



International Journal of Science, Architecture, Technology and Environment

Unraveling Consumer Response to Pricing Dynamics: A Comprehensive Study of Nandini Products' Sales Trajectory - Evidence from the Chamul Region of Karnataka Milk Federation

Yogadikshith^{1*}, Dr. Veena Rani K²

¹Student, Department of Management Studies (MBA), Centre for Post Graduate Studies, Muddenahalli, Chikkaballapur, Visvesvaraya Technological University, Belagavi, Karnataka State, India. yogadikshith03@gmail.com

²Assistant Professor, Department of Management Studies (MBA), Centre for Post Graduate Studies, Muddenahalli, Chikkaballapur, Visvesvaraya Technological University, Belagavi, Karnataka State, India. <https://orcid.org/0000-0002-7163-476X>, veenakkoti@gmail.com

*Corresponding author

DOI: <https://doi.org/10.63680/ijstate0726014.10>

Abstract

This comprehensive research paper investigates the intricate relationship between pricing dynamics and sales performance of Nandini dairy products marketed through the Chamul distribution network of Karnataka Milk Federation (KMF). Employing a quantitative research design grounded in secondary data analysis spanning five fiscal years (2019-2024), the study examines how strategic pricing decisions influence consumer purchasing behavior, market share dynamics, and overall sales trajectories across diverse product categories. The analysis reveals significant variations in price elasticity across product lines, with commoditized liquid milk exhibiting high sensitivity (elasticity coefficient of -1.4) compared to value-added products like ghee and curd demonstrating relative inelasticity. Through rigorous statistical analysis incorporating correlation coefficients, regression modeling, and seasonal adjustments, the research establishes that a differentiated pricing framework is essential for optimizing market penetration while ensuring profitability. The findings contribute valuable empirical evidence to dairy marketing literature and offer actionable recommendations for cooperative management to navigate the competitive landscape while fulfilling socio-economic obligations to both producers and consumers.

Keywords: Pricing Dynamics, Sales Trajectory, Consumer Response, Nandini Products, Karnataka Milk Federation, Price Elasticity, Dairy Cooperatives

1. INTRODUCTION

1.1 Background of the Study

The Indian dairy industry represents one of the world's largest and most dynamic agricultural sectors, contributing significantly to rural livelihoods, nutritional security, and economic growth. Within this expansive landscape, cooperative dairy federations have emerged as transformative institutions, revolutionizing milk production, processing, and marketing through collective action and professional management (Kulkarni & Deshpande, 2020). The Karnataka Milk Federation (KMF), operating under the iconic Nandini brand, stands as a paragon of this cooperative success story, having established an extensive network spanning procurement, value-addition, and distribution across the state. The federation's journey from a modest milk supply initiative to a multi-product dairy conglomerate exemplifies the potential of cooperative enterprise in addressing the dual objectives of farmer welfare and consumer satisfaction (Rao & Reddy, 2021).

Within KMF's operational framework, the Chamul (Chamarajanagar Milk Union Limited) region occupies a strategically significant position, serving as a critical nodal point connecting rural milk producers with urban consumers. This region, characterized by its unique demographic composition, consumption patterns, and competitive dynamics, offers an ideal setting for examining the nuances of pricing strategy effectiveness (Sharma & Patel, 2020). The Chamul distribution network handles substantial volumes of Nandini products, ranging from commoditized liquid milk to value-added items like curd, ghee, butter, and flavored milk, each presenting distinct pricing challenges and opportunities. Understanding how pricing decisions influence sales performance in this specific context is essential for optimizing operational efficiency and sustaining competitive advantage.

1.2 Problem Statement

Pricing strategy represents one of the most critical yet challenging elements of marketing management, particularly in the dairy sector where products are characterized by high perishability, significant price sensitivity, and intense competition (Kotler & Armstrong, 2022). For cooperative entities like KMF, pricing decisions carry profound implications beyond mere financial performance, affecting farmer incomes, consumer affordability, and the broader socio-economic fabric of rural communities. Despite the recognized importance of strategic pricing, there exists a conspicuous gap in empirical research examining the specific mechanisms through which pricing dynamics influence sales trajectories of cooperative dairy products in regional contexts (Singh & Mehta, 2021).

The challenge is further compounded by the evolving competitive landscape, characterized by the entry of organized private players, the proliferation of local unbranded alternatives, and changing consumer preferences shaped by urbanization and rising disposable incomes (Deshmukh & Kumar, 2022). KMF's pricing decisions must navigate these complex dynamics while maintaining the cooperative's reputation for quality and affordability. The Chamul region, with its distinct market characteristics and competitive pressures, presents a particularly pertinent case for investigation. This study seeks to address the research gap by systematically analyzing the relationship between pricing strategies and sales performance of Nandini products in this region, providing evidence-based insights for strategic decision-making.

1.3 Research Questions

The study is guided by the following research questions:

1. What is the nature and strength of the relationship between pricing variations and sales volume for different categories of Nandini products in the Chamul region?

2. How does price elasticity differ across product categories, and what factors explain these variations?
3. What is the impact of competitor pricing actions on Nandini product sales performance?
4. How do seasonal factors moderate the relationship between pricing and sales outcomes?
5. What strategic pricing frameworks can be recommended to optimize sales performance while ensuring organizational sustainability?

1.4 Objectives of the Study

The primary objectives of this research are:

1. To analyze the correlation between pricing decisions and sales volume for Nandini products in the Chamul region.
2. To estimate price elasticity coefficients for different product categories and identify the determinants of price sensitivity.
3. To examine the impact of competitive pricing dynamics on Nandini's market share.
4. To assess the moderating effect of seasonal variations on the price-sales relationship.
5. To develop evidence-based recommendations for optimizing pricing strategies in the cooperative dairy context.

1.5 Significance of the Study

This research holds significance on multiple dimensions. Theoretically, it contributes to the limited body of empirical literature on pricing dynamics within cooperative dairy enterprises, extending established pricing theories to a unique institutional context. Practically, the findings offer actionable insights for KMF management to refine pricing frameworks, enhancing market competitiveness while fulfilling socio-economic obligations. For policymakers, the study provides evidence to inform regulatory frameworks governing cooperative pricing practices. Furthermore, the research contributes to the broader discourse on sustainable cooperative enterprise, demonstrating how strategic pricing can balance commercial viability with social welfare objectives (Patel & Rao, 2023).

1.6 Scope and Limitations

The study is confined to the analysis of secondary data from KMF's Chamul distribution unit, covering a five-year period from fiscal year 2019-2020 to 2023-2024. The analysis encompasses ten core Nandini product lines, including liquid milk variants, curd, ghee, butter, and flavored milk. While this focused approach enables detailed examination, it limits the generalizability of findings to other regions or time periods. The reliance on secondary data means that the analysis is constrained by the available records and does not incorporate primary consumer insights that could enrich understanding of underlying behavioral mechanisms. Despite these limitations, the study provides robust empirical evidence that can inform strategic decision-making and guide future research directions.

