



## Analysis of Dairy Value Chains in Organized Sectors of Haryana: A Chain Wide Learning Approach

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### ABSTRACT

Despite the fact that India is the highest milk producer in the world, dynamic production and consumption pattern of milk furnishes immense scope for analyzing the existing dairy value chains in the country. Value chain analysis is important to understand the prevailing market situation, interrelationships among the core actors, their market participation and issues & challenges involved in the value chain. Main objective of the study is to analyze the value chains of milk in organized dairy sector comprising of co-operative and private dairies of Haryana. Chain wide learning method was employed to analyze the detailed value chain of milk considering the stakeholders from input suppliers to consumers for improving the performance of value chain. The empirical evidences indicated that procurement, chilling and processing costs were higher in the co-operative dairy than the private dairy plant. However, the co-operative plant realized higher producers' share in consumers' price (76.16%) than the private dairy plant (75.15%) with a higher degree of marketing efficiency (3.20). Therefore, attention must be given to mobilize large number of farmers towards organized dairy sector by providing modern technologies and training facilities to strengthen the value chain management practices for tapping the commercial potential of Indian dairy sector.

### INTRODUCTION

Agriculture being the soul of Indian economy provides direct or indirect source of necessary income and employment to around 70 per cent of India's burgeoning population. However, livestock rearing and dairying go hand-in-hand with agriculture involving majority of vulnerable segment of the society to ensure continuous flow of income to the rural folk and improving their socio-economic condition. In India, dairying is emerging as an integral part of the economy which is one of the fastest growing sectors of the country with an annual growth rate of around 6 per cent in milk production (Economic Survey, 2021). Currently, India is the global leader of milk production with an annual production of 198.4 million tonnes and per capita availability of 406 gram/day (NDDB,

2021). The phenomenal growth in Indian dairy sector is attributed to the extensive dairy development programs undertaken in the country accompanied with dynamic demand and supply patterns of several value added products (Birthal et al., 2017). Being the largest producer and consumer of dairy products, Indian dairy sector aims for better scientific management practices and technological up-gradation in milk processing and marketing activities (Acharya et al., 2022). Due to the decentralized production and supply of milk, an efficient marketing system helps in ensuring remunerative prices to the producers as well as provides quality milk to the consumers at affordable prices (Kumar & Staal, 2010). Modern marketing channels and strategies serves a prominent role in providing higher profits to milk producers by improving efficacy along the entire supply chain (Janssen & Swinnen, 2019). In India,

milk market is highly fragmented, comprising of both traditional (consumption at home and traditional milk vendors) and modern (private dairies and cooperatives) segments (Ashwar et al., 2017 & Mandi et al., 2022). Around 60 per cent of total produced milk is marketed through various agencies, out of which 36 per cent of milk is handled by informal sector and rest 24 per cent is disposed off through modern channels (Kumar et al., 2011). However, the dairy sector, due to continuous transformation, is moving towards a coordinated and sustainable supply chain from a traditional marketing system (BIRTHAL, 2008). Therefore, need of the hour is to analyze the entire value chain of milk for understanding the market structure and participation of the core actors along with the constraints & opportunities as the limiting factors for growth of dairy farmers.

Haryana state possesses about 2.5 per cent of country's total bovine population with an annual production of 117.35 lakh tonnes of milk (5.9 per cent of country's total annual milk production (GoH, 2020). In spite of well-structured cooperative network in Haryana, large amount of milk flows through traditional marketing channels and dairy cooperatives face huge competition from the private dairies and milk vendors (Mohapatra & Sendhil, 2020). In this endeavor, a comparative analysis of procurement, processing and marketing of milk in co-operative and private sector dairy plants in Haryana was undertaken in order to analyse the marketing efficiency of existing dairy value chains.

### METHODOLOGY

This study is based on the primary data collected from different stakeholders of dairy value chain in the rural households of Haryana. The district Jind was selected purposively as the Jind milk union is the oldest with largest capacity of 1.50 LLPD (GoH, 2020). Another district *i.e.* Karnal was also selected purposively due to existence of a large sized private dairy plant with highest milk handling capacity among the other private dairy plants existing in the state. Two blocks from each district and then two villages from each selected block were also selected randomly. From each block, 60 dairy farmers were selected and were post-stratified into different categories, *viz.*, small, medium and large households on the basis of their Standard Animal Units (SAUs). Total of 242 respondents comprising of 120 dairy farmers, 22 modern milk market agents and 100 consumers were surveyed by means of structured questionnaires.

