Milk Marketing Chains in Bihar: Implications for Dairy Farmers and Traders[§]

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Abstract

The study has addressed the issues associated with the alternative milk market chains and their implications on dairy farmers and traders. It has been conducted in Bihar, where modern milk market chains especially the milk co-operatives have grown significantly. The study has shown that in spite of growing presence of modern milk supply chains, the traditional milk supply chain is still dominant. The empirical evidence does not appear to support the perceptions of exploitative nature of the traditional milk market agents. Traditional milk processing seems to offer good opportunities for the small and resource-poor milk producers and traders to enhance their income. The traditional milk sector should be addressed in a constructive manner and the policies should be evolved which would allow informal players improve their performance including quality control and their integration with the emerging modern milk supply chains.

Introduction

The food marketing has been undergoing a paradigm shift in India and the emergence of integrated food supply chains is one of the fast growing and most visible market phenomena. Yet, about 80 per cent of marketed milk still passes through the traditional channels of handling raw milk and traditionally produced milk products (Kumar and Staal, 2010). These traditional and informal milk marketing chains often provide the main outlet for smallholder dairy producers and major source of fresh milk supply for consumers. They have been playing a pivotal role in linking growing demand among consumers with increased production from producers. The emergence of modern milk marketing chains is posing stiff competition for the existence of traditional milk market agents. However, the basic structure of milk production and marketing is not likely to change significantly in the near future and therefore, the dominance of traditional milk market chains will continue to persist in spite of the rapid growth of the organized and formal milk marketing chains. The structure and functioning of the traditional and informal milk market is not well understood in India. The criticism about the functioning of traditional/informal milk market is mainly built on the perceptions and not backed by the hard core empirical evidences. In-depth understanding of the traditional milk marketing would be useful in evolving policies and strategies for the development of an efficient milk value chain. This study was undertaken to deliberate on some of these issues in Bihar. The traditional milk marketing still controls about 85 per cent of the milk supply chain in Bihar, though it has vibrant presence of milk co-operatives. Specific objectives of the study were to: (i) understand the structure of milk production and milk marketing chain in Bihar, (ii) estimate the costs and returns in traditional milk marketing chain, and (iii) identify the drivers for participation in milk supply chain and value addition.

Data and Methodology

Data

Bihar is one of the India's largest milk producing states, and accounts for 8.9 per cent of the national

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Table 1. Distribution of sample dairy farming households in Patna district, Bihar

Milk producers		Milk market agents	
Category of dairy farmers	Sample size (No.)	Type of traders	Sample size (No.)
Landless	50	Raw milk traders	46
Marginal	96	Raw milk traders and processors	7
Small	34	Milk product processors	22
Medium	25	All	75
Large	20		
All	225		

Source: Milk Producers and Milk Market Agents Survey, 2007

milk production. However, milk availability (170 g/capita only) and milk productivity (3.7 kg/day/milking animal) in Bihar is one of the lowest in India (DAHD, GoI, 2008). The modern milk marketing chains, especially those involving milk co-operatives, have emerged significantly in the state. But, the traditional marketing continues to play an important role in the milk supply chain in the state. This study is based on the primary data collected from milk producers and milk market agents in the traditional milk value chain in Bihar. The data was collected in the year 2007.

Patna was selected purposively for the study and its three administrative blocks and then three villages from each selected block were selected randomly. From each block, 75 dairy households were selected. At the village level, the number of sample households was in proportion to the village population. Sample households were post-stratified into different categories[1], viz. landless, marginal, small, medium and large households. Thus, a total of 225 households were selected. Data were gathered for these 225 households covering a wide range of information about household, farm-size and milk marketing practices. The survey of milk market agents was conducted at the selected urban/peri-urban centres and rural areas in the selected blocks. In urban and peri-urban centres, different constituents of marketing chain, viz. collection points, distribution points and selling points were identified and milk market agents were randomly selected. In villages, it was assumed that milk market agents should be easily identifiable, hence complete enumeration was done. Altogether 75 informal milk market agents were surveyed from the selected blocks. The survey was done using a pre-tested structured questionnaire. The distribution

of sample dairy farming households is given in Table 1.