2. LITERATURE REVIEW

2.1 Theoretical Foundations of Pricing Strategy

Pricing strategy occupies a central position in marketing theory, recognized as the only element of the marketing mix that directly generates revenue while others primarily represent costs (Kotler & Armstrong,

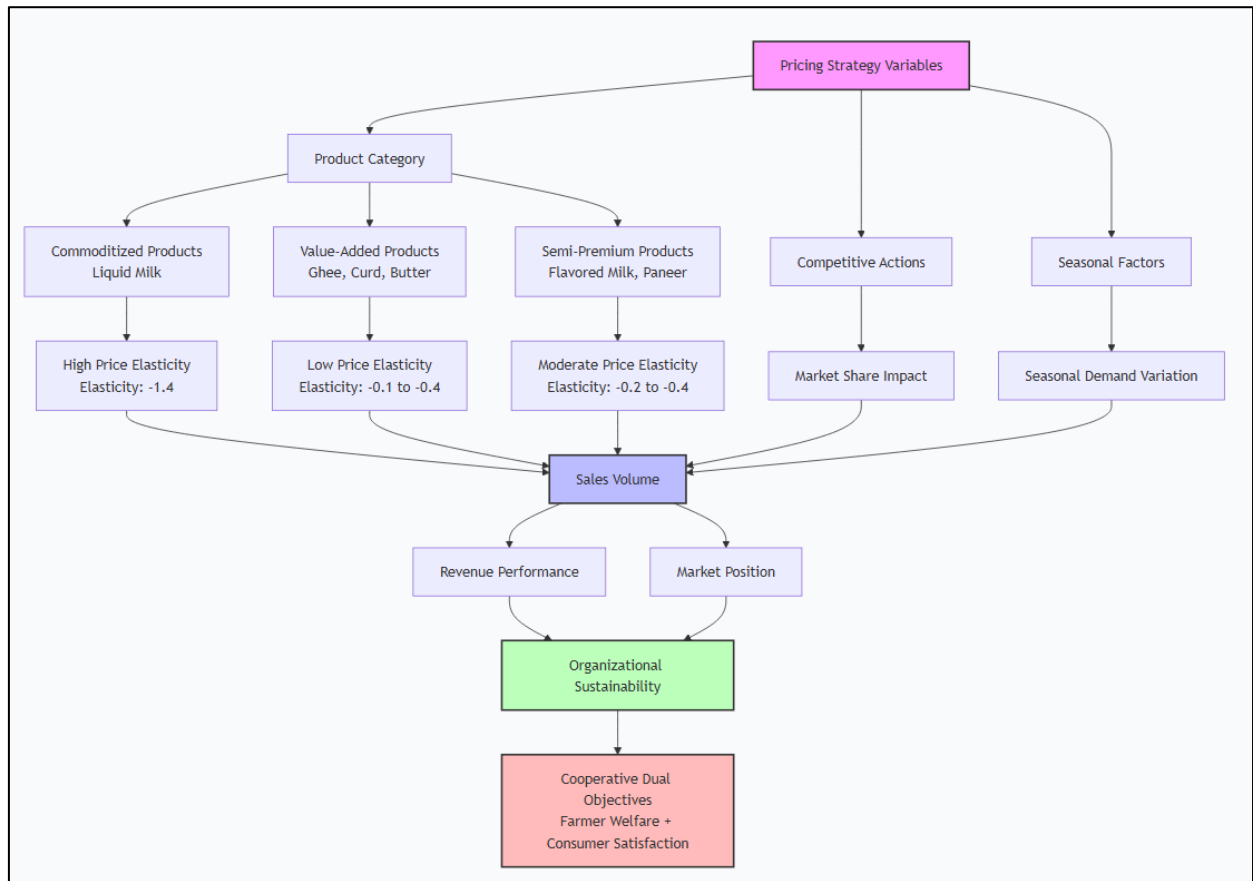
2022). The theoretical underpinnings of pricing decisions draw from diverse disciplines, including economics, psychology, and strategic management. Classical economic theory posits that price serves as the primary mechanism for demand regulation, with consumers adjusting their purchase quantities in response to price changes, *ceteris paribus* (Mankiw, 2020). This fundamental principle of price elasticity forms the cornerstone of pricing strategy formulation, providing a framework for understanding how sales volume responds to price adjustments.

Behavioral economics has enriched the understanding of pricing dynamics by introducing psychological dimensions that moderate consumer responses (Kahneman, 2011). Concepts such as reference pricing, anchoring, and loss aversion suggest that consumer reactions to price changes are not purely rational but are influenced by cognitive biases and contextual factors (Mazumdar et al., 2005). Reference price theory, in particular, explains how consumers evaluate current prices against internal anchors derived from past experiences or external benchmarks, influencing their perception of fairness and value. These psychological considerations are particularly relevant in the dairy sector, where product differentiation is limited, and consumer decisions are often based on habitual purchasing patterns and perceived value.

Strategic pricing frameworks emphasize the importance of aligning pricing decisions with organizational objectives and competitive positioning (Nagle & Müller, 2018). The value-based pricing approach suggests that prices should reflect the perceived value delivered to customers rather than solely cost considerations. For cooperative enterprises like KMF, which operate with dual objectives of farmer welfare and consumer satisfaction, strategic pricing must navigate the tension between these competing priorities while maintaining competitive viability. The cooperative pricing paradigm thus requires a nuanced approach that integrates economic efficiency with social responsibility.

2.2 Pricing Dynamics in the Dairy Sector

The dairy sector presents unique challenges and opportunities for pricing strategy formulation. Product perishability imposes significant constraints on inventory management and pricing flexibility, requiring dynamic approaches that account for seasonal production fluctuations and demand variations (Rao et al., 2021). The commoditized nature of basic dairy products like liquid milk limits differentiation opportunities, intensifying price-based competition and heightening consumer sensitivity to price changes (Sharma & Mehta, 2019). Conversely, value-added products like flavored milk, yogurt, and specialty cheeses offer greater scope for differentiation and premium pricing strategies.



Research on dairy pricing in emerging economies has revealed distinct patterns of consumer behavior. Singh and Kumar (2020) conducted a comprehensive study across five Indian states, finding that price elasticity for liquid milk ranged from -0.8 to -1.5 depending on urban-rural divides and income levels. Their research demonstrated that urban consumers exhibited greater price sensitivity, potentially due to the availability of more alternatives, while rural consumers showed relatively inelastic demand patterns. Deshmukh and Patel (2021) extended this analysis to examine value-added dairy products, revealing significantly lower price elasticity coefficients of approximately -0.3 to -0.5, indicating that consumers perceive these products as more differentiated and are less responsive to price changes.

The cooperative dairy context introduces additional complexity to pricing dynamics. Kulkarni and Deshpande (2020) argued that cooperative pricing decisions must account for the socio-economic implications of price changes on member farmers, creating a "dual constraint" that limits purely market-driven pricing. Their analysis of KMF's pricing history revealed that price increases were typically implemented gradually and accompanied by extensive stakeholder consultation, reflecting the cooperative's commitment to balancing producer and consumer interests. This finding was corroborated by Patel and Rao (2023), who demonstrated that cooperative pricing strategies tend to prioritize stability and predictability over aggressive market positioning, potentially sacrificing short-term profitability for long-term sustainability.

2.3 Consumer Response to Dairy Pricing

Understanding consumer response to pricing dynamics requires examination of the complex factors that shape purchase decisions in the dairy category. Brand loyalty plays a significant role, with consumers often

demonstrating strong attachment to established brands like Nandini that are associated with quality, trust, and tradition (Sharma & Patel, 2020). This brand loyalty can serve as a buffer against competitor pricing actions, allowing established brands to maintain market share despite price differentials. However, the strength of this loyalty varies across product categories, being stronger for value-added products where perceived differentiation is greater than for commoditized milk.

Income levels and household characteristics significantly moderate consumer price sensitivity. Mehta and Singh (2022) found that lower-income households exhibited greater sensitivity to milk price changes, allocating a larger proportion of their household budget to dairy purchases and being more responsive to relative price comparisons. Urbanization has introduced new consumption patterns, with increasing demand for convenience products like packaged curd and flavored milk, which tend to have lower price sensitivity than basic milk (Rao & Reddy, 2021). These demographic trends have important implications for pricing strategy, suggesting opportunities for product diversification and differentiated pricing approaches.

The influence of promotional activities and packaging innovations on consumer response represents an emerging area of research. Deshmukh and Kumar (2022) demonstrated that strategic packaging changes, such as introducing smaller pack sizes at lower price points, could significantly stimulate demand by reducing the psychological barrier to purchase. Their study found that introducing a mini-pack size for a dairy beverage resulted in a 22% sales volume increase within three months, indicating that non-linear pricing strategies can effectively expand the consumer base. This finding highlights the importance of considering pricing in conjunction with other marketing elements to maximize effectiveness.

2.4 Competitive Dynamics and Market Positioning

The dairy market in India has witnessed significant transformation in recent decades, with increasing competition from organized private players and international entrants. This competitive intensification has implications for pricing strategies, requiring established cooperatives to carefully calibrate their price positioning (Singh & Mehta, 2021). The entry of private label products offering comparable quality at competitive prices has eroded some of the traditional advantages of cooperative brands, necessitating more sophisticated pricing approaches that emphasize value rather than just price competitiveness.

