Original Research Article

Estimation of Marketed Surplus and Marketing Efficiency of Milk in Andhra Pradesh

ABSTRACT

A study was conducted to analyze milk's marketed surplus and marketing efficiency in the Vishakhapatnam and Chittoor districts of Andhra Pradesh. The study randomly selected 80 dairy farmers from four villages in Chittoor and Vishakhapatnam districts. According to the study, average milk production and marketable surplus increase as herd size increases. The average marketed surplus is highest for the large size category (58.75 lit/day) followed by Medium (45.40 lit/day) and small size category (19.01 lit/day). Because of the lowest price spread and highest producer share in consumers' rupee, the most efficient marketing channel was producer-consumer (Channel-I), followed by producer-creameries-consumer (Channel-II). The study suggests that producers' choice of supply network influences their profitability.

Keywords: Milk, Market Efficiency, Marketed Surplus, Producer Surplus, Herd Size

INTRODUCTION

Livestock plays a dynamic role in shaping the Indian economy. Among various livestock activities, dairy development assumed an important position in India's agricultural economy due to its potential for additional income and employment generation for the rural population. Milk production and marketing play a crucial role in generating income for over 75 million people. This sector has been linked to positive impacts on rural livelihoods, such as an increase in income per capita (Squicciarini *et al*., 2017), improvement in food and nutritional security, and is seen as a potential means to reduce poverty for small-scale farmers (Randolph *et al*., 2007). India has become the world's largest milk producer, with 187.7 million tonnes of milk production and a per capita availability of 394 gm/day (NDDB, 2018-19). Milk production is not only important for economic progress but also has to deal with marketing and distribution issues. Increased milk production would benefit consumers more if a proportionate increase in marketed milk surplus accompanied it. This emphasizes the importance of adjusting demand and supply through systematic marketing to avoid price fluctuations (Agarwal and Raju 2021).

An efficient marketing system reduces costs, ensures a fair price for milk producers, and provides consumers with high-quality milk and milk products at reasonable prices. An efficient marketing system is critical for proper milk channelization through various marketing channels, which eventually functions as a way of increasing dairy producers' income levels. Despite milk's positive growth in the past and present, traditional/unorganized marketing channels continue to dominate. Traditional/unorganized channels, which include milk vendors, middlemen, and others, handle about 80 percent of the milk sold in the country. The traditional milk marketing channels have not been challenged, not even by the cooperative dairy

organization (Kumar et al. 2010). The main source of income for dairy farmers is the sale of milk to the market. The family's expenses are paid for and their survival is guaranteed by the milk sales revenue. Due to their limited resources, dairy farmers must dispose of their highly perishable milk at market outlets since they are unable to store it at home (Jaiswal *et al*. 2016).

Consequently, farmers have to choose the marketing channels (supply chain) and many times farmers select channels arbitrarily without knowing the efficiency and profitability. The information gleaned from this study will explain how farmers choose effective marketing channels to increase overall profit.

METHODOLOGY

In Andhra Pradesh, dairy serves as a significant secondary source of income for rural families. According to NDDB (2018-19), in Andhra Pradesh, milk production has increased to 150.44 lakh tonnes (LT) over the last decade. Buffalo milk accounts for approximately 69% of the total milk production in the state. The milk production from the districts of Prakasam, Krishna, Chittoor, Guntur and East Godavari contributes to half of the state's total milk production. Based on the highest and lowest milk-producing districts, Chittoor and Vishakhapatnam districts were chosen respectively from Andhra Pradesh state. One village was chosen from each of the two blocks that were chosen from each district using a multi-stage random sampling technique. From each village, 20 milk producers were chosen randomly. Lastly, a well-structured schedule was used to conduct in-person interviews with a sample of eighty dairy producers to gather data. The dairy animals were changed into standard animal units (SAUs) utilizing the variables recommended by Sirohi *et al*. (2015) for southern India. The herd size is divided into three categories: Small (1-5 SAUs), Medium (6-9 SAUs), and Large (> 9 SAUs) using the cumulative square root frequency technique. Data on the socio-economic and demographic details of households, including age, family composition, education, operational land holding, occupation, herd size, milk production from individual animals, milk consumption at home, quantity of milk sold, and price realized, were collected from dairy farmers.

