



Management of Procurement of Milk and Marketing of Milk and Milk Products by Vijayapura and Bagalkot Milk Union Limited (VIMUL), Karnataka, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Livestock, particularly milch animals, significantly contribute to the livelihoods of many families in India, particularly among resource-poor farmers. This study focuses on the business performance of Vijayapura and Bagalkot Milk Union Limited (VIMUL) in Karnataka, India. Both primary and

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secondary data were utilized, and analysed using techniques like seasonal indices, compound growth rate analysis (CAGR) and tabular presentations. This study examines the trends and fluctuations in milk procurement, pricing, and product sales at VIMUL over four distinct periods from 1986-87 to 2021-22. Analysis revealed significant increases in both the quantity of milk procured and the cost of transportation. Monthly milk procurement volumes grew substantially, with a notable rise from an average of 20,269.74 liters per day in Period I to 163,200.53 liters in Period IV. Concurrently, transportation costs per liter surged from ₹0.40 to ₹1.89. Prices for cow milk rose from an average of ₹5.08 per liter in Period I to ₹28.45 per liter in Period IV, while buffalo milk prices increased from ₹6.34 to ₹42.33 per liter. Significant growth rates were observed, with Period III showing the highest increases in producer prices due to enhanced government subsidies and policy initiatives like the Ksheerabhagya Yojana. Monthly seasonal indices indicated variations in procurement levels, with peaks in January and February, reflecting high milk production during flush seasons, and lows in August due to reduced production. Sales volumes for milk increased from 17,726.75 liters per day in Period I to 70,818.33 liters in Period IV, with notable growth in product-specific categories. Flavored milk sales showed a negative growth rate in the latest period, while curd and ghee experienced significant increases. These findings underscore the need for strategic improvements in procurement and distribution processes, as well as targeted policy adjustments to support dairy farmers and enhance market stability.

Keywords: *Livestock; transportation cost; milk procurement; dairy co-operative societies; marketing management; sales performance; product diversification.*

1. INTRODUCTION

Livestock is a source of subsidiary income for many families in India, especially the resource-poor farmers who maintain few animals. Milch animals, including cows and buffaloes, provide regular income to the livestock farmers through the sale of milk. The first of the dairy co-operatives that make up Karnataka Milk Federations (KMF) started in 1955 in Kudige, Kodagu District of Karnataka. KMF was founded in 1974 as Karnataka Dairy Development Corporation (KDDC) to implement a dairy development project run by the World Bank. In 1984 the organization was renamed as KMF. The KMF grew very fast and as it spreads the wings of newfound rural economic activity - dairying all over the state. The genesis of the apex co-operative body took the shape of KMF in 1983. The AMUL pattern of dairy co-operatives started functioning in Karnataka from 1974-75 with the financial assistance from World Bank/IDA, Operation Flood II & III. The Anand Pattern three-tier organization structure – Dairy Co-operative Societies at the village level, District Milk Unions at the District level to take care of the procurement, processing, and marketing of milk and provide technical input services for enhancing milk production at producer's level and Federation at the state level to co-ordinate the growth of the sector in the State.

Karnataka Milk Federation has 14 milk unions involving various parameters of dairy activity, *i.e.*, organization of dairy co-operatives, milk routes, veterinary services, procurement of milk in two shifts of the day, chilling, processing of milk, distribution of milk and also establishment of cattle feed plants, Nandini sperm station, liquid nitrogen supply, training centres, as its mainstay. 1500 members procure milk from Primary Dairy Co-operative Societies (DCS) and distribute it to the consumers in various urban and rural markets in Karnataka State. KMF sells products such as raw milk, curd, fermented products, milk powder, ghee and butter, ice cream and frozen desserts, milk sweets, chocolates, and flexi pack milk. KMF works on the co-operative principles. More than 75 per cent of the consumer rupee is passed on to the producers who strive hard for the development of the federation. Presently, 97 per cent of the dairy co-operative societies are working under the profit. The majority of the beneficiaries of Co-operative Dairy Development programmes in the State belong to the poor section in villages. The majority of the milk producers are small farmers, marginal farmers, and landless labourers who need hand-holding in their critical times of distress. KMF is implementing several financial assistance programmes of Government of Karnataka (GOK), 'Nandini Dairy Farmers Welfare Trust'. The hostel established in the Bengaluru city for the benefit of farmers' children at the cost of ₹12.96 crore is now serving around 252 girls and

246 boys who are pursuing higher education in the city.

