

Supply Chain Management in Fisheries Industry: A Case Study of Karnataka

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Abstract—The Supply chain management assists the stakeholders to perform Supply added operations, add Supply to the product and have better returns from the market. This paper attempts at Supply chain management practices adopted by the players of the marine fisheries chain in KARNATAKA and how much Supply they are adding to the final fish product. The study has been structured to capture the essence of the processes and flow of the Supply chain in Marine fisheries. The study is designed in such a way that it addresses various research questions like the basic Supply chain structure, Supply added operations in fisheries Supply chain, cost of each operation along with price increase and finally the final price of the product. In this paper, in order to suggest the suitable Supply chain, thorough market research was conducted to study the Supply Chain Management practices employed by Fishermen, Middlemen, Retailers, Head loaders and Cycle carrier with respect to fresh fish in the coastal area of the State of KARNATAKA, India.

I. INTRODUCTION

The Supply Chain, also known as Supply Chain Analysis, is a concept from business management that was first described and popularized by Michael Porter in his 1985 best-seller book, *Competitive Advantage: Creating and Sustaining Superior Performance*. Michael Porter coined the term Supply system which means a larger interconnected Supply chains. Porter (1985) described the Supply system right from the supplier to the customer. The Supply system integrates the supplier of the firm (and their suppliers all the way back), the production centre or the firm itself, the distribution channels and the buyers of the firm. Another Supply chain thinker Lynch (2003) described Supply chain as a series of activities which includes purchasing,

manufacturing, distributing and marketing of company's products.

If an attempt is made to understand the insights of Supply chain concept, some of the individuals and institutions have given their understandings. Porter (1990) in his book opined that the Supply Chain framework is an interdependent system or network of activities, connected by linkages. Pathania-Jain (2001) proposed that the system should be managed carefully so that the linkages can be vital source of competitive advantage. Lynch (2003) discussed about Supply chain analysis and said that it entails the linkage of two areas which are the Supply of organizational activities with its main functional parts and the second the assessment of the contribution of each part in the overall added Supply.

World Business Council for Sustainable Development (WBCSD) defined as Supply chain refers to full life cycle of a product or process which includes sourcing of raw material, production, consumption and finally disposal of the product. Sustainability, UNEP and UNGC (2008) referred Supply chain as it encompasses thinking about the Supply created by the chain, particularly for end-use customers.

Kaplinsky, R. and M. Morris (2001) in their book titled "A Handbook for Supply Chain Research" which was prepared for the International Development Research Centre (IDRC) described Supply chain as the full range of activities, which are required to bring a product or service from conception, through the intermediary phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use.

Porter (1985) has given a definition of Supply chain in his book “Competitive Advantage” as the basic tool for diagnosing competitive advantage and finding ways to enhance it is the Supply chain, which divides a firm into the discrete activities it performs in designing, producing, marketing, and distributing its products. While Porter in 1990 said that Supply chain concept decomposes all activities of one firm into parts and analyses each individual activity and their interdependence”.

Brown (1997) considers, as a tool the Supply chain divides a business into strategically relevant activities. Through the company is able to identify the sources of competitive advantage and perform these activities more cheaply or better than its competitors. Walters and Lancaster (2000) have offered Supply chain definition as a business system which creates end user satisfaction (i.e. Supply) and realizes the objectives of other member stakeholders. Keeping in view, the advantages of Supply chain management, in this paper, an attempt has been made to evaluate the Supply Chain Management practices employed by fishermen, Middlemen, Retailers, Head loaders and Cycle carrier with respect to fresh fish and dry fish in the State of KARNATAKA, India.

II. OBJECTIVES OF THE STUDY

A Case Study of KARNATAKA” has been structured to capture the essence of the processes and flow of the Supply chain in Marine fisheries. The study is designed in such a way that it addresses various research questions like the basic Supply chain structure, Supply added operations in fisheries Supply chain, cost of each operation along with price increase and finally the final price of the product. The specific objectives of the study are:

- To identify the different Supply Chain Actors in marine fisheries sector.
- To make comprehensive study on various Supply chain actors, their role in Supply chain management of fisheries in relation to various markets.
- To assess various operational costs involved at each stage of fish catch to processing.
- To suggest the suitable Supply chains to the key stakeholders of the sector.