Tabular analysis was employed to estimate cost of procurement, chilling and processing of milk. Cost of milk procurement was computed by adding the cost of collection of milk at dairy cooperative societies as well as private milk collection centres' level, cost of transportation and cost of milk reception at the respective processing plants (Trienkens, 2011). Procurement cost and chilling cost were calculated by using following formulae:

$$\text{Procurement cost (Rs./litre/day)} = \frac{\text{Total procurement cost}}{\text{Total quantity of milk procured}}$$

$$\text{Chilling cost (Rs./litre/day)} = \frac{\text{Total chilling cost}}{\text{Total quantity of milk chilled}}$$

Total cost of processing of raw milk consists of both fixed cost and variable cost and the estimation procedure of the cost of processing is presented below.

Total cost of processing = Total fixed cost + Total variable cost

Fixed cost of a processing plant comprises of depreciations on buildings and machineries, interest on investments and expenses on salaries & supervision, whereas, variable cost includes cost of raw materials, electricity charges, labour wages, store & maintenance charges, water & steam charges, quality control expenses, cost of weighing & packaging *etc.* Chain Wide Learning (CWL) method was employed for dairy value chain analysis and mapping for understanding the linkages among the small-scale producers with the modern market environment (Vermeulen et al., 2008).

## RESULTS AND DISCUSSION

### Procurement cost of liquid milk

Table 1 represents the component wise average procurement cost per litre of milk incurred by ten dairy cooperative societies (DCS) and ten private milk collection centres (PMCC). The average cost of milk collection was higher in the case of PMCC (Rs. 0.51/litre) than the DCS (Rs. 0.42/litre) due to higher fixed expenses, repair & maintenance and electricity charges incurred by the PMCCs than DCS. Wages and salaries account for higher share in the variable costs, followed by electricity charges in case of both DCS and PMCC. The result pattern on the share of fixed and variable cost in total cost of milk collection corroborates the research findings of Vanishree et al., (2018).

The overall quantity of milk transported to the milk processing plants was found to be higher in DCS (935420 litre/annum) as compared with the PMCC (484510 litre/annum). The annual distance covered for transportation of milk was worked to be 843256.90 km and 435423.24 km in case of DCS and PMCC, respectively. As transportation is directly related to the service distance covered by the DCS or PMCC, the transportation cost of milk by DCS was found to be higher (Rs. 1.13/litre) as compared to the PMCC (Rs. 0.94/litre). The overall cost of milk reception at the milk processing plants was worked out to be Rs. 0.061/litre and Rs. 0.085/litre in case of cooperative and private plant, respectively. The higher overall reception cost in case of private milk plant can be attributed to its lower quantity of milk reception (462.43 litre/annum) as compared to the cooperative plant (862.16 litre/annum). The results obtained regarding the per cent share of fixed and variable costs were similar to the recent study conducted by Doni & Chauhan (2018).

The procurement cost of milk by the cooperative plant was higher (Rs. 1.61/litre) than the private milk plant (Rs. 1.53/litre) ascribed to handling of more quantity of milk. Transportation cost holds the highest share in total cost of procurement of milk (70.10% in cooperative and 61.24 per cent in private dairy plant), followed by cost of collection and cost of reception of milk.

### Cost of chilling

The overall chilling cost was estimated to be Rs. 0.53 and Rs. 0.47 per litre in the case of cooperative milk processing plant and private milk plant, respectively (Table 2). The higher chilling cost