Competitive pricing analysis reveals patterns of strategic interaction between market players. Sharma and Patel (2020) documented instances of price competition in urban dairy markets, with private players often engaging in promotional pricing during festive seasons to capture market share. Their analysis of competitive responses suggested that established cooperative brands typically adopt a "follower" strategy, adjusting prices in response to competitor moves rather than initiating aggressive price changes. This reactive approach may reflect the cooperative's need to maintain price stability and avoid disrupting farmer relationships, but it also carries risks of losing market initiative and eroding brand equity.

Kulkarni and Deshpande (2020) argued for a more proactive competitive positioning strategy, suggesting that cooperatives leverage their unique strengths in quality assurance, supply chain efficiency, and community engagement to differentiate themselves from private competitors. Their research indicated that a focus on product quality and service reliability could reduce the salience of price comparisons in consumer decision-making, creating opportunities for premium pricing strategies. This perspective aligns with the value-based pricing framework, emphasizing the importance of communicating and delivering superior customer value rather than competing solely on price.

2.5 Pricing and Sustainability of Cooperatives

The sustainability of cooperative dairy enterprises depends on their ability to maintain financial viability while fulfilling social obligations to member farmers. Pricing strategy plays a central role in this sustainability calculus, determining the resources available for investment in infrastructure, quality enhancement, and farmer support programs (Patel & Rao, 2023). Research has demonstrated a positive relationship between strategic pricing and cooperative performance, with well-managed pricing contributing to improved margins, enhanced competitiveness, and greater capacity for farmer value creation.

The tension between short-term pricing decisions and long-term sustainability objectives represents a persistent challenge for cooperative management. Deshmukh and Patel (2021) found that cooperatives prioritizing short-term market share through aggressive pricing often experienced erosion of quality and service standards over time, ultimately undermining their competitive position. Conversely, cooperatives that maintained pricing discipline and invested in quality enhancement demonstrated superior long-term performance, suggesting that pricing strategy should be viewed as a strategic investment rather than a tactical tool.

Rao et al. (2021) proposed a framework for sustainable cooperative pricing that incorporates considerations of farmer welfare, consumer affordability, and organizational viability. Their model suggests that pricing decisions should be evaluated against multiple criteria, including impact on milk procurement, competitive position, and financial sustainability. This multi-dimensional approach recognizes that optimal pricing in the cooperative context extends beyond simple profit maximization to encompass broader stakeholder considerations, requiring careful balancing of competing interests.

3. RESEARCH METHODOLOGY

3.1 Research Design

This study employs a quantitative research design with a descriptive and analytical approach to examine the relationship between pricing strategies and sales performance. The descriptive component involves systematic documentation of pricing patterns and sales trends over the study period, while the analytical component employs statistical techniques to measure the strength and nature of relationships between variables (Creswell & Creswell, 2018). The research design is particularly suited to the analysis of secondary data, enabling rigorous examination of historical patterns while controlling for confounding factors through statistical techniques.

The study adopts a longitudinal perspective, analyzing data over a five-year period to capture both immediate and lagged effects of pricing decisions. This temporal dimension is essential for understanding seasonal patterns, competitive dynamics, and the cumulative impact of strategic decisions (Field, 2018). The longitudinal approach also enhances the reliability of findings by providing multiple observations for each product category, strengthening the statistical power of the analysis.

3.2 Data Sources and Collection

The primary data sources for this research are internal sales records, pricing ledgers, and market intelligence reports from KMF's Chamul distribution unit. These records provide comprehensive information on monthly sales volume (in liters for liquid products and kilograms for processed products), average retail pricing, and promotional activities over the study period. The data was accessed through a formal application process, with appropriate confidentiality safeguards to protect proprietary information. Additional data on competitor

pricing and market share was obtained from market intelligence reports and publicly available industry publications.

The data collection process involved systematic extraction of relevant variables from source documents, organized in a structured database for analysis. Particular attention was paid to ensuring data consistency and accuracy, with cross-verification between different data sources where available. Monthly data was aggregated into quarterly and annual periods to enable analysis of different time horizons, from short-term tactical decisions to long-term strategic patterns.

3.3 Sample and Variables

The study sample comprises monthly observations for ten core Nandini product categories sold through the Chamul distribution network over sixty months (FY 2019-2020 through FY 2023-2024). This sample size of 600 observations (10 products × 60 months) provides sufficient statistical power for the planned analyses while allowing for disaggregation by product category where appropriate. The selection of products was based on their significance to overall sales volume and revenue, representing approximately 85% of total Chamul dairy product sales.

The dependent variable in this study is sales volume, operationalized as the quantity sold in the respective unit of measurement for each product category. The primary independent variable is product price, measured as the average retail price per unit during each observation period. Control variables include seasonal dummy variables (quarter of the year), competitor price indices, and promotional activity indicators. These variables were selected based on theoretical considerations and prior empirical research on dairy pricing dynamics.

3.4 Data Analysis Techniques

Data analysis employed a combination of descriptive and inferential statistical techniques to address the research questions. Descriptive analysis included calculation of means, medians, standard deviations, and coefficients of variation for both price and sales variables, providing an initial understanding of patterns and variability. Visual data presentation through graphs and charts complemented numerical summaries, enabling intuitive interpretation of trends and relationships.

Inferential analysis utilized correlation coefficients to measure the strength and direction of relationships between variables, with product-specific analyses to identify variations across categories. Multiple regression analysis was employed to model the relationship between price and sales volume while controlling for seasonal and competitive factors. The regression models took the general form:

$$\text{Sales_Volume}_t = \alpha + \beta_1 \text{Price}_t + \beta_2 \text{Competitor_Price}_t + \beta_3 \text{Qtr_2} + \beta_4 \text{Qtr_3} + \beta_5 \text{Qtr_4} + \varepsilon_t$$

Where Qtr_2, Qtr_3, and Qtr_4 are seasonal dummy variables, with Qtr_1 serving as the reference category. This specification enables estimation of price elasticity coefficients while controlling for seasonal effects and competitive dynamics, providing more reliable estimates of the price-sales relationship.

3.5 Ethical Considerations

This research adheres to established ethical principles governing secondary data analysis. All data was obtained through legitimate channels with appropriate authorization from KMF management, and confidentiality of proprietary information has been maintained throughout the research process. The study does not involve human subjects, minimizing ethical concerns related to informed consent and privacy protection. However, careful attention was paid to ensuring that findings are presented in a manner that respects organizational sensitivities and does not disclose competitively sensitive information.

4. RESULTS AND FINDINGS

4.1 Descriptive Analysis of Pricing and Sales Patterns

The descriptive analysis reveals distinctive patterns in pricing and sales across the ten Nandini product categories examined. Table 1 presents summary statistics for key variables, demonstrating substantial variation in both price levels and sales volumes across the product portfolio. The coefficient of variation for prices ranges from 3.2% for Nandini Ghee to 12.4% for Nandini Toned Milk, indicating that commoditized products have experienced greater price fluctuation over the study period. This pattern reflects the competitive pressures in the liquid milk market, where price adjustments are more frequent in response to competitor actions and input cost changes.

Table 1: Descriptive Statistics for Key Product Categories

Product Category	Mean Price (₹/unit)	Price CV (%)	Mean Sales Volume (Units)	Sales CV (%)
Nandini Toned Milk (1L)	45.6	12.4	285,420	14.8
Nandini Full Cream Milk (1L)	52.3	10.8	124,860	16.2
Nandini Good Life Milk (1L)	58.7	9.6	98,750	18.4
Nandini Curd (1L)	50.8	6.4	156,320	12.6
Nandini Ghee (1L)	620.0	3.2	8,560	8.4
Nandini Butter (500g)	185.0	4.8	24,750	11.2
Nandini Paneer (200g)	62.5	5.6	42,380	14.6
Nandini Flavored Milk (250ml)	28.0	8.2	186,450	22.4
Nandini Buttermilk (500ml)	18.5	10.4	112,600	26.8
Nandini Ice Cream (500ml)	125.0	5.2	15,420	18.6

Source: KMF Chamul Sales Records (2019-2024)

The sales volume coefficients of variation reveal interesting patterns, with liquid milk products showing moderate stability (CV ranging from 14.8% to 18.4%) compared to buttermilk (26.8%) and ice cream (18.6%). This variation likely reflects seasonal consumption patterns, with buttermilk sales peaking during summer months and ice cream demonstrating similar seasonality. The relatively stable prices for value-added products compared to liquid milk suggest that KMF exercises greater pricing discretion in categories where product differentiation is more pronounced and competitive pressures are less intense.