III. REVIEW OF LITERATURE

While conducting desk research of previous studies, it was found that there were some researchers who did Supply chain analysis earlier in some sectors, industries and even in some management functions.

- Ching Chyi Lee and Jie Yang (2000) conducted Supply chain research in knowledge sector and proposed a knowledge Supply chain model.
- Vorster (2001) organized Supply chain research in mines sector and proposed mining Supply chain.
- Vander Merwe and Cronje (2004) organized Supply chain management research in education sector and proposed education Supply chain.
- Gabriel (2006) has done Supply chain research in service sector and proposed Supply chain framework for customized services.
- Rijejan Landry et al. (2006) has done research in health sector and designed Supply chain model for health organizations.
- Ilyas et al. (2008) conducted research in BPO sector and determined outsourcing of Supply chain activities effectively.
- Wang Aimin and Li Sunxi (2011) proposed Supply chain management in CRM function.
- Seyed Mohammad Adeli et al. (2012) proposed charity Supply chain.

IV. METHODOLOGY OF THE STUDY

The study is descriptive research; empirical evidence is provided and the variables used are quantitative in nature. The study has adopted some tools and techniques for collection of information on various aspects. Some of them are detailed below.

A. Secondary Research

B. Primary survey through structured questionnaires administered to key stakeholders

A. Secondary Research

Under secondary research, a thorough desk review was done to develop insights into the key areas that needs to be focused during the primary research and discussions were held with various knowledgeable persons in the Marine Fisheries sector to collect information related to the issue on hand. Collection

of Secondary Data from various sources i.e., Census of India, Statistics and Planning Board, CMFRI, CIFT, CIFRI, NIO, MPEDA.

B. Primary Research

The survey was conducted using different questionnaires for different players of the fishery Supply chain from nine Coastal Districts of KARNATAKA covering 974 Kms of coastline from Mangaluru to Bengaluru (From Major Fish Landing Centres) to collect first-hand information on the specific parameters developed on the basis of objectives of the study. Separate questionnaires were administered to each key stakeholder of the study i.e. fishermen, middlemen, head loader, cycle carrier and retailer.

V. STUDY AREA

The study entitled “A Study on Supply Chain Management in Marine Fisheries: A Special Reference to KARNATAKA” was conducted according to the preferential sampling of the

researcher. The selection of the study area is on the basis of importance of the Marine Fish Landing Centers among the 9 Coastal Districts of KARNATAKA covering 974 kms of coastline from Mangaluru to Bengaluru, the number of fishermen at the landing center, the volume of trade generated, etc. The major regional market for fishery was covered during the study to develop a good understanding of the marine fishery Supply chain.

VI. SAMPLING

The sample frame was designed in such a way that all the key stakeholders are covered i.e. fishermen, middlemen, head loader, cycle carrier and retailers in the study area so that the complete picture of marine fisheries Supply chain can be assessed as it is presented in Table 1 in which the details about study area and sample size are mentioned with different respondents. Quota Sampling Technique was adopted to collect data from their respective coastal districts. Simple Random Technique was adopted to collect data within a district.

Table 1. Sampling according to Study Area

Respondent	Coastal Districts of KARNATAKA									TOTAL
	Mangaluru	Udupi	Karwar	Kaveri basin	North karnataka	Krishna	Gngavathi	Bengaluru	Bijapur	
Fishermen	50	50	50	50	50	50	50	50	50	450
Middlemen	8	8	8	8	8	8	8	8	8	72
Head loader	10	10	10	10	10	10	10	10	10	90
Cycle Carrier	10	10	10	10	10	10	10	10	10	90
Retailers	20	20	20	20	20	20	20	20	20	180
Total										882

A. Identification of Supply Chain Actors Performing Supply Chain Operations

Table 2: Supply Chain actors

Supply Chain Actor	Performing Supply Chain	Not Performing Supply Chain	TOTAL
Fishermen	378	72	450
	(84.00)	(16.00)	(100.00)
Middlemen	54	18	72
	(75.00)	(25.00)	(100.00)
Head loader	72	18	90
	(80.00)	(20.00)	(100.00)
Cycle Carrier	72	18	90
	(80.00)	(20.00)	(100.00)
Retailer	126	54	180

	(70.00)	(30.00)	(100.00)
TOTAL	702	180	882
	(80.00)	(20.00)	(100.00)
Source: Calculation from Primary Data (Figures in the brackets are percentages to their row totals)			