Methodology

Economics of Milk Supply Chain

The data collected through field surveys was used to estimate the costs and returns for different stakeholders in milk supply chain, viz. milk producers, traders and processors. Partial budget analysis was carried out to estimate and compare costs and returns of these stakeholders. Quantities of inputs used and output obtained, marketed and consumed were calculated as the mean of sample households in the survey area. Similarly, prices were the mean values calculated from the data collected from individual sample households. The cost on milk production included expenses on feed and fodder, labour, feed additives and veterinary care. To understand the structure of milk supply chain, tabular analysis was carried out. Cost and returns in the milk supply chains were computed to examine the profitability of different stakeholders in these chains in the state of Bihar. To compare the economic efficiency in milk marketing through different types of milk market agents, the marketing margins in different milk supply chains were compared.

The producer's share in consumer rupee (P_s) for different marketing chains was calculated using Equation (1):

$$P_s = \frac{P_F}{P_C} \times 100 \qquad \qquad \ldots (1)$$

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[1]Landless (without any land); marginal (≤ 1 ha); small (>1≤2 ha); medium (>2≤4 ha); large (> 4 ha)

where, P_F is the price received by the milk producer and P_C is the price paid by the consumer. The milk producers' share in the total marketing margins (P_m) created in the value chain was estimated as per Equation (2):

$$P_m = \frac{P_m}{MM_t} \times 100 \qquad \ldots (2)$$

where, P_m is the marketing margin received by the producer and MM_t is the total marketing margin in the milk value chain.

Determinants for Participation in Milk Processing and Value Addition

A logit model was estimated to identify the factors that influence decision of milk traders to participate in the value addition activities of milk. The model was specified as follows:

$$C_i = \delta_1 + \delta_2 Z_i + \mu_i \qquad \ldots (3)$$

where, C_i is a dummy variable taking the value of 1 if a milk trader undertakes value addition of milk, 0 otherwise; Z_i is a vector of independent variables and includes factors like schooling, age, labour availability, ownership of assets, experience in milk marketing, etc.; δ_1 and δ_2 are the estimated parameters, while μ_i is the error-term.

Results and Discussion

Structure of Milk Production and Marketing

At the household level, a total of 225 households rearing cattle and or buffaloes were surveyed. However, only 145 households reported producing milk during the survey period. The rearing of cattle and or buffalo is not necessarily a market-oriented activity, given the strong household demand for consumption of milk and milk products, which are protein staple in a largely vegetarian society. Out of these 145 milk-producing households, only 75 households reported selling milk through one or more of the marketing chains, namely individual consumers, private traders/ milk vendors and dairy co-operatives/ formal private milk processor. Different milk marketing chains in Bihar are depicted in Figure 1.

In India, milk production is dominated by smallholder producers having only a few buffaloes or cattle, in systems closely integrated with crop production through use of crop residues such as rice and wheat straw. The marginal and small landholders account for about 69 per cent of the total milk production in the country (Birthal, 2008). Similar to the structure of milk production at the national level, the milk production in Bihar is also predominated by small landholders. Landless, marginal and small landholders accounted for 64 per cent of total milk production and 69 per cent of marketed milk in Bihar (Table 2). Based on herd size, a similar pattern was discernible. In Bihar 78 per cent of milk production and 67 per cent of marketed milk was contributed by the households having one or two milch animals.

The extent of marketed surplus gives an indication about commercialization of the activity. About 49.3 per cent of the milk was being marketed while 50.7 per cent was being retained for domestic consumption. The milk supply chain (Figure 2) presents a mixed picture
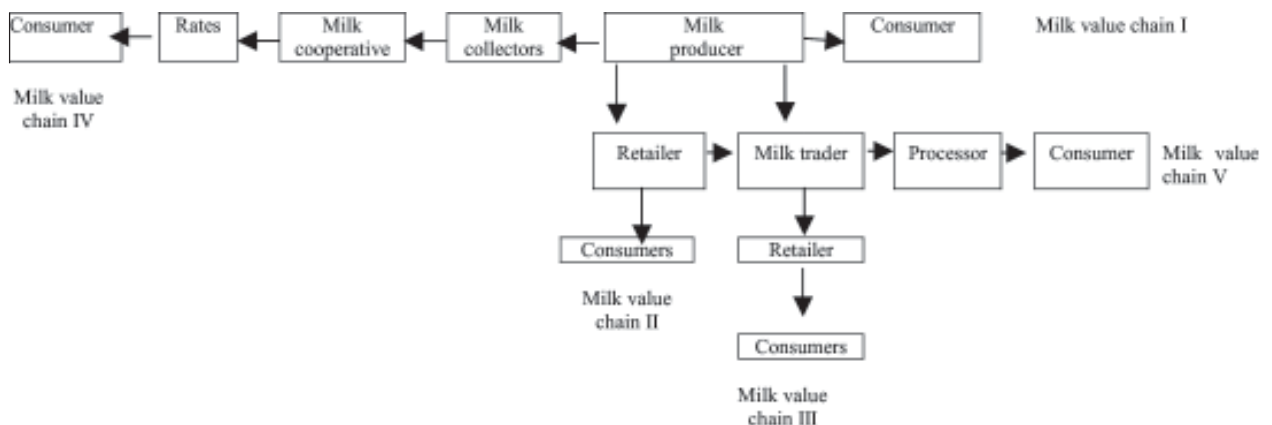