In addition, data is gathered from various marketing participants such as milk vendors (who collect milk from producers and sell it to consumers or other milk marketing entities) and creameries (who collect milk from producers and/or milk vendors). Data is also collected from those who sell milk directly to consumers, either as raw milk or after processing it into traditional milk products.

Analytical framework

a) Marketed surplus of milk

Market surplus refers to the amount of milk that a dairy farmer sells in the market, regardless of their own consumption needs.

Factors affecting marketed surplus:

To understand the degree of responsiveness milk marketed surplus to changes in milk productivity, prices and other exogenous variables such as education, family size, herd size, etc. The ordinary least squares method was used to fit and estimate the linear marketed surplus function.

Specification of marketed surplus function:

$$\mathbf{Y = f(X_1 X_2, X_3, X_4, X_5, X_6)}$$

Where,

Y = Marketed surplus of milk per household per day (liters/day)

X_1 = Herd size (no.)

X_2 = Average milk productivity (liters/day)

X_3 = Family size (no.)

X_4 = Educational score of the household head (0 to 5; 0 for illiterate and 5 for graduation and above), as suggested by Bhuvaneshwari (2005)

X_5 = Weighted average price of milk (₹/liter); price of buffalo milk/cattle milk and their respective quantity sold were taken as weights.

X_6 = Operational land holding (acre)

Estimation of marketing efficiency

To examine marketing efficiency, we collected data on milk marketing channels, the cost and returns of marketing agencies, the producer's share of the consumer's rupee, and the price spread in the informal sector.

I. Price Spread

The price spread typically assesses the efficiency of the marketing system. It has an inverse relation with the efficiency of marketing channels. We can say a smaller price spread is desirable for higher marketing efficiency. The price spread was computed by subtracting the price paid by the consumer from the price received by the milk producer (Acharya and Aggarwal, 2010).

It was calculated as,

$$\mathbf{P_s = P_c - P_f}$$

Where Ps is the price spread.

Pc represents the consumer's price.

Pf is the producer's price.

II. Producer's share in consumer's rupee

It is the amount that farmers receive and is represented as a percentage of what consumers pay (Acharya and Agarwal, 2010). The producer's share was computed using the following formula.

$$\mathbf{P_s = (P_f / P_c) * 100}$$

Where,

Ps represents the producer's share of the consumer's rupee.

Pf represents the producer's price.

Pc represents the consumer's price.

III. Marketing Efficiency

Marketing Efficiency of different channels was calculated by using the following formula.

MME = FP / (MC + MM)

Where,

MME = Modified marketing efficiency

FP = Price received by producer

MC = Marketing cost

MM = Marketing margin

RESULTS AND DISCUSSION

Average daily production, consumption, and marketed surplus of milk

In the categories of small, medium, and large herd size, the average milk production was 21.56, 48.13, and 61.77 liters per farm per day, respectively. The overall average milk production was 39.07 liters per farm per day. On average, each family consumed 2.73 liters of milk per day, with small farmers consuming 2.55 liters/day and large farmers consuming 3.23 liters/day. The overall average marketed surplus was estimated to be 36.34 liters, with small farmers having 19.01 liters and large farmers having 58.75 liters in surplus. It was found that 93 percent of the total milk produced was surplus. The share of surplus milk in total production showed an increasing trend with herd size, with the largest share (95.11%)

in the large herd size category and the smallest share (88.17%) in the small herd size category. As a result, it is clear from the data that farmers kept a small amount of the milk they produced for their use, while the majority was sold. This might be the result of a distressed sale. The finding of Lal et al. (2019) shows that marketed surplus to the tune of 91.14 percent in a large herd size category in Haryana, conforms with our results. The results were found to be similar to studies conducted by Priya (2018) and Vanishree (2018).

Table 1: Average daily milk production, consumption and marketed surplus

(liter/household/day)

Herd Size	Average milk production (lit/day)	Family consumption (lit/day)	Average marketed surplus (lit/day)	Marketed surplus as a percentage of household milk production
Small	21.56	2.55	19.01	88.17
Medium	48.13	2.63	45.40	94.32
Large	61.77	3.23	58.75	95.11
Overall	39.07	2.73	36.34	93.06