From the sample what was obtained from the study area, the respondents (i.e. key stakeholders) were divided into two categories i.e. performing Supply chain and not-performing Supply chain. From Table 2, it can be found that there are 378 (84%) fishermen who perform Supply chain operations and 72 (16%) fishermen who are not performing Supply chain operations. Among the sample, 54 (75%) middlemen who are performing Supply chain operations and 18 (25%) who are not performing Supply chain operations. Among the head loaders, 72 (80%) head loaders who are performing Supply chain operations and 18 (20%) who are not performing Supply chain operations. There are 72 (80%) cycle carriers who perform Supply chain operations and 18 (20%) cycle carriers who are not performing Supply chain operations.

Among the retailers, 126 (70 percent) performing Supply chain operations and 54 (30%) retailers who are not performing Supply chain operations. Among the total sample, 702 (80%) head loaders who are

performing Supply chain operations and 180 (20%) respondents who are not performing Supply chain operations.

B. Calculation of prices of fish without Supply Chain Operations

In this section, an attempt has been made to calculate prices of fish sold out without performing Supply Chain Operations. Table 3 presents cost sale price, profit and profit percentage getting by Supply chain actors. In order to calculate prices, the following parameters were observed as factors that influence price of fish.

1. Fisherman price at sea shore.
2. Middleman commission.
3. Transportation Charges.
4. Market fee.
5. Wholesaler margin.
6. Retailer Margin.

Table 3. Average Price of Fish without Supply Chain Operations

Supply Chain Actor	Cost of Fish Rs. / Kg	Sale Price Rs. / Kg	PROFIT Rs. / Kg	% of PROFIT
Fishermen Intermediary Marketing	35	42	7	17%
Fishermen Direct Marketing Consumer	35	48	13	27%
Fishermen Direct Marketing Company	35	60	25	42%
Middlemen	42	55	13	24%
Head loader	55	75	20	27%
Cycle Carrier	55	80	25	31%
Retailer	55	65	10	15%

C. Identified General Supply Chain Operations by fishermen

Table 4 presents general Supply chain operations adopted by fishermen for fresh fish to increase Supply there by price. The identified Supply chain operations performed by the fishermen for fresh fish are Cleaning, Washing, Separating, Grading, Weighing, Icing and Packaging. The average cost incurred by the fishermen was found to be Rs.11.83 per kg and average price increased found to be Rs.21.38 per kg. Hence there was increase of Rs.9.55/- per kg (55%) (Price increase – cost

incurred) for fresh fish.

Table 4. Cost and Price addition through Supply Chain for Fresh Fish

Particulars of Item	Cost in Rupees/Kg	Price Increase	% of Price Increase
Supply Chain Operations (fresh fish)			
Cleaning	1.50	3.76	18%
Washing	1.89	2.98	14%
Separating	0.97	1.89	9%
Grading	0.59	1.90	9%
Weighing	1.79	2.75	13%
Icing	2.89	3.98	19%

Packaging	2.20	4.12	19%
Total	11.83	21.38	100%
Supply addition for Fresh Fish per Kg (Price - Cost) PROFIT		9.55	55%

VII. INTERMEDIARY MARKETING

A. Fresh fish Supply Chain Operations by fishermen practicing

Table 5. Fresh Fish Supply Chain with Intermediary Marketing – Fishermen

Particulars of Item	Supplies in Rs. / Kg	Supplies in %
Supply Addition Operations by fisherman		
Fisherman Price at Seashore	35.00	61%
Transportation cost to Village	0.80	1%
Supply Addition Process 1 Cleaning	3.76	7%
Supply Addition Process 2 Washing	2.98	5%
Supply Addition Process 3 Separating	1.89	3%
Supply Addition Process 4 Grading	1.90	3%
Supply Addition Process 5 Weighing	2.75	5%
Supply Addition Process 6 Icing	3.98	7%
Supply Addition Process 7 Packaging	4.12	7%
Final Avg. sale price (for Middlemen / Retailer)	57.18	
PROFIT/Supply addition (Final Sale Price - Seashore Price)	22.18	38%

Table 5 shows, fishermen cost of fish Rs.35/kg, transportations charges Rs.0.80/Kg, after Supply addition operations like cleaning (Rs.3.76/kg), Washing (Rs.2.98/kg), Separating (Rs.1.89/kg), Grading (Rs.1.90/kg), Weighing (Rs. 2.75/kg), Icing (3.98/kg) and Packaging (4.12/kg), the Supply has been increased to Rs.57.18/Kg. Overall, there is 38% (Profit) price increase added to the product.

