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An Economic Analysis of Milk Production and Marketing in Uttar Pradesh with Special Reference to Varanasi District, India

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Abstract

This study examines the economics of milk production and marketing in Varanasi district, Uttar Pradesh, focusing on resource structure, production costs, and marketing channels. Primary data were collected from 75 milk-producing households across three villages (Dhanesari, Koirajpur, and Wajidpur) in Harahua block during June-July 2025. Farmers were categorized into marginal (1-2 animals), small (3-4 animals), and large (≥5 animals) based on herd size. The study revealed that buffalo milk production was more cost-effective than cow milk across all farm categories. Per-liter production costs ranged from ₹44.30 to ₹78.89, with large buffalo farms showing the lowest costs. Three major marketing channels were identified: direct producer-to-consumer sales, producer-vendor-consumer, and producer-cooperative-retailer-consumer chains. Direct sales provided the highest producer share (100%) in consumer price, while cooperative channels, though offering lower margins, provided more stable market access. The study highlights significant opportunities for improving dairy profitability through better breed management, feeding practices, and marketing channel optimization.

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Keywords

Dairy economics, milk production, marketing channels, Varanasi, buffalo milk, cost analysis

Introduction

India stands as the world's largest milk producer, contributing approximately 25% of global milk output with a production of 239.3 million tonnes in 2023-24 (Department of Animal Husbandry and Dairying, 2023). Uttar Pradesh leads this production, accounting for 16.21% of the country's total milk output. The dairy sector plays a crucial role in India's rural economy, providing livelihood support to millions of farmers, particularly smallholders and marginal farmers.

Varanasi district, located in eastern Uttar Pradesh, represents a significant region for livestock-based rural livelihoods. The district has maintained a robust tradition of animal husbandry, with dairy farming forming a key component of its agrarian economy. Despite progress in adopting improved cattle breeds and modern feeding practices, several challenges persist including low productivity of indigenous cattle, limited access to veterinary services, unorganized milk marketing, and poor price realization by producers.

The significance of milk as a nutritional source cannot be overstated. Milk and dairy products are rich in essential nutrients including protein, calcium, phosphorus, vitamin B2 (riboflavin), and vitamin B12 (cobalamin). For children, one glass of milk can meet approximately 35% of daily protein needs, 52% of calcium requirements, and nearly 98% of vitamin B12 needs (Yayar, 2012). The per capita availability of milk in India has increased from 217 grams per day in 2000-01 to 471 grams per day in 2023-24, surpassing the global average of 329 grams per day.

Understanding the economics of milk production and marketing systems is essential for sustainable

development of the dairy sector. This study addresses the gap in empirical understanding of cost-benefit dynamics and marketing efficiency in the Varanasi region, providing actionable insights for policy formulation and sector development.

Several studies have examined various aspects of dairy economics and marketing in India. Naik and Rout (1995) found that variable cost per liter of milk was lowest in larger dairy farms due to economies of scale, while smaller farms faced higher costs due to uneconomic herd sizes. Pawar and Sawant (1995) examined marketing efficiency across government, private, and cooperative channels in Western Maharashtra, finding that private dairies achieved higher efficiency in procurement and distribution.

Banerjee and Yadav (2003) studied milk production and marketing in Central Uttar Pradesh, concluding that cost of production per liter decreased with enterprise size and that crossbred cattle were more profitable than indigenous breeds. Their research also highlighted that producer's share in consumer price decreased with longer marketing channels.

Kumar and Singh (2007) analyzed economic aspects of milk production in Panipat district, Haryana, demonstrating that buffalo rearing was more profitable than crossbred and local cows for supplementing farm income. Similarly, Singh (2009) studied marketing channels in Sultanpur district, U.P., identifying four major channels and finding that cooperative channels were most widely used (65% of producers) despite lower marketing efficiency.

More recent studies have emphasized the importance of organized marketing systems. Mohammad and Gupta (2011) analyzed milk disposal patterns in West Bengal, revealing that most farmers sold milk within villages on credit basis, indicating the prevalence of informal marketing arrangements. These studies collectively highlight the need for comprehensive analysis of production economics and marketing efficiency in dairy systems.

Materials and Methods

Study Area Selection

Uttar Pradesh was deliberately chosen as it leads India in milk production. Varanasi district was selected due to its substantial cattle population and significant milk production levels. From the eight blocks in Varanasi district, Harahua block was specifically chosen based on its high concentration of milk producers and recognition by NITI Aayog as a model block for infrastructural development assessment.