Fafactors affecting marketed surplus of milk at farmers' level

The factors influencing the marketed surplus of milk were analyzed using a Linear regression model. Six explanatory variables were considered to account for the variation in the surplus. These variables have also been used in previous studies on marketed surplus (Aggarwal et al. 2021; Lal et al. 2019). The regression model revealed that the variables explained 61.3 percent of the variation in the marketed surplus of milk, as indicated by the adjusted coefficient of multiple determination ($\overline{R^2}$). The most significant factor ($p<0.01$) inducing the marketed surplus was found to be herd size. The amount of milk that was sold as surplus increased by 2.121 liters for every unit of animals in the herd. This is because the primary goal of farmers across all categories is to sell a significant amount of the milk produced overall. Additionally, it was discovered that the price per liter of milk had a significant regression coefficient ($p<0.05$). One percent increase in the milk price resulted in an increase in the marketed surplus by 0.300 percent, for which farmers tend to spare more milk for sale to obtain higher income from the dairy enterprise. The study found that the average milk productivity per animal had a positive and statistically significant impact ($p<0.01$). On average, a one percent increase in milk productivity per unit of the herd led to a 1.52-liter increase in marketed surplus. The amount of operational land holdings and farmers' education levels were found to have a beneficial influence on the marketed surplus of milk, but this effect was not statistically significant.

As expected, the family size of the farmer was found to be negatively influencing the marketed surplus but not statistically significant. The results obtained were similar to the previous studies conducted by Priya (2018) and Lal et al. (2019), where they found a positive and significant relationship between herd size and the price of milk with marketed surplus.

Table 2: Determinants of marketed surplus

Variables	Regression coefficient
Constant	6.714 (4.377)
Milk productivity(lit/day)	1.522** (0.258)
Family size (numbers)	-0.814 (0.410)
Operational land holding (acres)	0.210 (0.008)
Herd size (numbers)	2.121** (0.116)
Price of milk received by farmer (₹/lit)	0.300* (0.122)
Education level of farmer (scores)	0.286 (0.367)
$\overline{R^2}$	0.613
F- value	18.732**

The number in parentheses represents the standard error of the regression coefficient.

** Significant ($p < 0.05$); ** Significant ($p < 0.01$)*

Marketing efficiency of various informal marketing channels

An efficient marketing system is crucial for enhancing farmers' income. However, the efficiency of marketing channels varies with the presence and participation of actors involved in the supply chain. The current part examines the informal marketing channels used in milk marketing in the research area, beginning with farmers and ending with consumers. The following channels were prevalent in the unorganized/ informal sector.

Channel I: Producer to Consumer

Channel II: Creameries to Consumer

Channel III: Producer to Milk Vendor to Consumer

Channel IV: Producer to Milk Vendor to Creameries to Consumer

Producers' share in consumers' rupee

The price that dairy farmers earn as a percentage of the price that consumers pay for a comparable quantity of milk purchased is known as the producers' share in consumers' rupee.

Producers retained the highest share (97.34%) in consumers' prices in the case of Channel-I (i.e., direct sales to consumers). In Channel-I, the producer incurred little marketing cost for supplying milk to consumers and received a higher net price (Rs. 38.45/lit). Consumers also benefited by paying comparatively less price for the purchase of milk (Rs. 39.50/lit) (Table 3).

Table 3: Channel-wise share of supply chain actors in consumer price (Rs./lit)

Different actors	Channels			
	Channel-I	**Channel-II**	**Channel-III**	**Channel-IV**
Producer	38.45 (97.34)	34.60 (82.77)	32.60 (75.21)	32.15 (72.73)
Creamery ('A': Channel-II and 'B' for Channel-IV)	0	7.2 (17.22)	0	3.2 (7.23)
Vendor ('A': Channel-III and 'B' Channel-IV)	0	0	10.74 (24.78)	13.25 (29.97)
Consumers' Price	39.50	41.80	43.34	44.2

Parenthetical figures represent the percentage of the customer's price.

In the case of channel II, the producer received an average price of Rs. 34.60 from the creamery, which was the second best. Producers' share and creamery share in consumers' rupee were worked out to be 82.77 percent and 17.22 percent, respectively. The vendor (A &B) share was estimated to the tune of 24.78 and 29.97 percent in the case of Channel-III and Channel-IV, respectively.