**Table 1.** Total cost of procurement

Components of cost	Average cost (000'Rs/annum)	
	Dairy cooperatives	Private milk collection centres
Cost of collection		
1) Fixed cost		
Depreciation on fixed assets	22.78 (5.68)	18.76 (7.06)
Interest on fixed assets	9.85 (2.46)	4.34 (1.63)
Rent paid	14.67 (3.66)	10.23 (3.85)
Sub-total	47.3 (11.80)	33.33 (12.55)
2) Variable cost		
Wages and salaries	268 (66.87)	164 (61.74)
Repair and maintenance	28 (6.99)	19.86 (7.48)
Electricity charges	45.76 (11.42)	39.21 (14.76)
Stationeries	8.49 (2.12)	6.42 (2.42)
Miscellaneous	3.2 (0.80)	2.8 (1.05)
Sub-total	353.45 (88.20)	232.29 (87.45)
Total cost (1+2)	400.75 (100.00)	265.62 (100.00)
Total milk collected (litre/annum)	954.17	520.82
Cost of collection per litre of milk (Rs./litre) (A)	0.42	0.51
Cost of transportation (Rs/annum)		
Total transportation cost (Rs./annum)	1055456	455234
Total quantity of milk transported (litre/annum)	935420	484510
Transportation cost (Rs./litre) (B)	1.13	0.94
Cost of reception		
1) Variable cost (lakh Rs./annum)		
Electricity charges	11.42 (21.64)	7.32 (18.71)
Water charges	3.65 (6.92)	2.12 (5.42)
Repair and maintenance	1.92 (3.64)	1.13 (2.89)
Labour wages	4.12 (7.81)	3.87 (9.89)
Miscellaneous cost	1.08 (2.05)	0.76 (1.94)
Sub-total	22.19 (42.04)	15.2 (38.84)
2) Fixed cost (lakh Rs./annum)		
Depreciation on fixed assets	3.62 (6.86)	2.24 (5.72)
Interest on fixed assets	8.54 (16.18)	8.12 (20.75)
Salary to regular staffs	18.43 (34.92)	13.57 (34.68)
b) Sub-total	30.59 (57.76)	23.93 (61.16)
Total cost (a+b)	52.78 (100.00)	39.13 (100.00)
Quantity of milk received (litre/annum)	862.16	462.43
Cost of milk reception(Rs/litre) (C)	0.061	0.085
Total procurement cost (A+B+C) (Rs/litre)	1.61	1.53

Figures within parentheses are the percentages of total cost

**Table 2.** Cost of chilling incurred by cooperative and private dairy plant

Components of cost	Cooperative dairy plant		Private dairy plant	
	Cost incurred (lakh/annum)	Share (%)	Cost incurred (lakh/annum)	Share (%)
1) Variable cost				
Electricity charges	98.56	25.61	63.46	32.27
Refrigeration charge	82.49	21.43	41.09	20.89
Fuel charges	63.7	16.55	32.23	16.39
Stationary charges	6.91	1.80	1.67	0.85
Cost of testing material	12.45	3.23	5.34	2.72
Repairs and maintenance cost	18.76	4.87	8.54	4.34
Sub-total (1)	282.87	73.49	152.33	77.46
2) Fixed cost				
Depreciation on fixed assets	37.21	9.67	23.04	11.72
Interest on fixed assets	41.14	10.69	12.31	6.26
Salary paid to permanent staff	23.67	6.15	8.97	4.56
Sub-total (2)	102.02	26.51	44.32	22.54
Total cost (1+2)	384.89	100.00	196.65	100.00
Average milk chilled (lakh/annum)	725.54		414.92	
Chilling cost per litre (Rs.)	0.53		0.47	

**Table 3.** Processing cost of full cream milk

Component of cost	Cooperative dairy plant		Private dairy plant	
	Cost (Rs. /litre)	Share (%)	Cost (Rs./litre)	Share (%)
<b>Variable cost (A)</b>				
Labour charges	0.29	9.73	0.22	9.95
Electricity charges	0.41	13.76	0.37	16.74
Water and steam charges	0.27	9.06	0.19	8.60
Refrigeration charges	0.30	10.07	0.23	10.41
Quality control expenses	0.12	4.03	0.06	2.71
Packaging material	0.41	13.76	0.33	14.93
Storage and stationary	0.31	10.40	0.21	9.50
Sub-total	2.11	70.81	1.61	72.85
<b>Fixed cost (B)</b>				
Depreciation on fixed assets	0.36	12.08	0.26	11.76
Interest on fixed assets	0.20	6.71	0.12	5.43
Expenses on salary and administration	0.31	10.40	0.22	9.95
Sub-total	0.87	29.19	0.60	27.15
Total processing cost (A+B) (Rs./litre)	2.98	100.00	2.21	100.00

in cooperative milk plant could be due to higher quantity of milk chilled per annum. In case of both the plants, the variable cost incurred had a share of 73.49 and 77.46 per cent of the total chilling cost, respectively. Among the variable costs, electricity charge constitutes a major share in case of both the plants, followed by refrigeration charges and fuel cost. The proportion of fixed cost was worked out to be 26.51 and 22.54 per cent of the gross chilling cost, respectively in the case of cooperative and private milk plant.