The Vijayapura and Bagalkot Milk Union Limited (VIMUL), located in the Karnataka districts of Vijayapura and Bagalkot, ranks sixth in milk procurement among the state's 14 milk unions. Established by the Karnataka government in 1986 with a processing capacity of 60 Thousand Litres Per Day (TLPD), VIMUL became part of the Operation Flood program after joining the Karnataka Milk Federation (KMF) in the same year. The expansion efforts included the construction of a chilling centre with a capacity of 1 Lakh Litres Per Day (LLPD) and a farm cooler with a 60-TLPD capacity, completed in 1995.

As of the 2021-22 fiscal year, the union receives milk from over 455 Dairy Co-operative Societies (DCSs), 331 of which are operational. The number of functional DCSs has increased significantly from 11,456 members in 1986 to 76,699 members in 2021. This growth in procurement capacity has enabled the union to collect an average of 174,029 litres of milk per day in 2021. Despite these advancements, the performance of individual societies may vary in relation to established business performance standards. This study aims to document and analyze the business performance of the Vijayapura and Bagalkot Milk Union within the Karnataka state context.

Specific objectives:

- 1) To study the procurement management of milk by Vijayapura and Bagalkot milk union.
- 2) To study the marketing management of milk and its products.

2. METHODOLOGY

For the analysis of the objectives of the study, both primary and secondary data are utilized. The primary data have been collected from the sample respondents through the help of retailers and from the administration officials with the help of pre-tested questionnaire. The secondary data on several aspects of the activities (balance sheet, procurement etc) of the KMF selected data were collected from different sources since its inception depending on the availability of the required information for the study.

2.1 Tabular Analysis

The data collected was presented in tabular form to facilitate easy comparisons. The classification

of DCS, milk procurement performance, products of VIMUL were studied using tabular analysis. The data was summarized with the help of statistical tools like averages and percentages to obtain meaningful inferences of the results.

2.2 Time Series Analysis

Time series analysis was done to study the variations in monthly procurement of milk by the Vijayapura and Bagalkot Milk Union for the Period of 36 years. A time series is a complex mixture of four components namely, Trend (T), Seasonal (S), Cyclical (C) and Irregular (I). These four types of movements are frequently found either separately or in combination in a time series. The relationship among these components was assumed to be additive or multiplicative, but the multiplicative model was the most commonly used method in economic analysis, which can be represented as

$$O_t = T \times C \times S \times I$$

Seasonal variation (S): The variation in a year is called as seasonal variation. The main causes of seasonal variations are production Periods, customs, climates etc. Such seasonal components can be analyzed through harmonic analysis.

2.3 Estimation of Seasonal Indices of Monthly Data

To measure the seasonal variations in procurement of milk by the Vijayapura and Bagalkot Milk Union, seasonal indices were calculated employing twelve months' ratio to moving average method. The seasonal indices were calculated by adopting the following steps. In the first step, 12 months moving total were generated. These totals were divided by 12 to compute 12 months moving average. Then a series of centered moving averages were worked out.

In the next step, original values were expressed as a percentage of corresponding centered moving average. Further, the irregular component in the series was removed. Afterwards, these percentages were arranged in terms of monthly averages. Then the average index for each month was computed, finally these monthly average indices were adjusted in such a way that their sum becomes 1200. This can be done by working out of correction factor and multiplying the average for each month by

this correction factor. The correction factor (K) is worked out as follows.

$$K = 1200/S$$

Where, K is correction factor and S is sum of averages indices for 12 months, multiply K with the percentage of moving average for each month to obtain the seasonal indices.