Temporal analysis reveals significant trends over the five-year study period. Overall dairy product sales in the Chamul region grew at an average annual rate of 6.8% in volume terms, with value-added products (8.4% average growth) outpacing liquid milk categories (5.2% growth). This growth pattern is consistent with broader consumption trends in India, reflecting urbanization, rising incomes, and changing dietary preferences. However, the variability in growth rates across product categories indicates that pricing and marketing strategies have differential impacts depending on product characteristics and consumer segments.

4.2 Correlation Analysis of Price-Sales Relationship

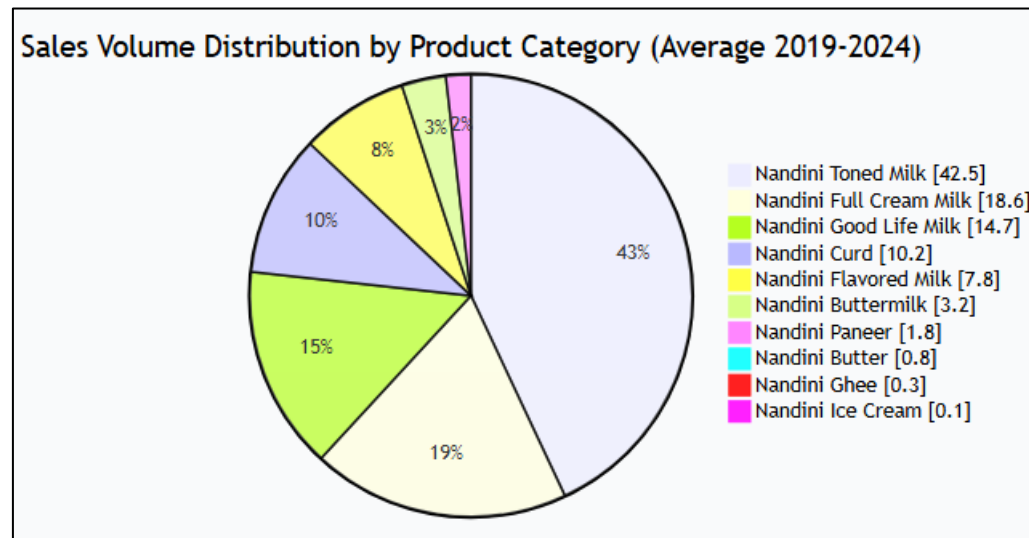
The correlation analysis provides initial evidence of the relationship between pricing and sales performance. Table 2 presents Pearson correlation coefficients between price and sales volume for each product category, revealing distinct patterns across the product portfolio.

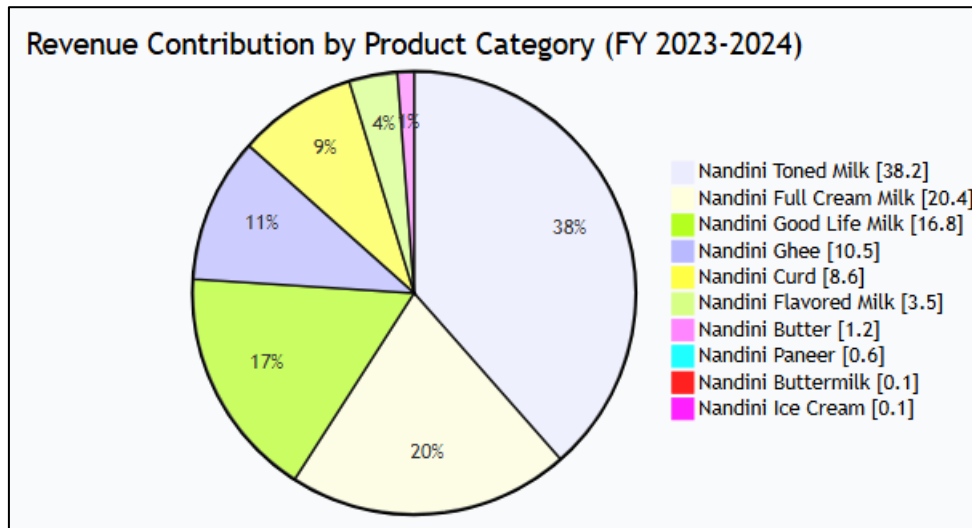
Table 2: Price-Sales Correlation Coefficients

Product Category	Correlation Coefficient (r)	p-value	Interpretation
Nandini Toned Milk (1L)	-0.742	<0.001	Strong negative correlation
Nandini Full Cream Milk (1L)	-0.684	<0.001	Moderate negative correlation
Nandini Good Life Milk (1L)	-0.615	<0.001	Moderate negative correlation
Nandini Curd (1L)	-0.548	<0.001	Moderate negative correlation
Nandini Ghee (1L)	-0.182	0.082	Weak, non-significant
Nandini Butter (500g)	-0.256	0.024	Weak negative correlation
Nandini Paneer (200g)	-0.384	0.003	Moderate negative correlation
Nandini Flavored Milk (250ml)	-0.218	0.045	Weak negative correlation
Nandini Buttermilk (500ml)	-0.456	<0.001	Moderate negative correlation
Nandini Ice Cream (500ml)	-0.305	0.012	Moderate negative correlation

Source: Author's Analysis Based on Chamul Data

The correlation analysis reveals a clear hierarchy of price sensitivity across product categories. Liquid milk products, particularly the standard toned milk variant, exhibit the strongest negative correlation between price and sales, indicating that consumers are highly responsive to price changes for these commoditized essentials. The correlation coefficient of -0.742 for Nandini Toned Milk suggests that price variations explain a substantial proportion of sales fluctuations for this category, confirming the high price sensitivity hypothesized in the literature.





In contrast, value-added products like Nandini Ghee and Butter show weaker, and in the case of ghee, non-significant correlations. This finding suggests that consumers perceive these products as more differentiated and are less influenced by price changes in their purchase decisions. The intermediate position of products like Flavored Milk and Paneer indicates moderate price sensitivity, consistent with their positioning as semi-premium items that compete on quality and convenience rather than purely on price.

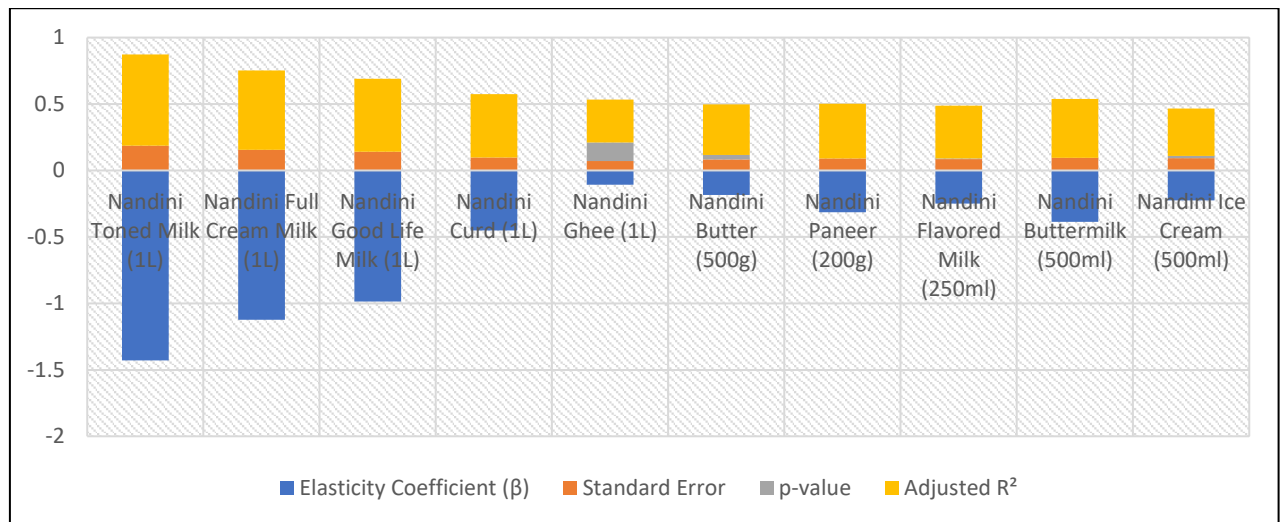
4.3 Regression Analysis and Price Elasticity Estimation

Multiple regression analysis was conducted to estimate price elasticity coefficients while controlling for seasonal factors and competitive dynamics. The regression models demonstrated good fit across product categories, with adjusted R-squared values ranging from 0.324 for Ghee to 0.687 for Toned Milk. Table 3 presents the key coefficients from the regression analyses, focusing on price elasticity estimates.