Figure 1. Different value chains in Bihar

Table 2. Share of different categories of households in production and marketing of milk in Bihar

Farm categories	Milk production (litres/day)	Share in milk production (%)	Share in milk marketing (%)
Land Size			
Landless	2.1	14.5	13.8
Marginal	2.4	31.1	35.8
Small	3.9	18.1	19.8
Medium	4.9	16.6	13.9
Large	7.3	19.7	16.7
All	3.3	100	100
Herd Size			
One animal	2.3	46.6	35.3
Two animals	5.4	31.8	32.5
Three animals	5.1	9.7	13.2
More than three animals	12.6	11.9	19
All	3.4	100	100

*Source:* Milk Producers Survey, 2007

in Bihar. Private informal traders turned out to be the biggest buyer of marketed milk (38.4%) in Bihar, closely followed by dairy co-operative societies (34.8%) and consumers (21.4%). Formal private processors accounted for 5.4 per cent of marketed milk in Bihar. Direct marketing to consumers was a significant component of milk marketing chain in Bihar. About 21 per cent of marketed milk was sold directly to consumers. The higher proportion of direct sale of milk to consumer can be attributed to the fact that in Bihar only 40 per cent of the rural households are engaged in milk production activities (Kumar, 2008).

Table 3. Milk flows in Bihar

Utilization of milk at household level (% of production)	
Marketed surplus	49.3
Home consumption	50.7
Milk sold to different buyers (% of marketed surplus)	
Consumers	21.4
Dairy Co-operatives	34.8
Private traders/milk vendors	38.4
Private processors	5.4

Importance of Traditional Milk Marketing Chain

The extent of dependence of different categories of dairy farmers on the traditional milk marketing chain is depicted in Table 4. The penetration of modern milk supply chain seems to be reasonable, but the traditional milk supply chain dominates the milk market in Bihar. On an average, 72 per cent of the farmers market their milk through the traditional milk supply chains and 60 per cent of the marketed milk was purchased by these milk market agents. There was no discernible relationship between herd-size and the choice of milk marketing chain. The majority of milk producing households rearing one, two, three or more than three milch animals, market their milk through the traditional milk supply chain. The proportion of milk-producing households marketing their milk through traditional milk supply chains varied from about 64 per cent (households having in-milch 2 animals) to 80 per cent (having more than 3 in-milch animals). The proportion of marketed milk sold through the traditional milk supply chain varied from 48 per cent to 71 per cent across different categories. The same appeared to be true when the relationship between farm-size and choice of milk-
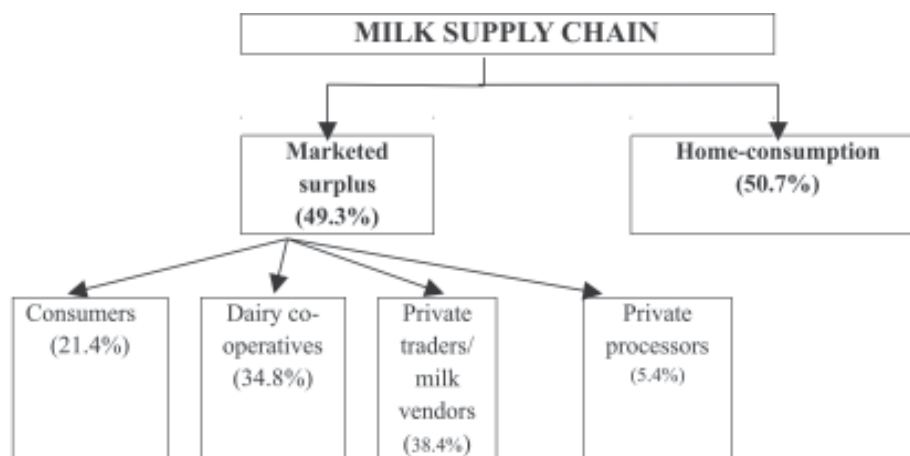
Figure 2