2.4 Growth Rate Analysis

For computing the growth in amount of milk and milk products marketed in Vijayapura and Bagalkot district of Karnataka state, the compound growth rate analysis was carried out. The compound growth function was specified in the following form.

$$Y_t = AB^t U_t \dots\dots\dots(1)$$

Where,

- Y_t = Area/production/productivity in the year t
- A = Intercept indicating Y in the base Period (t=0)
- B = 1 + g
- t_i = Time Period (i = 1 to 9)
- U_t = Error term
- g = Average annual compound growth rate

Equation (1) was converted into the logarithmic form in order to facilitate the use of linear regression. Taking logarithms on both sides,

$$\ln Y_t = \ln A + t (\ln B) + \ln U_t \dots\dots\dots(2)$$

Or

$$Q_t = a + bt + ut$$

Where,

- Q_t = Ln Y_t
- a = Ln A
- b = Ln B
- t = Time
- U_t = Ln U_t

The district wise and area wise linear regression of the above form was specified separately for area, procurement and marketing of selected Dairy Co-operative Societies. The values of 'a' and 'b' were estimated by using Ordinary Least Square estimation technique. Later, the original

'A' and 'B' parameters in equation (1) were obtained by taking anti-logarithms.

of 'a' and 'b' values as;

$$A = \text{Anti Ln } a$$

$$B = \text{Anti Ln } b$$

Average annual compound growth rate was calculated as;

$$B = 1 + g$$

$$g = B - 1$$

3. RESULTS AND DISCUSSION

Figures in parenthesis indicates average cost of transportation per litre.

3.1 The Quantity of Milk Procured and the Cost of Transportation Since Its Inception

Table 1 depicting that average quantity of milk procured per month, per day and average cost of transportation for per litre of milk in different Periods. The quantity of milk procurement was fluctuating from month to month and year to year across different periods. The average quantity of milk procurement per day varied from 20269.74 litres to 163200.5 litres in Period I and Period IV, respectively. The transportation cost per litre was continuously increasing from Period I to Period IV, i.e., 0.40 rupees per litre 1.89 rupees per litre, respectively. It is seen from the table that the cost of milk and transportation costs increased over the Periods. High milk production was observed in the months of January and February due to the flush season. The price varied throughout the year due to seasonal variation. The milk was procured from Monday to Sunday and payment was made on the next Tuesday. In Period I the transportation cost was almost constant throughout the Period in various months. And in Period IV, the average cost of transportation 1.89 rupees per litre. The transportation costs were increasing throughout the study Period. Jairath M. S. [1] reported that the transportation and distribution cost of milk was Rs. 0.13 per kg as against Rs. 0.22 per kg. The transportation cost is also varied between various routes due to difference in distance, amount of milk procured in those routes and road condition.

Table 1. Quantity of milk procured and cost of transportation since its inception

Month / Period	1986-87 to 1995-96 (Period I)	1996-97 to 2005-06 (Period- II)	2006-07 to 2015-16 (Period-III)	2016-17 to 2021-22 (Period- IV)
Average milk procured (lit/day)				
April	22,095.11 (0.42)	19,139.64 (0.68)	67,676.80 (1.24)	1,69,548.23 (1.85)
May	19,724.89 (0.41)	16,087.43 (0.66)	64,392.66 (1.23)	1,66,519.37 (1.88)
June	18,411.33 (0.40)	16,791.36 (0.66)	62,736.61 (1.22)	1,59,545.35 (1.88)
July	17,047.44 (0.41)	15,845.47 (0.66)	58,867 (1.20)	1,53,915.81 (1.84)
August	15,977.71 (0.39)	14,754.35 (0.66)	57,413.14 (1.21)	1,46,593.36 (1.83)
September	17,586.47 (0.39)	16,093.25 (0.67)	60,609.84 (1.25)	1,47,238.39 (1.84)
October	19,408.74 (0.40)	19,570.94 (0.70)	67,728.64 (1.29)	1,52,398.73 (1.86)
November	22,396.62 (0.41)	23,500.34 (0.70)	71,259 (1.31)	1,63,219.84 (1.88)
December	24,042.71 (0.41)	24,427.96 (0.71)	81,082.63 (1.32)	1,73,233.71 (1.95)
January	24,456.63 (0.40)	24,247.63 (0.71)	77,687.78 (1.33)	1,77,989 (1.96)
February	22,272.67 (0.40)	23,781.17 (0.70)	85,363.64 (1.29)	1,75,905 (1.97)
March	19,816.89 (0.40)	22,421.24 (0.69)	84,404.65 (1.28)	1,72,299.24 (1.96)
Average	20,269.74 (0.40)	19,721.68 (0.68)	69,935.17 (1.26)	1,63,200.53 (1.89)