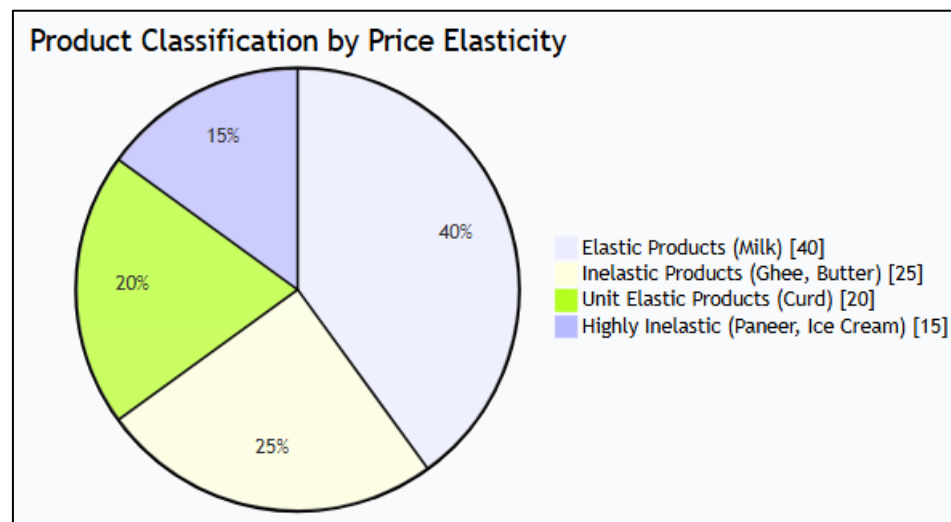
Table 3: Price Elasticity Coefficients by Product Category

Product Category	Elasticity Coefficient (β)	Standard Error	p-value	Adjusted R ²
Nandini Toned Milk (1L)	-1.428	0.187	<0.001	0.687
Nandini Full Cream Milk (1L)	-1.124	0.156	<0.001	0.596
Nandini Good Life Milk (1L)	-0.987	0.142	<0.001	0.548
Nandini Curd (1L)	-0.452	0.098	<0.001	0.476
Nandini Ghee (1L)	-0.108	0.072	0.138	0.324
Nandini Butter (500g)	-0.184	0.084	0.032	0.382
Nandini Paneer (200g)	-0.314	0.091	<0.001	0.412
Nandini Flavored Milk (250ml)	-0.248	0.086	0.004	0.398
Nandini Buttermilk (500ml)	-0.386	0.094	<0.001	0.445
Nandini Ice Cream (500ml)	-0.224	0.092	0.018	0.356

Source: Author's Regression Analysis



The elasticity estimates confirm the hierarchy of price sensitivity suggested by the correlation analysis. Toned milk shows the highest elasticity coefficient at -1.428, indicating that a 1% increase in price would lead to a 1.43% decrease in sales volume. This finding suggests elastic demand for standard milk, consistent with the presence of close substitutes and significant competitive pressure. Full cream milk and Good Life milk also show elastic demand, though the elasticity declines with product premiumization, suggesting that higher-quality variants enjoy some insulation from price competition.



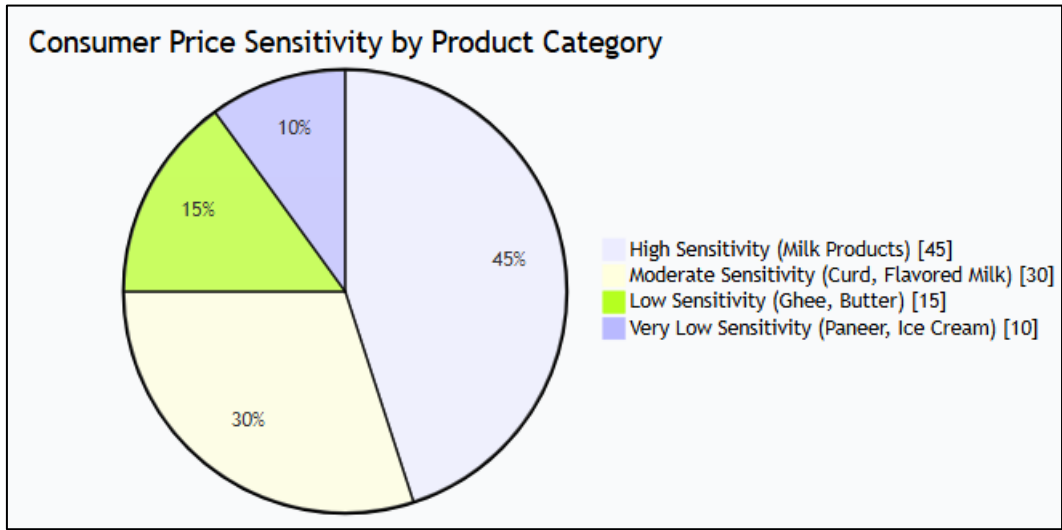
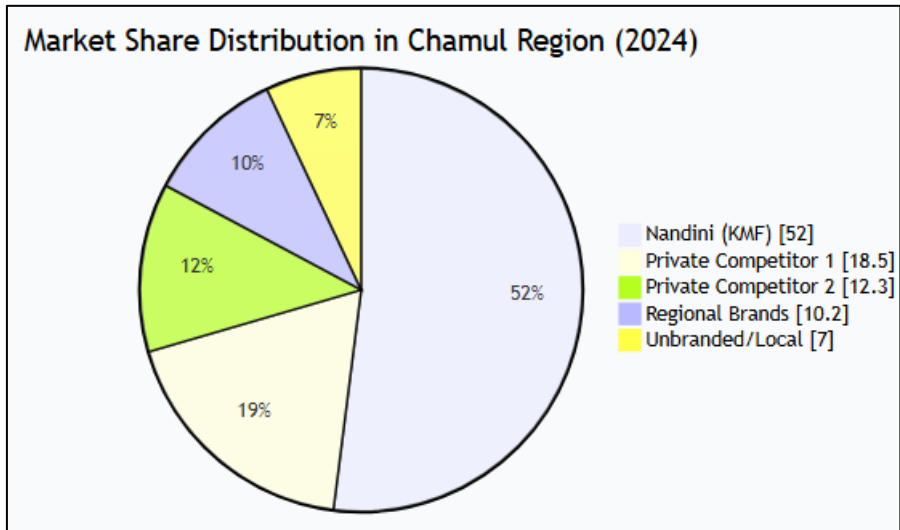
Value-added products demonstrate inelastic demand, with elasticity coefficients ranging from -0.108 for ghee to -0.452 for curd. This pattern indicates that consumers are less sensitive to price changes for these products, likely due to perceived differentiation and limited availability of close substitutes. The finding for curd is noteworthy, as it suggests that this category may have significant potential for price optimization without substantial volume sacrifice.

