

Costs and Returns of Milk Production in Nizamabad District of Telangana State: An Empirical Economic Analysis

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Abstract- Dairy farming serves as a cornerstone of rural livelihoods in India, providing income security and cushioning agrarian households against crop volatility. This study examines the economics of milk production across small, medium, and large dairy farms in the Nizamabad district of Telangana State. Utilizing primary cross-sectional data collected through a multistage stratified sampling design (N=300), the research evaluates cost structures, lactation yields, input–output relationships, and disposal channels for cows and buffaloes. The empirical findings reveal an average daily maintenance cost of ₹48.45 per cow and ₹59.56 per buffalo, with annual maintenance costs per milch animal settling at ₹17,685.29 and ₹21,739.73, respectively. Feed and fodder constituted the single largest cost component, accounting for nearly 84% of total variable maintenance expenditures (dry fodder ~39.7%, green fodder ~20.0%, and concentrate ~24.5%). The unit cost of milk production averaged ₹12.77 per litre for cows and ₹14.70 per litre for buffaloes. Average lactation yields stood at 1,560.64 litres for cows and 1,684.43 litres for buffaloes, with larger herds demonstrating significant economies of scale through lower unit costs (₹11.09/litre for cows and ₹13.48/litre for buffaloes) and higher productivity (1,811.68 litres and 1,860.82 litres). Daily net returns averaged ₹105.21 per cow and ₹161.01 per buffalo, culminating in favorable input–output ratios of 1:3.17 and 1:3.70 at the aggregate level. Disposal patterns indicate that 75.00% of fluid milk entered the marketed surplus, with direct-to-consumer and private unorganized channels handling the majority of sales. The paper concludes with targeted policy measures focusing on subsidized community fodder banks, decentralized veterinary care, and the consolidation of dairy Farmer Producer Organizations (FPOs) to enhance smallholder competitiveness.

Keywords: dairy economics, production cost, lactation yield, input–output ratio, net returns, nizamabad district, telangana.

I. INTRODUCTION

Livestock rearing forms the socioeconomic bedrock of the Indian rural economy, functioning as a vital instrument of inclusive growth, nutritional security, and regular cash flow for small and marginal landholders. While traditional agriculture remains exposed to climatic vagaries and price instabilities, the livestock sector—particularly dairying—has consistently registered robust growth. Dairying accounts for roughly 5 percent of India's national gross domestic product (GDP) and directly sustains more than 80 million rural households. India holds the premier rank globally in total milk production, contributing over 23 percent to worldwide output.

Within the agrarian economy of Telangana, the livestock subsector has emerged as an indispensable driver of the Gross State Value Added (GSVA). Agro-climatic regions such as the Nizamabad district combine established canal and lift irrigation networks with extensive bovine rearing, supporting mixed crop-livestock farming systems. Despite this structural prominence, dairy producers in the semi-arid tropics confront recurring bottlenecks, including seasonal fodder shortages, escalating prices of commercial concentrates, limited formal institutional credit, and localized marketing constraints.

Evaluating the micro-level economics of milk production—specifically understanding the disaggregated cost components, input–output efficiency, and marketing margins across different herd-size strata—is crucial for evidence-based policymaking. While aggregate state statistics capture broad output expansions, they often mask herd-level cost disparities and structural inefficiencies experienced by smallholders versus commercial

enterprises. Accordingly, this study provides an empirical assessment of the costs, returns, investment dynamics, and marketing channels characterizing bovine milk production in the Nizamabad district of Telangana.

II. OBJECTIVES OF THE STUDY

The overarching aim of this study is to evaluate the economic feasibility, cost-return structure, and operational efficiency of dairy farming across herd-size classes in Nizamabad District, Telangana.

The specific research objectives are:

1. To analyze investment patterns, feeding regimes, and milk utilization/disposal channels across small, medium, and large dairy farm households.
2. To estimate disaggregated maintenance costs, lactation yields, and net returns for cows and buffaloes across operational farm sizes.
3. To assess input–output efficiency and economies of scale in milk production across different dairy enterprise categories.
4. To identify key production and marketing constraints encountered by dairy farmers and outline strategic policy interventions for sustainable dairy development.