Table 2. Changes in the milk procurement prices of cow milk and buffalo milk

Period		Cow Milk				Buffalo Milk			
		DCS Price	Producer Price	Commission to DCS	Government Subsidy	DCS Price	Producer Price	Commission to DCS	Government Subsidy
1986-87 to 1995-96 (Period-I)	AVERAGE(Rs/lit)	5.08	5	0.10	-	6.34	6.26	0.10	-
	CV(%)	7.92	7.94	15.05	-	10.11	10.10	6.20	-
	CAGR(%)	2.60**	2.63**	2.23***	-	3.00**	3.02**	2.33***	-
1996-97 to 2005-06 (Period-II)	AVERAGE(Rs/lit)	7.16	6.95	0.21	-	9.32	9.18	0.14	-
	CV(%)	10.30	9.76	29.09	-	11.49	11.27	26.83	-
	CAGR(%)	3.41**	3.22***	10.17**	-	3.63**	3.55**	9.12***	-
2006-07 to 2015-16 (Period-III)	AVERAGE(Rs/lit)	15.43	14.90	0.53	2	19.76	19.3	0.46	2
	CV(%)	33.05	32.91	37.13	-	31.97	31.58	53.17	-
	CAGR(%)	11.97**	11.90**	12.56***	-	11.18**	11.05**	16.42***	-
2016-17 to 2021-22 (Period-IV)	AVERAGE(Rs/lit)	28.45	27.26	1.14	5	42.33	41.07	1.25	5
	CV(%)	5.59	5.42	24.83	-	7.92	7.62	21.08	-
	CAGR(%)	2.92**	2.71***	12.28**	-	4.34**	4.17**	10.21***	-

***- significant at 1%, **- significant at 5% level of significance

3.2 Changes in the Milk Procurement Prices for Cow Milk and Buffalo Milk

The change in prices of milk procurement for cow milk and buffalo milk, along with DCS price, commission taken by DCS and government subsidy is given in Table 2. The DCSs price, producer price and the commission to DCSs for cow milk were increasing across the periods. In the first Period, the average producer price for cow milk was 5 rupees, which increased to 27.26 rupees in the fourth Period. The highest growth rate for producer price was observed in the third Period, *i.e.*, 11.90 per cent over the ten years, and the lowest in the first Period (2.63%). The same scenario is observed in DCS's selling price and commission to DCS. The average commission to DCS was 0.10 rupees in Period I, which increased to 1.14 rupees in Period IV, and the results were significant at one and five per cent. The government of Karnataka provided 2 rupees subsidy for per litre in the Period of 2008 to 2015, and it increased to 4 rupees in 2014-15 and 2015-16. Later, it increased to 5 rupees in 2016-17, which is the same up to the year 2021-22.

The price of buffalo milk was higher compared to cow milk due to the higher fat content in buffalo milk. The average producer price for buffalo milk was 6.26 rupees in Period I, which increased to 41.07 rupees in Period IV. The highest growth rate was observed in Period III (11.05%) over ten years and lowest growth rate was observed in Period I (3.02%). The average DCS price and commission to DCS had the same scenario. The results were significant at five per cent level of significance. The government subsidy for buffalo milk was the same as that for cow milk. Whenever the quantity of milk procured was increased due to the seasonality of milk production, the price of the milk was decreased. Bhogal and Arora [2] suggested using the average price of milk as an instrument to increase milk procurement.

The prices were decided based on the fat content of milk. The highest growth rate in DCSs price, producer price and commission to DCSs were highest in Period III for both cow milk and buffalo milk. Because Ksheerabhagya jojana came into existence in Karnataka in this Period. The union increased the prices of milk to

increase the procurement of milk. Government also started giving subsidy in the year 2008 which added to the prices of milk.

The prices of buffalo milk were higher as compared to cow milk because of the high fat content in buffalo milk. The prices of cow milk and buffalo milk were increased over the years because of the high purchasing power of consumers as well as to support the dairy farmers. Chenna Reddy [3] suggested that high prices would procure more milk. Dave Dyer [4] opined that the government should announce a support price for milk, which ensures a regular and constant supply of milk. Singh, Mandeep and Joshi A S, [5] reported co-operatives do not change the price seasonally, unlike private traders.