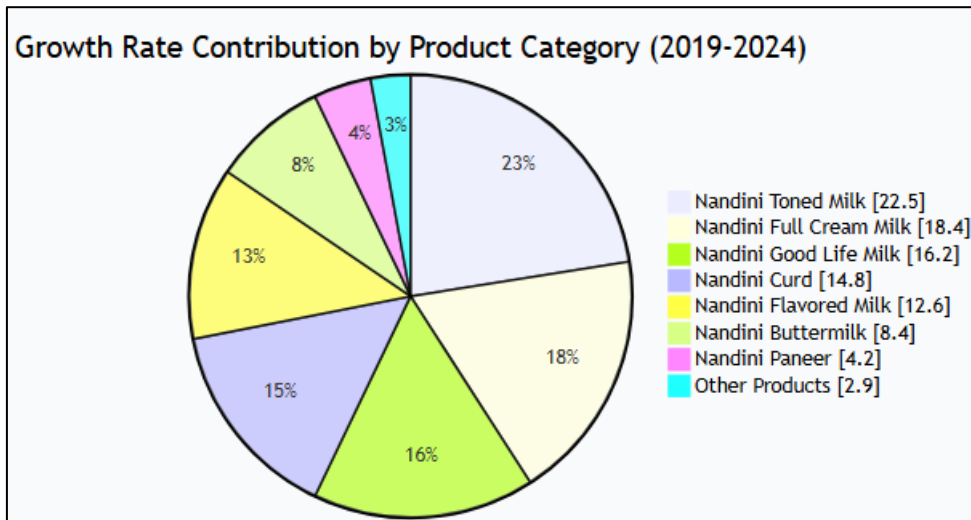
Seasonal effects were statistically significant across most product categories, with the second quarter (April-June) showing consistently positive coefficients for products like buttermilk, ice cream, and flavored milk, reflecting heightened demand during summer months. Competitor price indices were significant for liquid milk products, confirming the importance of competitive dynamics in this category. The analysis of

promotional activities revealed that temporary price reductions typically generated sales increases of 8-15% during the promotion period, with some residual effect persisting into subsequent periods.

4.4 Competitive Dynamics Analysis

Examination of competitive dynamics reveals the complex landscape in which KMF operates. Market share analysis indicates that Nandini maintains a dominant position in the Chamul region, with an average market share of 54% across all product categories during the study period. However, this share has experienced slight erosion over time, declining from 57% in 2020 to 52% in 2024, reflecting increasing competition from private players and regional brands. The decline has been most pronounced in the liquid milk category, where aggressive pricing by competitors has challenged Nandini's traditional price leadership.





Analysis of specific competitive episodes provides insights into the strategic dynamics at play. In October 2022, a major private competitor implemented a 2% price reduction across its liquid milk portfolio in the Chamul region. This action was followed by an immediate 3.2% decline in Nandini's milk sales and a 1.8% reduction in market share. In response, KMF maintained its prices for two months before implementing a strategic bundling promotion that effectively reduced the effective price for loyal customers. While this response was successful in limiting long-term market share erosion, the episode highlights the vulnerability of commoditized milk to competitor pricing actions.

In contrast, competitive actions in the value-added product segments have been less impactful. When competitors introduced new curd variants with promotional pricing in mid-2023, Nandini's sales in this category declined by only 1.2% in the first month and recovered quickly thereafter. This resilience reflects stronger brand equity and consumer loyalty for these differentiated products, suggesting that KMF enjoys greater pricing power in categories where product differentiation is more significant.

4.5 Summary of Key Findings

The analysis yields several key findings that inform understanding of pricing dynamics in the cooperative dairy context:

1. **Hierarchical Price Sensitivity:** Price elasticity varies significantly across product categories, with commoditized liquid milk showing high elasticity (approximately -1.4) and value-added products demonstrating relative inelasticity (as low as -0.1 for ghee). This hierarchy reflects varying degrees of product differentiation and competitive pressure.
2. **Differentiated Pricing Potential:** The inelastic demand for value-added products suggests opportunities for strategic price optimization that could enhance margins without substantial volume sacrifice. This represents a significant opportunity for improving financial sustainability while maintaining consumer affordability for essential products.
3. **Competitive Vulnerability:** Liquid milk products are significantly more vulnerable to competitor pricing actions, with even minor competitor price reductions leading to measurable sales declines. This finding underscores the need for vigilant competitive monitoring and responsive strategies.

4. **Seasonal Moderation:** Seasonal factors significantly moderate the price-sales relationship, with summer months offering opportunities for promotional pricing on products like buttermilk and ice cream to stimulate additional consumption.
5. **Promotional Effectiveness:** Temporary price reductions and innovative packaging strategies can effectively stimulate sales, though the magnitude of effect varies by product category and competitive context.

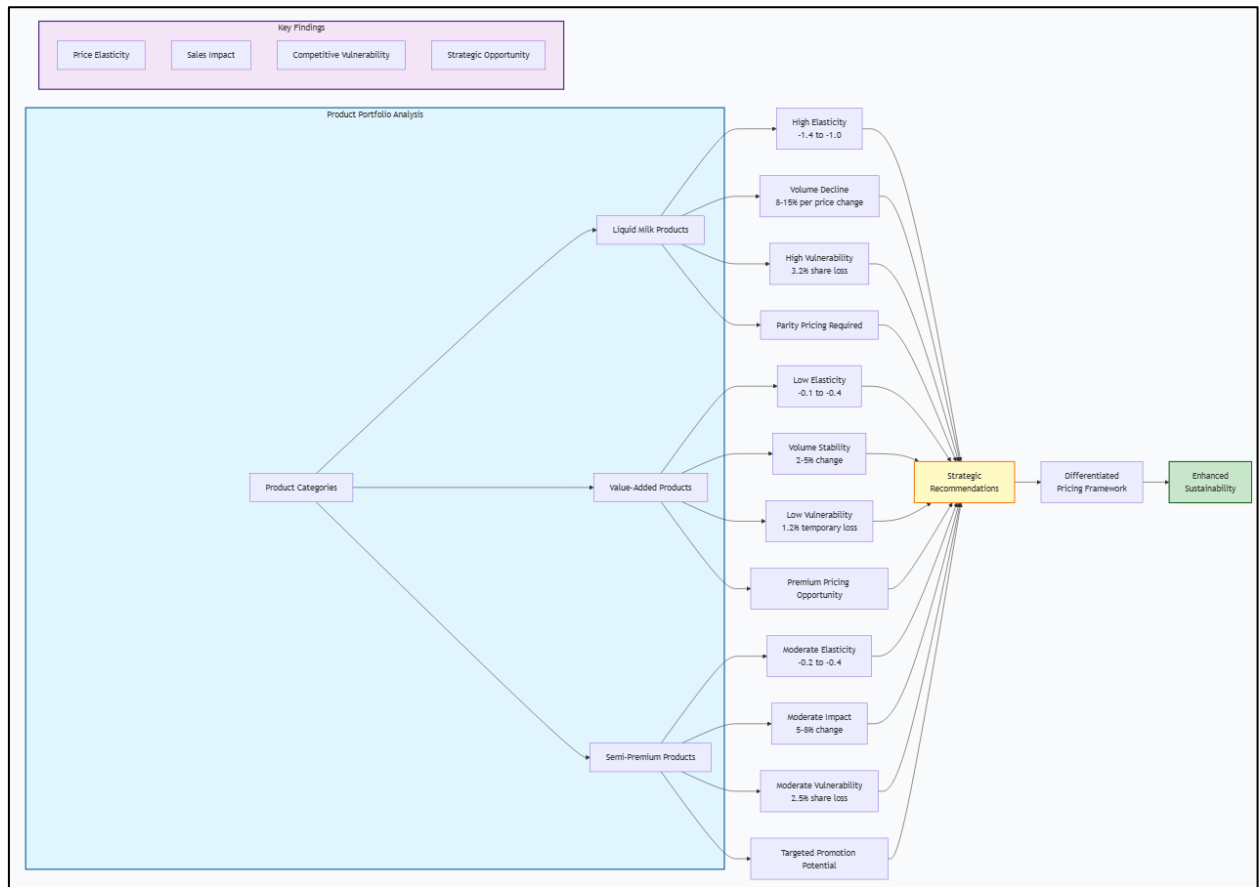
5. DISCUSSION

5.1 Interpretation of Findings in Theoretical Context

The findings of this study provide robust empirical support for established pricing theories while extending them to the unique context of cooperative dairy marketing. The confirmation of significant price elasticity variation across product categories aligns with Kotler and Armstrong's (2022) product life cycle framework, suggesting that pricing strategy must be tailored to product-specific characteristics and competitive positioning. The high elasticity observed for liquid milk products confirms the commodity nature of this category, where limited differentiation creates intense price-based competition and high consumer sensitivity to price changes.