B. Fresh fish Supply Chain Operations by fishermen practicing Direct Marketing

This section concentrates on direct marketers in fishing community who practice direct marketing and involving in Supply chain operations. The fishermen are selling their product directly to consumer and sometimes to Exporter / Fish Companies also.

Table 6. Fresh Fish Supply Chain with Direct Marketing – Fishermen

Particulars of Item	Supplies in Rs. / Kg	Supplies in %
Supply Addition Operations by fisherman		
Fisherman Price at Seashore	35.00	61%
Transportation cost to Village	0.80	1%
Supply Addition Process 1 Cleaning	3.76	7%
Supply Addition Process 2 Washing	2.98	5%
Supply Addition Process 3 Separating	1.89	3%
Supply Addition Process 4 Grading	1.90	3%
Supply Addition Process 5 Weighing	2.75	5%
Supply Addition Process 6 Icing	3.98	7%
Supply Addition Process 7 Packaging	4.12	7%
Final Avg. sale price	57.18	
Fisherman Selling fish to Consumer Directly		
Avg. Sale Price fixed by Fisherman	57.18	77%
Transportation Charges	4.36	6%
Packing	0.59	1%
Fisherman Margin	12.15	16%
Final Avg. Price for Consumer	74.28	
PROFIT/Supply addition (Final Sale Price - Seashore Price)	39.28	52%
Fisherman Selling fish to Company Directly		
Avg. Sale Price fixed by Fisherman	57.18	66%
Fisherman Margin	30.00	34%
Final Avg. Price for fish company / Exporter	87.18	
PROFIT/Supply addition (Final Sale Price - Seashore Price)	52.18	59%

Table 6 shows that there is more than 50% Supply increased to the product after performing Supply chain operations by fishermen. The fishermen selling fish directly to consumer are getting 52% more returns on their fish catch whereas the fishermen selling fish directly to company/ exporter are getting 59% more returns on their fish. Here it should be noted that the exporter / fish company will purchase product if and if only export quality / high Supply product fish available.

C. Middlemen Supply Chain - Fresh fish

Table 7 shows that middlemen are getting fish either from seashore or fish villages at the average price of Rs.57.18/kg. The middlemen are investing their money on transportation charges, market fee etc. There is 38% Supply increase in fresh fish middlemen Supply chain.

Table 7. Middlemen Supply Chain - Fresh fish

Particulars of Item	Supply's in Rs. / Kg	Supply's in %
Final Avg. sale price fixed by fishermen *	57.18	
Supply Addition Operations by Middleman		
Avg. Sale Price fixed by Fisherman	57.18	61%
Middleman Commission	16.5	18%
Transportation Chagres	4.36	5%
Market Fee	1.55	2%
Wholesale Margin (pricing strategy) **	5.6	6%
Retailer Margin (pricing strategy) **	8.45	9%
Final Avg. Price for Consumer	93.64	
PROFIT /Supply addition (Final Sale Price - Seashore Price)	36.46	38%
*- Avg. Sale Price Fixed by Fishermen at Seashore / Village. **-The middlemen include ideal wholesale / retail margin in his price.		

D. Head loader Supply Chain – Fresh fish

Head loader is like door-to-door sales woman present in urban / town households and sells fish by carrying the product on her head. Table 8 shows that there is 62% price after Supply addition processes. The major cost goes to transportation. Return will be high because of reduced customer cost as the product is available at door step.

Table 8: Head Loader Supply Chain - Fresh Fish

Particulars of Item	Supplys in Rs. / Kg	Supplys in %
Final Avg. sale price fixed by fishermen *	57.18	
Supply Addition Operations by Head loader		
Avg. Sale Price fixed by Fisherman	57.18	67%
Cost of Transportation	20.00	23%
Margin of Head loader	8.45	10%
Final Avg. Price for Consumer	85.63	
PROFIT/Supply addition (Final Sale Price - Seashore Price)	28.45	62%

*- Avg. Sale Price Fixed by Fishermen at Seashore / Village.