### Processing cost of full cream milk

Total cost incurred by the processing plants for conversion of raw milk into full cream milk along with its manufacturing and packaging forms the total processing cost of full cream milk. The processing cost incurred by both the dairy plants was estimated and presented in the Table 3.

As presented in Table 3, the proportion of total fixed cost to the processing cost of milk was estimated to be 29.19 and 27.15 per cent, respectively for cooperative and private dairy plant. The share of variable cost to the processing cost was 70.81 and 72.85 per cent for cooperative and private dairy plant, respectively. Among the variable costs, electricity charges and packaging material constituted a major share in case of both the plants. Electricity charges comprised 13.76 and 16.74 per cent, respectively in the case of cooperative and private dairy plant. The cost incurred for packaging material was estimated to be Rs. 0.41/litre (13.76%) in the case of cooperative plant and Rs.0.33/litre (14.33 %) in private processing plant. The total processing cost was estimated to be higher (Rs. 2.98/litre) in the case of cooperative milk plant as compared to the private milk processing plant (Rs. 2.21/litre). The share of cost of raw material was highest to the total cost as compared to other cost components, corroborating the earlier findings of Thakur et al., (2020). Nain et al., (2019) also mapped the value chain in case of flowers and vegetables and found that the producer share decreases with length of value chain.

A perusal of the Table 4 revealed that marketing cost of milk for cooperative plant was estimated to be Rs. 5.12/litre, which comprised of procurement cost (Rs. 1.61/litre), chilling cost (Rs.

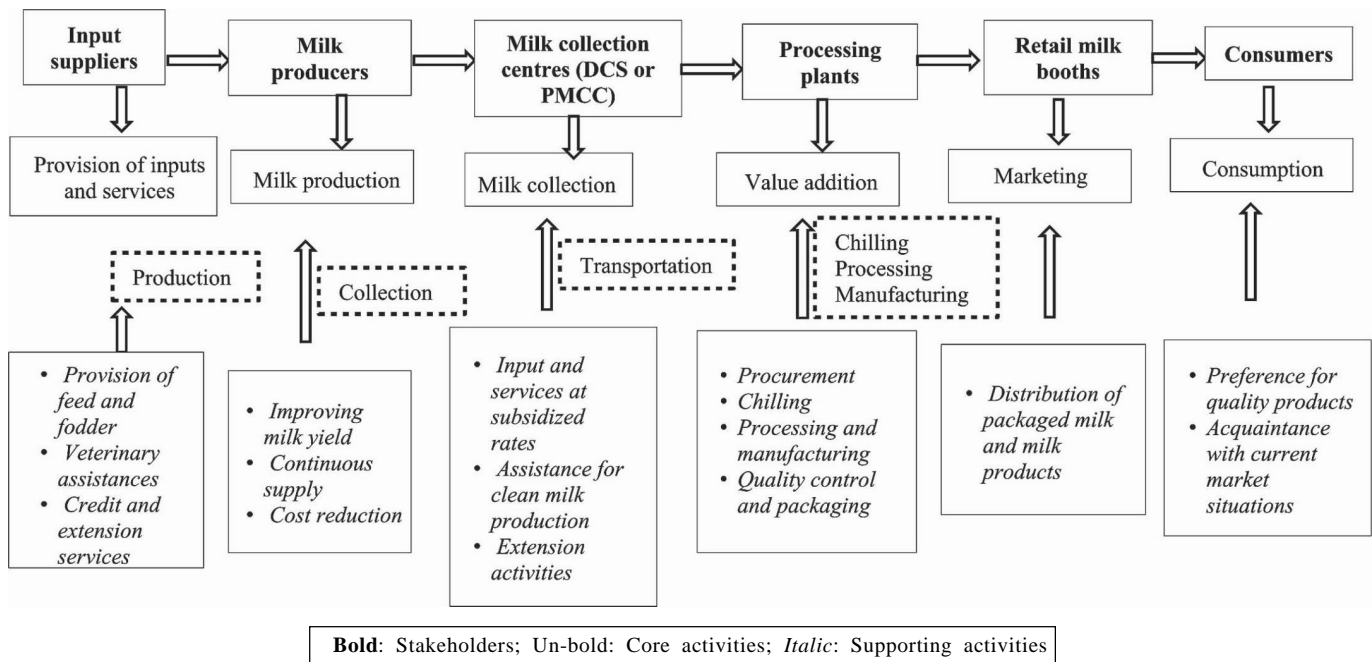
**Table 4.** A comparative analysis of value chains of full cream milk