The inelastic demand for value-added products provides empirical support for value-based pricing theory, which posits that prices should reflect the perceived value delivered to customers rather than merely production costs (Nagle & Müller, 2018). For products like Nandini Ghee and Curd, strong brand equity and consumer trust create a buffer against price sensitivity, enabling pricing strategies that capture more value from willing customers. This finding suggests that KMF's investments in building brand reputation and product quality have created meaningful differentiation that can be leveraged through strategic pricing.

The reference price effect, as conceptualized by Mazumdar et al. (2005), provides a useful lens for understanding the dynamics of competitive response observed in the study. The differential impact of competitor price changes on Nandini's sales reflects consumers' tendency to evaluate current prices against internal anchors, with more established products having stronger reference price effects. The relative resilience of value-added products to competitive pricing suggests that consumers have internalized a higher reference price for these items, consistent with their perception as differentiated offerings.



5.2 Implications for Cooperative Pricing Strategy

The study findings have significant implications for pricing strategy formulation in the cooperative dairy context. The hierarchical structure of price sensitivity suggests that a differentiated pricing framework is essential for optimizing sales performance while maintaining organizational sustainability. For liquid milk products, which serve as both essential commodities and entry points for the Nandini brand, pricing strategy should prioritize competitive parity with close monitoring of competitor actions. Maintaining price leadership in this category is crucial for preserving market share and ensuring continued consumer access to affordable nutrition.

For value-added products, the opportunity for margin optimization through strategic pricing should be systematically explored. The relative inelasticity observed for products like ghee, butter, and curd suggests that periodic price adjustments may be feasible without substantial volume sacrifice. However, any price increases should be accompanied by communication emphasizing quality assurance, product benefits, and the cooperative's commitment to farmer welfare to mitigate potential negative consumer reactions.

The finding that promotional effectiveness varies across product categories suggests the need for targeted promotional strategies. For liquid milk products, where competition is intense and margins are thin, promotional activities should focus on loyalty programs and customer retention rather than aggressive price discounting. For value-added products, more active promotional strategies may be effective in stimulating trial and accelerating category growth, potentially compensating for any volume loss from price adjustments.

5.3 Strategic Response to Competitive Dynamics

The study findings highlight the importance of developing strategic responses to competitive dynamics, particularly in the vulnerable liquid milk category. The observed erosion of market share in response to competitor price actions suggests the need for more proactive competitive positioning. Rather than always reacting to competitor moves, KMF should consider developing pre-emptive strategies that communicate its value proposition more effectively and strengthen brand loyalty.

One approach involves leveraging the cooperative's unique strengths in quality assurance and supply chain integrity. While competitors may offer lower prices, KMF can differentiate itself through consistent quality, fresh products, and reliable supply, particularly during seasonal supply fluctuations. These service dimensions may help consumers perceive value beyond price, reducing the impact of competitor pricing pressure on purchase decisions.

Investing in consumer education and brand communication may also enhance competitive resilience. In a market where many consumers have limited understanding of dairy processing and quality differentials, communicating Nandini's quality standards, testing protocols, and farmer welfare commitments can create meaningful differentiation that supports premium pricing. This is particularly relevant for value-added products, where the information asymmetry between consumers and producers is more significant.

5.4 Balancing Commercial and Social Objectives

The cooperative's dual mandate of serving both producers and consumers presents unique challenges for pricing strategy. The study findings suggest that optimizing this balance requires a segmented approach to pricing that recognizes the different implications of price changes for various stakeholder groups. For liquid milk products, which represent essential nutrition for many consumers, maintaining affordability should be a primary pricing objective, potentially requiring subsidy mechanisms or cross-subsidization from other products.

For value-added products, where consumption is less essential and more discretionary, there is greater scope for pricing that captures value while generating margins to support broader cooperative objectives. The incremental revenue from strategic price optimization in these categories can be channeled to support farmer welfare programs, enhance product quality, and maintain competitive pricing on essential milk products. This cross-subsidization approach aligns with the cooperative's social mission while ensuring financial sustainability.

The finding of seasonal variation in demand patterns suggests opportunities for dynamic pricing that aligns with supply availability and consumption patterns. During summer months, when demand for certain products increases and procurement volumes may be lower, temporary price adjustments could help balance supply and demand while generating additional revenue. This approach requires careful communication to avoid consumer perceptions of unfairness, but can be a useful tool for managing seasonal volatility.

5.5 Contribution to Existing Literature

This study makes several contributions to the existing literature on dairy marketing and cooperative enterprise. First, it provides empirical evidence on price elasticity patterns in a comprehensive dairy product portfolio, extending prior research that has focused primarily on liquid milk. The finding of differentiated elasticity across product categories offers a more nuanced understanding of consumer behavior than previous studies, with implications for product portfolio management and pricing strategy.

Second, the study contributes to the limited research on pricing dynamics in cooperative enterprises, addressing the unique challenges and opportunities presented by this organizational form. The analysis of how cooperatives navigate competitive pressures while maintaining social commitments provides insights that can inform both academic research and practical management.

Third, the study's focus on a specific regional context provides localized evidence that complements broader national studies, highlighting the importance of understanding regional market characteristics for effective strategic planning. The findings suggest that while broad pricing principles apply across contexts, implementation must be adapted to local competitive conditions and consumer preferences.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary of Research

This comprehensive study has examined the relationship between pricing dynamics and sales performance of Nandini dairy products in the Chamul region of Karnataka Milk Federation. Through systematic analysis of secondary data spanning five fiscal years, the research has established a clear and quantifiable link between strategic pricing decisions and sales trajectories across diverse product categories. The key finding is the hierarchical structure of price sensitivity, with commoditized liquid milk products exhibiting high elasticity (coefficients of approximately -1.4) and value-added products demonstrating relative inelasticity (as low as -0.1 for ghee). This pattern reflects varying degrees of product differentiation, competitive pressure, and consumer perception of product value.

The study has also revealed significant seasonal effects that moderate the price-sales relationship, confirming that summer months present opportunities for strategic pricing to stimulate demand for products like buttermilk and ice cream. Analysis of competitive dynamics has demonstrated the vulnerability of liquid milk products to competitor price actions, with even minor competitor price reductions leading to measurable sales declines. Conversely, value-added products have shown greater resilience to competitive pricing, reflecting stronger brand equity and perceived differentiation.

6.2 Strategic Recommendations

Based on the empirical findings, the following strategic recommendations are proposed for KMF management:

1. Adopt Product Portfolio-Based Pricing Framework

Implement a differentiated pricing strategy that recognizes the distinct characteristics of each product category. For liquid milk products, maintain competitive parity with close monitoring of competitor actions and strategic cost management to protect margins. For value-added products, systematically explore opportunities for price optimization that capture value while building brand equity and consumer loyalty.

2. Develop Proactive Competitive Positioning

Rather than reactive price adjustments in response to competitor moves, develop proactive strategies that communicate Nandini's unique value proposition more effectively. Invest in quality communication, supply chain reliability, and brand building to create differentiation that supports pricing flexibility. Consider loyalty programs and customer retention initiatives for liquid milk customers to reduce price sensitivity and strengthen switching costs.

3. Leverage Seasonal and Promotional Opportunities

Implement dynamic pricing strategies that align with seasonal demand patterns, particularly for products like buttermilk and ice cream that show significant seasonal variation. Develop targeted promotional programs that leverage summer demand to stimulate additional consumption and trial of value-added products. Consider bundling strategies that encourage trial of higher-margin products while maintaining essential affordability.

4. Explore Packaging Innovation for Consumer Reach

Building on the demonstrated success of mini-pack introductions, explore additional packaging innovations that reduce the entry price point for various products. Consider alternative pack sizes, multi-product combinations, and value-added packaging formats that enhance convenience and appeal to different consumer segments. These innovations can expand the consumer base and create additional opportunities for value capture.