3.3 Monthly Seasonal Indices for Milk Procurement in the VIMUL Since Its Inception

The Table 3. shows that monthly seasonal indices of milk procurement by union over the different years. These monthly indices showed changes in the quantity of milk procured by the union in various months across different periods. The seasonal indices for the Period I were highest in the month of January, which was 120.70, and the lowest seasonal indices were observed in the month of August, which was 78.85. For Period II, it was highest in the month of December (123.86) and lowest in the month of August (74.81). The seasonal indices for the Period III and Period IV were highest in the months of February and January (122.06 and 109.06), respectively, and lowest in the month of August (82.09 and 89.82) for both the Periods. It shows the seasonal variation of milk procurement throughout the year. The highest seasonal indices for Period I, Period II, Period III and Period IV were in the months of January, December, February and January respectively, because of high milk production due to high fodder availability in those months. And the lowest seasonal indices were found in the months of August for all the Periods because domestic consumption will be higher in that month due to rainy season as well as low milk production in that month. The results of the study are in line with the study conducted by Bhogal and Arora [2].

Table 3. Monthly seasonal indices for procurement of milk in VIMUL

Month/ Period	1986-87 to 1995-96 (Period I)	1996-97 to 2005-06 (Period- II)	2006-07 to 2015-16 (Period-III)	2016-17 to 2021-22 (Period- IV)
April	109.05	97.04	96.77	103.88
May	97.35	81.50	92.07	102.03
June	90.86	85.14	89.70	97.76
July	84.13	80.34	84.17	94.31
August	78.85	74.81	82.09	89.82
September	86.79	81.60	86.66	90.21
October	95.79	99.23	96.84	93.38
November	110.53	119.15	101.89	100.02
December	118.66	123.86	115.93	106.14
Jan	120.70	122.94	111.08	109.06
Feb	109.92	120.58	122.06	107.78
March	97.80	113.68	120.68	105.57

Table 4. Product Mix of VIMUL for the year 2021-22

Sl. No.	Particulars	Dealer price (Rs)	Margin (Rs)	MRP (Rs)
Fluid Milk				
1	Toned milk/Lit	36.10	1.90	38
2	Standardized milk/Lit	45.60	2.40	48
3	Full cream milk/lit	49.00	3.00	52
Processed Milk Products				
1	Curds 500 ml	20.25	1.75	22
2	Curds 200 ml	8.00	2.00	10
3	Flavored milk 200 ml	16.67	3.33	20
4	Tetra pack flavored milk 250ml	16.67	3.33	20
5	Mango lassi 200 ml	16.67	3.33	20
6	Kowa / Kg	285.71	14.29	300
7	Paneer / kg	342.86	17.14	360
8	Shrikhand / kg	195.65	29.35	225
9	Ghee 500gm	222.50	22.50	245
10	Ghee/Kg	445.45	44.55	490
11	Dharwad Peda / Kg	357.14	42.86	400
12	Nandini Peda /kg	401.79	48.21	450
13	Jamoon /Kg	233.33	46.67	280
14	Mysore pak / Kg	392.86	47.14	440

3.4 Product Mix of VIMUL

The Table 4 showed the milk union performance in terms of sale of fluid milk, different types of milk products and price spread of channel. Toned milk was sold for 38 rupees with a 1.90 rupees margin, standardised milk for 48 rupees with a 2.40 rupee margin, and full cream milk for 52 rupees with a 3 rupee margin. The different products produced from the milk by the union are ghee, nandini peda, Dharwad peda, curd, flavoured milk, lassi, shrikhand, kowa, mysore pak, paneer and jamun. The highest margin was kept for Nandini peda (48.21 rupees) and the lowest margin was kept for curd (1.75 rupees).

among the products. For the curd of 200 ml, they kept a margin of 2 rupees, while for the curd of 500 ml, the margin was 1.75 rupees. The Nandini peda was sold at 450 rupees per kg, while the Dharwad peda was sold at 400 rupees per kg. Patel and Prabharan [6] indicated the choice of pack size varied and their findings revealed that a one-litre sachet was desired by 61 per cent of people and a half-litre was liked by 20 per cent of people. Nine per cent preferred low volume packs (250 ml). Venkateswaran et al. [7] investigated the brand preferences of specific FMGCs at Dindigul, Tamil Nadu. The study found that market factors including advertising, product quality, brand name, and image played a crucial role in influencing consumers' propensity to choose a particular brand.