Sampling Design

A multi-stage stratified random sampling method was employed:

•Stage I: Purposive selection of Varanasi district

•Stage II: Random selection of Harahua block

•Stage III: Purposive selection of three villages (Dhanesari, Koirajpur, Wajidpur)

•Stage IV: Random selection of 75 households (25 from each village) Households were categorized based on milch animal ownership:

•Marginal farmers: 1-2 milch animals (36 households)

•Small farmers: 3-4 milch animals (24 households)

•Large farmers: ≥5 milch animals (15 households)

Data Collection

Primary data were collected during June-July 2025 through personal interviews using pre-tested schedules. Information gathered included:

•Operational land holdings and cropping patterns

•Livestock population and breed composition

•Milk production and feeding practices

•Cost structure and income patterns

•Marketing channels and associated costs

Analytical Framework

Cost analysis followed standard farm management concepts with modifications for dairy systems:

Cost A: All actual cash and kind expenses (feed, hired labor, veterinary care, equipment maintenance)

Cost B: Cost A plus interest on fixed capital and imputed value of home-produced fodder

Cost C: Cost B plus imputed value of family labor

Income measures included gross income, net income, family labor income, and farm business income. Marketing channel analysis examined cost distribution, margins, and price spreads across different pathways.

Results and Discussion

Resource Structure of Sample Farms

The total operational area across 75 sample households was 173.55 hectares, with significant variation in land distribution. Marginal farmers, though constituting 48% of households, operated only 9.55 hectares (5.5% of total area). In contrast, large farmers (20% of households) controlled 122.50 hectares (70.6% of total area), indicating highly skewed land distribution. The livestock population varied across villages, with Koirajpur having the highest number of cows (95 total) and Wajidpur leading in buffalo population (67 total). Holstein Friesian (HF) cows dominated across all regions, comprising 61.11% in Dhanesari, 43.90% in Koirajpur, and 34.37% in Wajidpur. Among buffaloes, Murrah breed predominated, accounting for over 70% in all villages.

Milk Production Performance

Daily milk production showed clear differences across farm categories and animal types. For cows, daily production totaled 137.5 liters (marginal), 243.5 liters (small), and 399 liters (large farms). Per-cow daily yield ranged from 8.3 to 9.0 liters, with small farms achieving the highest per-animal productivity (9 liters).

Buffalo milk production followed similar patterns: 129.5 liters (marginal), 136 liters (small), and 304 liters (large farms) daily. Per-buffalo yields ranged from 8.0 to 8.5 liters, again with small farms showing superior per-animal performance.

Table.1 Selection of study area

S.No.	Particulars	Selection of study area
1	District	Varanasi
2	Block	Harahua
3	Village	Dhanesari, Koirajpur, Wajidpur,

Table.2 Distribution of sample households by area

Holding Groups	Dhanesari [HH,Area]	Koirajpur [HH,Area]	Wajidpur [HH,Area]	Overall HH	Overall Area
Marginal	(12) 3.18	(10) 2.65	(14) 3.72	36	9.55
Small	(8) 13.83	(11) 19.01	(5) 8.65	24	41.50
Large	(5) 40.83	(4) 32.67	(6) 49.00	15	122.50
Overall	(25) 57.84	(25) 54.33	(25) 61.37	75	173.55

Table.3 Milk production on sample farms

S.No.	Catagory	Cow milk production			Buffaloes milk production		
		Total/day liter	Per cow/day liter	Per household/day in liter	Total/day liter	Per buffalo/day liter	Per household/day in liter
1.	Marginal	137.5	8.5	1	129.5	8	1
2.	Small	243.5	9	2	136	8.5	1.5
3.	Large	399	8.3	2.5	304	8.4	2

Table.4 Per-liter cost of cow milk production

Particulars	Marginal farmers	Small farmers	Large farmers
Paid out cost A1	41.85	41.37	46.04
Cost -A2	44.36	43.85	48.81
Cost- B	51.58	54.50	65.91
Cost- C	58.35	64.17	78.89

Table5 Per-liter cost of buffalo milk production

Particulars	Marginal farmers	Small farmers	Large farmers
Paid out cost A1	38.95	38.25	29.95
Cost -A2	41.28	40.54	28.57
Cost- B	47.32	49.72	37.71
Cost- C	53.77	58.84	44.30

Production Cost Analysis

The cost analysis revealed significant variations across farm categories and animal types. For cow milk production, per-liter Cost C ranged from ₹58.35 (marginal farms) to ₹78.89 (large farms). Buffalo milk production showed more favorable economics, with Cost C ranging from ₹44.30 (large farms) to ₹58.84 (small farms).