producing households on marketing chain was examined. All the categories of milk-producing households were found marketing their milk through the traditional milk supply chain. Nevertheless, the proportion of milk in the traditional milk supply chain varied from 20 per cent in the case of large farmers to 94 per cent in the case of landless farmers. Similarly, the proportion of marketed milk sold through traditional milk supply chain varied from 7 per cent (large farmers) to 98 per cent (landless milk producers). There was a slight linear trend which showed that the landless dairy farm households were more likely to sell their milk through the traditional milk supply chain than landholder dairy farmers (Table 4).

From the above descriptive analysis several points have emerged. Firstly, the dominance of landless marginal and small dairy farmers in milk production is quiet strong in Bihar. Secondly, in spite of the presence of modern milk supply chain, the traditional milk marketing supply chain continues to play a dominant role. Thirdly, and most importantly, there is no distinguishable difference in the choice of marketing chain based on either land-size or herd-size.

Economics of Milk Production

In the majority of households, milk production was only one component of the farming and employment

Table 4. Dependence of milk producers on traditional milk marketing chain in Bihar

Size group	Share (%) of farmers selling milk	Proportion (%) of milk sold
Land size		
Landless	93.8	98.0
Marginal	77.4	62.3
Small	61.5	63.9
Medium	60.0	73.3
Large	20.0	6.6
All	72.0	59.8
Herd size		
Only one animal	73.8	63.4
Two animals	63.2	58.5
Three animals	77.8	70.8
More than three animals	80.0	47.8
All	72.0	59.8

Source: Milk Producers Survey, 2007

strategy. In such cases, returns to land and labour should be viewed in terms of returns per litre of milk. The revenue per litre included the price of milk received minus the cost on selling milk, if any. Costs included only variable costs such as feed and input services. The costs of family labour and land were not included. The dairying appeared to be a profitable venture in the study area. On an average, milk producers selling milk through traditional milk marketing chain make a profit of Rs 2.98 per litre of milk production. The profit from milk production turned out to be considerably higher in case of farmers linked with modern milk supply chain (Rs 4.71/litre). There is not much difference in the prices paid for milk by traditional and modern milk marketing chains. However, the farmers linked with modern milk supply chain could reduce cost of milk production (per unit) and thus were able to raise their profitability. This may be attributed to the reduction in transaction cost in acquision of inputs and services, adoption of better breeds and improved management practices by linking with modern milk supply chain. However, the household income generated from dairying in the study area is meager (Rs 43/day to Rs 94/day). This is attributed to the lower herd-size and consequently, the lower scale of production. This holds true for farmers irrespective of their linkage with the milk marketing chains. Since this activity is profitable and the demand for milk and milk products is growing rapidly, there is enough scope to upscale milk production activities. The up-scaling would substantially help to enhance the household income of the milk-producing households. Further, the constraints which have been preventing the expansion and intensification of dairying in spite of its profitability, need to be identified and ameliorated.

Costs and Returns in Milk Marketing and Processing

In this analysis, costs and returns have been considered separately for raw milk traders and milk processors. Only variable cost was considered for estimating the returns. The net return was calculated by deducting variable cost from gross return, and thus represented the return to labour and investment by the trader. The variable cost mainly consisted of transaction costs in purchasing and selling of milk. In particular, the expenditures on transport (in procurement and sale of milk), materials like preservatives, water, electricity, taxes and rents, etc. were considered.

Table 5. Economics of milk production in district Patna, Bihar

(Rs/litre)

Particulars	Milk producer's selling milk to milk chain	
	Traditional	Modern
Yield (litre/day)	3.67	6.37
Herd size (No.)	1.23	1.77
Cost of milk production	8.76	6.52
Cost on dry fodder	2.13	3.62
Cost on green fodder	0.45	0.91
Cost on concentrate	3.09	3.40
Cost on labour	0.71	0.40
Cost on veterinary & miscellaneous expenditure	0.14	0.44
Price of milk	11.75	11.23
Net revenue over variable cost	2.98	4.71
Household net revenue (Rs/day)	43.07	93.62