S. No.	Particulars	Cooperative dairy plant	Private dairy plant
1.	Cost of raw material (Rs./litre)	41.89	40.58
2.	Procurement cost (Rs./litre)	1.61	1.53
3.	Chilling cost (Rs./litre)	0.53	0.47
4.	Processing cost (Rs./litre)	2.98	2.21
5.	Total cost (Rs./litre) (1+2+3+4)	47.01	44.79
6.	Selling price (Rs./litre)	55	54
7.	Marketing margin (Rs./litre) (6-5)	7.99	9.21
8.	Total marketing cost (Rs./litre) (2+3+4)	5.12	4.21
9.	Marketing cost & margin (Rs./litre) (7+8)	13.11	13.42
10.	Marketing efficiency (1/9)	3.20	3.02

0.53/litre) and processing cost (Rs. 2.98/litre). The procurement cost, chilling cost and processing cost incurred by the private dairy plant were worked out to be Rs. 1.53, Rs. 0.47 and Rs. 2.21 per litre, respectively and the total marketing cost was estimated to be Rs. 4.21 per litre of milk. Cost of raw material contributed a major share in the total cost incurred by cooperative milk plant and private plant i.e. 89.11 and 90.60 per cent, respectively. The selling price per litre of milk was found to be Rs. 55 and Rs. 54 in case of cooperative dairy plant and private dairy plant, respectively. The analysis indicated that marketing margin realized in case of both the plants were Rs. 7.99/litre and Rs. 9.21/litre, respectively, attributed to higher cost of milk procurement and processing in case of cooperative dairy plant. However, the producers' share in consumers' rupee realized was found to be higher in cooperative plant (76.16%) than the private dairy plant (75.15%) which resulted in higher marketing efficiency in cooperative dairy plant i.e. 3.20 as compared to private dairy plant (3.02).

### Mapping of dairy value chain

In mapping of the detailed value chain of milk, the important activities carried out by different stakeholders along the value chain from production to consumption were identified (Porter, 1985). Analysis was done with respect to different processes



**Figure 1.** Detailed value chain of milk

involved in the value chain such as provision of inputs and services, milk procurement by DCSs and PMCCs, processing of milk by the milk plants, organization of various awareness programs for clean milk production, etc. CWL analytical tool was followed for detailed value chain mapping of milk in the study area including the core and supporting activities of the core actors and their involvement in value chain has been presented in Figure 1.

## CONCLUSION

Indian dairy sector has undergone through a sea change transformation to be a self-reliant industry by means of enhanced production, procurement, processing and marketing system. Therefore, analysis of existing dairy value chain by CWL method along with prevalent market structures, participation of core actors with challenges associated at each stakeholder level is essential to improve the efficiency of both input and product markets. Higher marketing margin in case of private plants necessitates establishment of more number of milk collection centres and chilling units. Strong efforts must be taken for effective dairy value chain management in order to improve the risk handling and resilience abilities of the value chain as well as the concerned stakeholders. It is essential to encourage dairy farmers for active participation in the value chain to enable a regulatory environment to bridge the knowledge gap among the farmers. Continuous efforts must be taken to sustain the dynamic production and consumption pattern of milk by means of constructive value chain management practices in order to realize the full potential of Indian dairy sector.

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