The cost structure analysis revealed that green and dry fodder constituted the largest expense component, accounting for 23.95% to 30.84% of total costs. Labor charges represented another major component (20.09%

to 27.57%), particularly significant for marginal farmers who relied heavily on family labor.

Buffalo rearing demonstrated superior cost efficiency, particularly in large-scale operations. The total annual maintenance cost for buffaloes was consistently lower than for cows across all farm categories, with large buffalo farms showing the most favorable economics.

Profitability Analysis

Despite varying cost structures, milk production remained profitable across all categories. For cows, the difference between gross income and Cost C was positive for all farm sizes: ₹32,969 (marginal), ₹52,100 (small), and ₹83,131 (large farms) annually per animal.

Buffalo production showed even more favorable returns, with annual profits over Cost C of ₹79,689 (marginal), ₹40,457 (small), and ₹67,457 (large farms). The results indicate that while large farms achieved higher absolute returns, marginal buffalo farmers obtained relatively better profit margins.

Marketing Channel Analysis

Three distinct marketing channels were identified and analyzed:

Channel I (Producer to Consumer): This direct marketing channel provided producers with 100% of the consumer price, with minimal marketing costs (₹0.50 per liter). Producer prices ranged from ₹37.50 to ₹55.50 per liter, depending on farm size and animal type.

Channel II (Producer-Vendor-Consumer): This channel involved milk vendors as intermediaries. Marketing costs ranged from ₹3.50 to ₹6.70 per liter, with vendor margins between ₹2.50 and ₹3.00. Consumer prices varied from ₹43.50 to ₹65.20 per liter.

Channel III (Producer-Cooperative-Retailer-Consumer): The most complex channel involved cooperatives and retailers. Total marketing costs ranged from ₹11.25 to ₹12.20 per liter, with total marketing margins between ₹3.50 and ₹4.50. Final consumer prices ranged from ₹55.25 to ₹72.20 per liter.

Buffalo milk consistently commanded higher prices across all channels, reflecting its superior quality characteristics and market demand. Large-scale producers generally achieved better price realization, particularly through organized marketing channels.

Feeding and Management Practices

Feeding patterns showed seasonal variations, with green fodder feeding highest during rainy season (30.25 to 39.05 kg/day for buffaloes) and lowest during summer (24.75 to 31.95 kg/day). Concentrate feeding was relatively modest, ranging from 2.48 to 3.74 kg/day, with buffaloes receiving slightly higher quantities reflecting their greater milk production potential.

Farm size influenced feeding practices, with larger farms generally providing higher quantities of both fodder and concentrates. This investment in better nutrition contributed to the observed productivity differences across farm categories.

Conclusion

This study provides comprehensive insights into the economics of milk production and marketing in Varanasi district. Key findings include:

1. Production Economics: Buffalo milk production demonstrates superior cost-effectiveness compared to cow milk, particularly in large-scale operations. Per-liter production costs were consistently lower for buffaloes across all farm categories.
2. Scale Effects: While large farms achieved higher absolute production and income, economies of scale were more pronounced in buffalo operations than cow operations. Small farms showed the highest per-animal productivity, suggesting optimal resource utilization at moderate scales.
3. Marketing Efficiency: Direct producer-to-consumer sales provided the highest returns to producers, capturing 100% of consumer price. However, cooperative channels, despite lower margins, offered more stable and organized market access.
4. Resource Utilization: Significant disparities in land distribution were observed, with large farmers controlling disproportionate land resources. This inequality affects production capacity and market access.
5. Profitability: Despite cost variations, milk production remained profitable across all categories, with buffalo rearing showing consistently better returns. The sector provides viable livelihood opportunities, particularly for small and marginal farmers.

The study highlights the importance of promoting buffalo-based dairy systems, improving feeding and management practices, and strengthening marketing infrastructure. Policy interventions should focus on breed improvement, fodder development, cooperative strengthening, and providing better market access to small producers.

Future research should examine the impact of climate change on feeding patterns, evaluate the effectiveness of different extension approaches, and analyze the potential for value-added dairy products in the region.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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