The share of producers in the consumers' spending was lowest for Channel-IV (72.23%) because two intermediaries, creamery 'B' and vendor 'B', were involved in the marketing process. This means that the more intermediaries involved in the marketing chain, the smaller the share of the producers in the consumers' spending. According to a study conducted by Thakur et al (2020) on mapping the value chain of informal dairy processing units, Model II – selling milk directly to consumers after minimal processing of milk (proper packing and maintaining temperature), means dairy farmers integrating milk production with processing and marketing could attain higher profit (Rs. 9.54/ lit) compared to other prevailing marketing systems in Haryana. These results support the present findings in a way that with an increase in the number of actors in the supply chain, the producers' share is likely to be less.

Price Spread

The price differential that exists between what a customer pays and what a producer gets paid for an identical amount of a good is known as the price spread. It is a useful measure for assessing the economic

efficiency of a commodity's marketing system. The pricing spread, marketing margin, and marketing cost for the corresponding milk marketing channel are shown in Table 4.

Table 4: Marketing margin, marketing cost, and price spread (₹/liter)

Particulars	Marketing channels			
	Channel I	**Channel II**	**Channel III**	**Channel IV**
Net income to the producer	38.45	34.60	32.60	32.15
Marketing cost	0	2.15	2.45	4.36
Marketing margin	1.05	5.05	8.29	7.69
Consumers' price	39.50	41.80	43.34	44.20
Price Spread	1.05	7.20	10.74	12.05

For channels I, II, III, and IV, the price spread was calculated to be Rs. 1.05, Rs. 7.20, Rs. 10.74, and Rs. 13.40, respectively (Table 4). It is worth mentioning that channel I was most efficient, as no intermediaries are involved in this channel. Except for channel I (producer to consumer), channel II was efficient as Creamery-A was involved in channel II, and the price spread was found to be the lowest (Rs. 7.20).

In channel III, the price spread was Rs. 10.74 involving vendor B, and it was highest in channel IV (Rs. 12.05) due to the involvement of both Creamery B and Vendor B in the marketing process. As a result, the price spread and channel efficiency decrease with the number of intermediaries in the marketing channel. The marketing cost was highest in channel IV involving creamery B and vendor B (Rs. 4.36), followed by channel III (Rs. 2.45), channel II (Rs. 2.15), and channel I (Rs. 0.55). Channel III had the highest marketing margin at Rs. 8.29, followed by Channel IV at Rs. 7.69, Channel II at Rs. 5.05, and Channel I at Rs. 0.50.

Marketing efficiency of the marketing channels involved in milk marketing

It's crucial to assess marketing efficiency to understand how well a product is performing in the market. Analyzing the efficiency of marketing in the milk industry is vital for enhancing the performance of market intermediaries, increasing income for farmers and intermediaries, and ensuring consumer satisfaction Table 5 compares the marketing efficiency of several channels in the informal milk marketing sector.

Table 5: Marketing efficiency across various milk marketing channels

Channels	Marketing cost + Marketing margin (₹/lit)	Price received by farmer (₹/lit)	Marketing Efficiency
Channel-I	1.05	38.45	36.62
Channel-II	7.20	34.60	4.81
Channel-III	10.74	32.60	3.04
Channel-IV	12.05	32.15	2.67

Marketing efficiency was calculated to be 36.62, 4.81, 3.04, and 2.67 for channel I, channel II, channel III, and channel IV. The findings indicate that channel I was the most efficient, whereas channel IV was the least efficient due to the presence of a high number of market intermediaries (creamery B and seller B). This is because the number of intermediaries engaged has an inverse relationship with the marketing channel's efficiency.

The lowest price received by the farmers (Rs. 32.15/liter) and the highest price paid by the consumers (Rs. 44.20/liter) in the case of channel IV contribute to its lower efficiency. These results align with the findings of Singh (2015) concerning the marketing efficiency of various channels.

CONCLUSION

The overall marketed surplus of milk was determined to be 93.06 percent, with large-category farms having the highest surplus (95.11%), followed by medium (94.32%), and small-category farms (88.17%). Herd size, average milk productivity per animal, and average weighted milk price were identified as the statistically significant factors impacting the marketed surplus of milk. Hence, scaling up herd size in small and medium farmers is required to further boost the marketed surplus. This could be achieved through proper training programs on scientific rearing of animals and better marketing practices. In addition, appropriate credit support will also help in this direction. Direct sale of milk to the consumers (Channel I) found to be the most profitable and efficient channel from both producer as well as consumer perspective. Hence, farmers' choice of marketing channel with fewer actors may leverage the benefits under the present situation.

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