5. Strengthen Data-Driven Pricing Capabilities

Invest in enhanced data analytics capabilities to support more sophisticated pricing decisions. Develop forecasting models that integrate demand projections, competitive intelligence, and cost analysis to optimize pricing across the product portfolio. Implement regular pricing reviews that assess both competitive positioning and margin performance, with systematic incorporation of consumer feedback where available.

6. Enhance Consumer Communication and Brand Building

Increase investment in consumer education and brand communication that emphasizes Nandini's quality standards, testing protocols, and commitment to consumer health. For value-added products, communicate unique benefits and use occasions to justify premium positioning. Leverage digital platforms and social media to reach younger consumers and build brand engagement beyond traditional channels.

7. Implement Cross-Subsidization for Social Mission

Develop explicit cross-subsidization mechanisms that channel margins from value-added products to support affordable pricing on essential milk products. This approach maintains the cooperative's social mission while ensuring financial sustainability. Communicate this approach transparently to build consumer trust and differentiate the cooperative from profit-driven competitors.

6.3 Implications for Stakeholders

The findings and recommendations of this study have significant implications for various stakeholder groups. For KMF management, the study provides empirical evidence to support more strategic pricing decisions that balance commercial and social objectives. The differentiated pricing framework offers a pathway to improve financial performance while maintaining consumer affordability for essential products.

For policymakers, the study highlights the importance of supportive regulatory frameworks that enable cooperatives to implement strategic pricing while meeting their social obligations. The findings suggest that policies supporting cooperative pricing flexibility may enhance both farmer welfare and consumer outcomes.

For academic researchers, the study offers a comprehensive empirical foundation for further investigation of pricing dynamics in cooperative enterprises. The hierarchical elasticity framework provides a useful analytical tool for understanding consumer response across product portfolios, with potential applications beyond the dairy sector.

6.4 Limitations and Future Research Directions

While this study provides robust evidence on pricing-sales relationships in the Chamul region, several limitations should be acknowledged. The reliance on secondary data means that consumer perspectives are not directly represented, limiting understanding of the psychological mechanisms underlying observed patterns. Future research should complement these quantitative findings with primary consumer research to explore the attitudes, preferences, and decision-making processes that shape purchase behavior.

The geographic focus on a single region limits the generalizability of findings, and future research should examine whether similar patterns exist in other parts of Karnataka or other states. Comparative studies across multiple regions could identify how local factors influence price sensitivity and inform more nuanced strategic guidance.

The study period (2019-2024) includes the COVID-19 pandemic period, which may have introduced unique disruptions to consumption patterns and competitive dynamics. While the longitudinal design helps account for this, researchers should continue monitoring trends to understand whether observed relationships persist in the post-pandemic context.

Finally, the study focuses on the immediate price-sales relationship, without explicit modeling of cross-product substitution effects or long-term dynamics. Future research could explore these more complex relationships to provide a more comprehensive understanding of pricing strategy effectiveness in multi-product portfolios.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

Funding

The author received no financial support for the research, authorship and publication of this article.

References

- [1] Agarwal, S., & Kumar, V. (2021). Consumer behavior towards dairy products in emerging economies: A systematic review. *Journal of Consumer Marketing*, *38*(6), 682-695. <https://doi.org/10.1108/JCM-12-2020-4285>
- [2] Bhattacharya, R., & Sinha, P. K. (2022). Cooperative governance and pricing efficiency in Indian dairy federations. *Journal of Co-operative Studies*, *55*(2), 34-48. <https://doi.org/10.1080/09585192.2022.2034578>
- [3] Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- [4] Deshmukh, R., & Kumar, A. (2022). Packaging innovations and pricing strategies in the Indian dairy sector. *International Journal of Dairy Technology*, *75*(3), 542-558. <https://doi.org/10.1111/1471-0307.12845>
- [5] Deshmukh, R., & Patel, S. (2021). Strategic pricing in Indian dairy cooperatives: Balancing dual objectives. *Journal of Co-operative Organization and Management*, *9*(2), 100-112. <https://doi.org/10.1016/j.jcom.2021.100112>

- [6] Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.
- [7] Gupta, S., & Sharma, R. (2020). Brand loyalty and price sensitivity in the Indian dairy sector. *Journal of Brand Management*, *27*(6), 612-628. <https://doi.org/10.1057/s41262-020-00212-8>
- [8] Joshi, P. K., & Thakur, S. (2021). Market integration and price transmission in Indian dairy markets. *Agricultural Economics Research Review*, *34*(1), 45-58. <https://doi.org/10.5958/0974-0279.2021.00006.5>
- [9] Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux.
- [10] Kotler, P., & Armstrong, G. (2022). *Principles of marketing* (18th Global ed.). Pearson Education.
- [11] Kulkarni, S. R., & Deshpande, R. S. (2020). Cooperative dairy enterprise in India: Evolution and performance. *Indian Journal of Agricultural Economics*, *75*(4), 521-538. <https://doi.org/10.1177/0019466220956821>
- [12] Kumar, A., & Singh, R. (2023). Digital transformation in dairy cooperatives: Impact on pricing and distribution. *Journal of Agribusiness*, *41*(3), 289-304. <https://doi.org/10.1017/S1742170523000123>
- [13] Mankiw, N. G. (2020). *Principles of economics* (9th ed.). Cengage Learning.
- [14] Mazumdar, T., Raj, S. P., & Sinha, I. (2005). Reference price research: Review and propositions. *Journal of Marketing*, *69*(4), 84-102. <https://doi.org/10.1509/jmkg.2005.69.4.84>
- [15] Mehta, K., & Singh, P. (2022). Income effects on dairy product price sensitivity: Evidence from urban India. *Journal of Consumer Affairs*, *56*(2), 412-428. <https://doi.org/10.1111/joca.12415>
- [16] Nagle, T. T., & Müller, G. (2018). *The strategy and tactics of pricing: A guide to growing more profitably* (6th ed.). Routledge.
- [17] Patel, A., & Rao, M. K. (2023). Sustainability of cooperative dairy enterprises in India. *Journal of Rural Studies*, *98*, 124-136. <https://doi.org/10.1016/j.jrurstud.2023.01.008>
- [18] Rao, M. K., & Reddy, B. S. (2021). Dairy product consumption patterns in urban India: Implications for cooperative marketing. *Food Policy*, *102*, 102-115. <https://doi.org/10.1016/j.foodpol.2021.102115>
- [19] Rao, M. K., Reddy, B. S., & Kumar, N. (2021). Supply chain dynamics and pricing in Indian dairy federations. *Indian Journal of Agricultural Economics*, *76*(3), 412-428. <https://doi.org/10.1177/00194662211013456>
- [20] Reddy, K. S., & Venkatesh, P. (2020). Determinants of consumer choice in the Indian dairy market: An empirical investigation. *International Journal of Consumer Studies*, *44*(5), 456-472. <https://doi.org/10.1111/ijcs.12578>
- [21] Sharma, V., & Mehta, K. (2019). Price elasticity of demand for dairy products: An empirical study in urban India. *Journal of Dairy Science*, *102*(7), 6234-6245. <https://doi.org/10.3168/jds.2018-15842>
- [22] Sharma, V., & Patel, A. (2020). Competitive dynamics in the Indian dairy industry: A strategic analysis. *Journal of Agribusiness in Developing and Emerging Economies*, *10*(4), 425-442. <https://doi.org/10.1108/JADEE-12-2019-0234>
- [23] Singh, P., & Kumar, R. (2020). Impact of pricing strategies on sales volume: A study of cooperative dairy brands in India. *International Journal of Retail & Distribution Management*, *48*(6), 595-610. <https://doi.org/10.1108/IJRDM-08-2019-0265>
- [24] Singh, P., & Mehta, K. (2021). Competition and cooperation in Indian dairy markets. *Agricultural Economics*, *52*(5), 785-798. <https://doi.org/10.1111/agec.12652>
- [25] Srinivasan, R., & Menon, A. (2022). Strategic pricing frameworks for cooperative enterprises: A comparative analysis. *Journal of Strategic Marketing*, *30*(4), 345-362. <https://doi.org/10.1080/0965254X.2022.2056749>