Source: Milk Producers Survey, 2007

It has been found that raw milk traders incurred a sum of approximately Rs 1.10/litre as marketing cost and it added about 10 per cent to the expenditure incurred on procurement of milk (Table 6). On an average, the milk traders in the study area could earn a profit of Rs 155/day which is a little higher than the prevailing wage rate and comparable with the income through alternative employment opportunities available in the state. Further, getting work on the existing wage rate elsewhere is always not certain. The margins in fresh or raw milk trading depend on several factors like distance, level of infrastructure, urbanization, availability of milk with respect to demand, purchasing power, tastes and preferences, etc. As these parameters change across different locations, the net returns received by milk market agents will also change.

Milk is also processed into different intermediate and end products. While calculating gross income, the total value of different processed products was taken into account. On the cost side, apart from the cost of milk, expenditures on labour, material, fuel, electricity, etc. were also taken into consideration. Milk processing offers sufficient scope for value-addition and income generation for the milk processors. On an average, traditional milk processer earns a margin of about Rs 11/litre in Bihar. The value-addition margins have been reported as Rs1.38/litre to Rs 10.50/litre of milk in Orissa, depending on the marketing channels and level of processing (Saha *et al.*, 2004). The margin in milk processing in traditional milk chain has been reported to be Rs 15/litre in Assam (Kumar and Staal, 2010). These value-added products are generally sold in unbranded form in the market by these traditional milk market agents, and are accepted on processors' credibility and reputation in the market. The costs and returns, as depicted in Table 6, suggest that milk processing does considerable value addition and offers

Table 6. Costs and returns of raw milk trading, processing and value addition

Sl No.	Particulars	Milk trading (Rs/day)	Milk processing and value addition (Rs/day)
1	Milk handled per day (litres)	59.8	71.4
2	Value of milk purchased	667.30	983.00
3	Value of consumed and leftover milk	8.00	60.70
4	Cost on transport	38.50	4.50
5	Cost on additional material	0.0	130.50
6	Cost on labour	9.30	105.70
7	Expenditure on rents/ electricity etc.	15.90	136.90
8	Cost on marketing and processing	63.70	377.70
9	Gross expenditure	731.00	1360.70
10	Gross revenue	878.20	2103.40
11	Net revenue (10-9+3)	155.20	803.40
12	Unit cost of milk marketing/processing (Rs/litre)	1.10	5.30
13	Net revenue (Rs/litre)	2.30	11.20

Source: Milk Market Agents Survey, 2007

good opportunities for income enhancement and employment generation.

Profit Distribution Across Stakeholders in the Milk Value Chain

Milk marketing system in Bihar is fairly complex. A number of marketing agents interact at various levels in milk supply chain, from producers to consumers. The producer's share in consumer rupee in an assessment of the relative bargaining capacity power in the market. It also exhibits producer's access to and integration with the market. An analysis of profit distribution across different stakeholders involved in the milk supply chain is depicted in Table 7. The producer's share in consumer rupee varied from 45 per cent to 76 per cent, depending upon the milk marketing chain and the level of processing involved. Producers got a higher share when they sold directly to the milk processors. It implies that producer's integration with milk market agents, who operate at a higher level of supply chains, ensures a higher share in consumer rupee to the producer. The producer got highest absolute amount when he sold the milk to the informal milk processor. The producer's share in consumer price of milk across different parts of the country has been reported to be 50 per cent to 98 per cent (CALPI, 2006; Kumar *et al.*, 2010). The presence of different types of milk market agents in the study area ensured a competitive price for the producers. One of the criticisms about exploitative nature of the informal/traditional milk market does not

hold ground empirically. Out of the total profit generated in the traditional milk supply chain, farmers were able to get 51 per cent share. However, when the milk was processed and value-added products were prepared, the proportional gains were not transferred to the milk producers. This is true for both traditional as well as formal milk processing chains. In fact, most of the functionaries in the traditional milk marketing chain are resource-poor with low education level and therefore, they substantially depend on milk marketing of for their livelihood.

