). To make a substantial profit, processors need to concentrate more on producing value-added products like fish chips, fish fingers, fish balls etc., which has an excellent domestic and export market. Since the initial investment for fish processing units is very high, it might not be in an affordable cost range for single processors. Group funding and processing have been identified as viable options to overcome this condition.

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