E. Cycle Carrier Supply Chain - Fresh fish

Cycle Carrier is like door-to-door salesman present in urban / town households and sells fish by carrying the product on a bicycle. Table 9 shows that there is 66% price after Supply addition processes. The major cost goes to transportation. Return will be high because of reduced customer cost as the product is available at door step.

Table 9. Cycle Carrier Supply Chain - Fresh Fish

Particulars of Item	Supplys in Rs. / Kg	Supplys in %
Final Avg. sale price fixed by fishermen *	57.18	
Supply Addition Operations by Cycle Carrier		
Avg. Sale Price fixed by Fisherman	57.18	60%
Cost of Transportation	30.00	31%
Margin of Cycle Carrier	8.45	9%
Final Avg. Price for Consumer	70.36	
PROFIT /Supply addition (Final Sale Price - Seashore Price)	13.18	66%

F. Retailer Supply Chain - Fresh fish**Table 10. Retailer Carrier Supply Chain - Fresh Fish**

Particulars of Item	Supplys in Rs. / Kg	Supplys in %
Final Avg. sale price fixed by fishermen *	57.18	
Supply Addition Operations by Retailer		
Avg. Sale Price fixed by Fisherman	57.18	74%
Transportation Chagres	4.36	6%
Market Fee	1.55	2%
Weighing	0.79	1%
Cutting	3.89	5%
Washing	0.89	1%
Packing	0.45	1%
Retailer Margin	8.45	11%
Final Avg. Price for Consumer	77.56	
PROFIT/Supply addition (Final Sale Price - Seashore Price)	20.38	59%
*- Avg. Sale Price Fixed by Fishermen at Seashore / Village.		

Table 10 shows that retailer will be involving in different Supply chain operations like cutting,

washing etc. there is 59% price increase after retail Supply added operations to the product.

G. Comparison between Supply added selling and non-Supply added selling

Table 11: Comparison between Supply added selling and non-Supply added selling

Supply Chain Actor	Supply Added Selling		Non-Supply Added Selling		Difference	
	Profit		Profit		diff.	diff.
	Rs. / Kg	%	Rs. / Kg	%	Rs. / Kg	%
Fishermen Intermediary Marketing	22.18	38%	7	17%	15.18	68%
Fishermen Direct Marketing Consumer	39.28	52%	13	27%	26.28	67%
Fishermen Direct Marketing Company	52.18	59%	25	31%	27.18	52%
Middlemen	36.46	38%	13	24%	23.46	64%
Head loader	53.72	62%	20	8%	33.72	63%
Cycle Carrier	63.72	66%	25	11%	38.72	61%
Retailer	45.65	59%	10	15%	35.65	78%

The findings of the study are summarized in the Table 11. As it shows, the Supply chain actor and their profit after selling the product to the customer are presented.

- The fishermen practicing intermediary marketing and performing Supply added operations are getting 68% more returns than non-Supply added selling.
- The fishermen practicing direct marketing to consumer and performing Supply added operations are getting 67% more returns than non-Supply added selling.
- The fishermen practicing direct marketing to company and performing Supply added operations are getting 52% more returns than non-Supply added selling.
- The middlemen performing Supply added operations are getting 64% more returns than non-Supply added selling.
- The middlemen performing Supply added operations are getting 63% more returns than non-Supply added selling.
- The head loader performing Supply added operations are getting 63% more returns than non-Supply added selling.
- The cycle carriers performing Supply added operations are getting 61% more returns than non-Supply added selling.
- The retailers performing Supply added operations are getting 78% more returns than non-Supply added selling.

VIII. CONCLUSION

It can be concluded that in the sample of fishermen, 16 percent fishermen are not performing any Supply addition activities and straight away selling fish catch to either middlemen or retailer whereas 84 percent fishermen are performing Supply added operations ranging from two or three to six or seven different Supply addition processes. The most used Supply added activities for fresh fish are cleaning, grading, separating, washing, weighing, icing and packaging. The Supply addition operations by different people like fishermen, middlemen, retailer, head loader and cycle carrier are analyzed and it is found that on an average 12 percent Supply is being added to fish if they perform Supply addition processes. Therefore, it is strongly recommended to all the players of the fish supply chain to practice Supply chain management in order to get more Supply in terms of price to vendor and satisfaction to customer in terms of convenience of using the product.

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