Determinants of Traders Participation in Processing and Value Addition of Milk

The returns to labour were substantially higher in milk value chain (processing) than in milk supply chain trading. These are quite high to attract traders to this value addition activity. However, several socio-economic characteristics of the trader influence their decision to participate in milk processing activity. A clear understanding of the factors influencing traders' decision to participate in milk value chain would help in facilitating the entry of milk market agents in these value addition activities. A logit model was used to identify those drivers that could induce the milk market agents' participation in the milk processing. The results of the logit model are depicted in Table 8. By and large, the age, education, household size, experience and occupation have been found to influence the traders' decision to participate in the milk value chain. Other

Table 7. Profit distribution under different marketing chains in district Patna, Bihar

Particulars	Traditional market agents		Formal market agents		
			Milk co-operatives		
	Raw milk trader	Traditional milk processor	Milk	Butter	Ghee
Cost of milk production (Rs /litre)	8.8	8.8	6.5	6.5	6.5
Price received by milk producers	11.3	13.8	11.2	11.2	11.2
Farmers margin (Rs/litre)	2.5	5.0	4.7	4.7	4.7
Cost of milk processing and marketing	1.1	5.3	4.8	2.5	2.3
Value of consumed and leftover (Rs/Litre)	0.1	0.9	0.0	0.0	0.0
Price received by milk market agents	14.8	30.3	20.0	20.0	20.0
Milk market agents margin (Rs/Litre)	2.4	11.2	4.0	6.3	6.5
Market margin in the value chain	4.8	16.2	8.7	11.0	11.2
Producer's share in consumer rupee	76.4	45.5	56.0	56.0	56.0
Producer's share in total profit in the milk value chain (%)	51.4	31.0	53.9	42.6	41.9

Source: Milk Producers and Milk Market Agents Survey, 2007

Table 8. Factors influencing traders' decision to participate in milk value chain

Dependent variable trader type (Milk processor =1 and Raw milk trader =0)		
Explanatory variables	Coefficient	Standard error
Age of the trader (years)	-0.2026***	0.0797
Education (years of schooling)	0.7035***	0.2166
Household size (No.)	-0.5667**	0.2654
Initial capital (Rs)	0.0000	0.0000
Experience in milk trading (years)	0.2671***	0.1008
Occupation (only milk marketing=1, otherwise=0)	4.3915***	1.4578
Mode of business acquisition (self started=1, otherwise=0)	-0.9556	1.1576
Ownership (sole=1, otherwise=0)	-1.9022	1.5177
Source of financing (formal credit=1, otherwise=0)	0.8055	2.5760
Constant	2.2047	3.3685
LR Chi^2(9)	44.8600	
log-likelihood	-19.3765	
Number of observations	62	

Note: *** significant at 1 per cent level; ** significant at 5 per cent level; and * significant at 10 per cent level.
Source: Milk Market Agents Survey, 2007

variables included in the model were not found significant. Education, experience in milk trading and sole dependence on milk trading for livelihood influence positively the traders decision to participate in milk value chain. A person with a higher education level is expected to have a better access to information and more clarity about emerging marketing opportunities in the milk value chain. The more experienced milk traders seemed to participate more eagerly in the milk value chain, as the experience helps the traders to understand the nitty-gritty of the business and thus facilitates their entry into more lucrative marketing opportunity. The traders who solely depend on milk marketing have higher propensity to adopt milk value addition to maximize their income. The age and household size did influence the traders' decision to participate in milk value addition activities negatively. With increase in age, the traders' risk bearing abilities as well as the quest for exploring new business entity are reduced.

Conclusions and Policy Implications

The study has observed dominance of landless, marginal and smallholders in milk production. The continued preference for and strong role of direct sales from producers to consumers, has been observed. The private traders appeared to be the biggest buyer of milk, closely followed by the milk co-operatives. The study has also suggested that informal raw milk trading and processing offers good opportunities for milk market agents, the majority of whom were operating at small scale. The informal trading and processing is an economically viable proposition. The study has demonstrated that the informal milk market does not appear to be exploitative and the presence of multiple players in the milk market ensures better price for the milk producers. The value addition to milk offers more lucrative options for milk market agents. Skill up-gradation and improvement in education level of milk marketing agents facilitate their entry in value addition activities. There has been no evidence that milk co-operatives and other modern milk supply chain are explicitly favouring large scale producers. The traditional milk markets need to be addressed in a constructive manner in view of its continued dominance in marketing and value addition of milk. However, the increased attention to quality and safety by the growing middle class may work against these markets. The quality gap can be addressed to a large extent by popularizing training and certification programs for small-scale milk traders and processors. These policies would allow informal players to improve their performance, including quality control, which would serve the interests of both small producers and consumers.

Acknowledgement

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