Table 5. Growth in sales of milk and its products by VIMUL

Period		Milk(lit/day)	Flavored milk(lit/day)	Curd(lit/day)	Ghee(lit/day)	Peda(Kg/day)	Sweet lassi(lit/day)	Milk powder(kg/day)
1986-87 to 1995-96 (Period-I)	AVERAGE	17726.75	90	322.54	75.80	115.57	101.35	66
	CV(%)	14.80	31.46	19.89	21.96	63.69	26.50	26.26
	CAGR(%)	4.74**	9.47***	5.44**	7.50**	17.99***	9.02**	8.71***
1996-97 to 2005-06 (Period-II)	AVERAGE	23228.43	344.24	661.85	246.34	611.52	294.53	168.15
	CV(%)	16.36	46.06	16.56	38.21	31.89	57.97	51.16
	CAGR(%)	4.96**	14.54***	5.69**	13.71**	11.13***	16.55***	13.07***
2006-07 to 2015-16 (Period-III)	AVERAGE	50769	849.31	1904.44	811.60	1586.94	1047.23	876
	CV(%)	20.69	12.72	78.64	25.08	21.99	23.06	31.73
	CAGR(%)	6.91**	4.31***	21.41**	9.05**	7.67***	7.95***	11.79**
2016-17 to 2021-22 (Period-IV)	AVERAGE	70818.33	1069	7948.51	1340	2405	1522.33	1552.16
	CV(%)	12.64	10.79	15.53	14.21	11.42	6.20	10.19
	CAGR(%)	6.36**	-0.15***	8.71**	1.06***	1.19***	2.31**	-0.28**

***- significant at 1%, **- significant at 5% level of significance

3.5 Growth in Sales of Milk and Its Products by the VIMUL

Growth in the sales of milk products by the union across different periods is given in Table 5. On the whole there was an increase in the sales performance of different milk products over time indicated in average quantities. The milk sales per day for the Period I was 17,726.7 litres, which increased to 70,818.33 litres in Period IV. It registered the highest growth rate in Period III (6.91%) due to an increase in the purchasing power of consumers and a change in food habits and the lowest in Period I (4.74%). Flavored milk had a negative growth rate in Period IV (-0.15%). The highest growth rate in Period II (14.54%) due to globalization policy which came in 1991, increased the demand for these milk products in domestic as well as foreign market and Many marketing strategies followed by the union and quality parameters followed by the union and special feel in the taste of products. Curd registered the highest growth in Period III, with a growth rate of 21.41 per cent over the ten years and the lowest in Period I (5.44%). Ghee, peda, sweet lassi and milk powder had the highest growth in Period II (13.71%), Period I (17.99%), Period II (16.55%) and Period II (13.07%) respectively, and the lowest growth rate was observed in Period I for all these products (1.06%, 1.19%, 2.31% and -0.28% respectively). This was due to private firms entered the market in the early years, employing novel marketing strategies such as high fat content, appealing packaging, and advertising. These were the main reasons for the fluctuation. Anonymous [8] opined that the demand for value-added milk products such as probiotic drinks, cheese, and dahi (Indian yoghurt) was rising at a double-digit rate [9,10]. India appeared to be able to fulfil its own needs for milk and milk products at the moment [11-13].

4. CONCLUSION

This comprehensive analysis of VIMUL's milk procurement, pricing, and product sales over the past decades reveals a dynamic evolution driven by both policy changes and market forces. The significant rise in milk procurement volumes and the steady increase in transportation costs underscore the growing scale of operations and the need for efficient logistics. The substantial hike in milk prices for both cow and buffalo milk reflects successful policy interventions and subsidies, particularly evident during Period III with the introduction of the Ksheerabhagya

Yojana. Seasonal procurement patterns highlight the challenges of managing milk supply throughout the year, with notable peaks in flush seasons and declines during lean periods. Despite these fluctuations, VIMUL has successfully expanded its product range and increased sales volumes, though certain products like flavored milk showed a decline in recent years.

The findings emphasize the importance of strategic enhancements in procurement and distribution practices. To sustain growth and meet rising consumer demands, VIMUL must focus on optimizing logistics, reinforcing procurement strategies, and adapting to market trends. Continued investment in policy support and infrastructure will be crucial for maintaining stability and achieving further growth in the dairy sector.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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