III. RESEARCH METHODOLOGY

3.1 Study Area and Sampling Framework

Nizamabad District of Telangana State was selected purposively based on its high bovine population, established milk routes, and active cooperative procurement network. A multistage stratified random sampling design was employed:

- Stage I (Revenue Divisions): All three administrative divisions—Nizamabad, Armoor, and Bodhan—were covered.
- Stage II (Mandals): One mandal was selected randomly from each division ($n = 3$).
- Stage III (Villages): Two villages were chosen at random from each sample mandal ($n = 6$).
- Stage IV (Farm Households): Dairy farmers were enumerated and stratified into three operational herd-size categories:
 - Small Farms: 1–3 milch animals
 - Medium Farms: 4–10 milch animals
 - Large Farms: > 10 milch animals

- Large Farms: > 10 milch animals

Using the Probability Proportional to Size (PPS) technique, a total sample of $N = 300$ milk producers was drawn, comprising 150 small, 90 medium, and 60 large farm households.

3.2 Data Collection and Variable Quantification

Primary cross-sectional data were gathered through personal in-depth interviews using a pre-tested, structured schedule. The dataset captured detailed inventories of livestock assets, physical quantities and farm-gate valuations of dry and green fodders, feed concentrate mixes, family and hired labour allocation, disease management expenditures, lactation lengths, lactation yields, and marketing routes.

3.3 Economic and Analytical Framework

Standard farm management accounting cost concepts were adapted for the dairy enterprise:

1. Dairy Farming Costs (D-Costs):

- D-Cost A (Paid-out Costs): Out-of-pocket operational expenditures, encompassing purchased green/dry fodder, concentrates, hired human labour wages, veterinary and breeding expenses, electricity/water charges, plus depreciation on livestock, cattle sheds, and dairy equipment.
- D-Cost B: $D\text{-Cost A} + \text{Interest on owned fixed capital investment (evaluated at 8.00\% per annum)}$
- D-Cost C (Total Economic Cost): $D\text{-Cost B} + \text{Imputed value of family labour (evaluated at the prevailing local daily wage rates for permanent agricultural labour)}$.

2. Income and Profitability Metrics:

- Dairy Gross Receipts (DGR): Total revenue from fluid milk sales plus the imputed economic value of home-consumed milk, dung/manure production, and calf appreciation.
- Dairy Farm Business Income (DFBI): $DGR - D\text{-Cost A}$
- Dairy Family Labour Income (DFLI): $DGR - D\text{-Cost B}$
- Dairy Net Income (DNI): $DGR - D\text{-Cost C}$
- Unit Cost of Production:

$$\text{Net Cost per Litre (₹)} = \frac{\text{Total Maintenance Cost (D-Cost C)} - \text{Value of By-products (Dung \& \dots)}}{\text{Total Milk Yield per Lactation (Litres)}}$$

3. Depreciation Computations:

- **Milch Stock:** Calculated via the Straight-Line Method at 8.00% per annum for animals aged 5 years and above, based on an assumed productive lifespan of 13 years.
- **Buildings & Sheds:** Depreciated at 2.50% to 5.00% per annum depending on structural classification (*pucca* or *semi-pucca*).
- **Machinery & Utensils:** Depreciated uniformly at 10.00% per annum.

4. Empirical Results and Discussion

4.1 Daily Production and Maintenance Cost per Milch Animal

The daily maintenance expenditure incurred per milch animal provides direct insight into operational cost pressures across species and herd sizes.

As summarized in Table 1, the overall daily maintenance cost averaged ₹48.45 for cows and ₹59.56 for buffaloes. Across herd-size groups,

medium holdings recorded the highest daily maintenance costs (₹58.90 for cows and ₹71.99 for buffaloes), followed by smallholders (₹49.09 and ₹60.00). In contrast, large commercial farms achieved substantial operational efficiencies, recording daily costs of ₹36.51 and ₹44.52 for cows and buffaloes, respectively.

Feed and roughage represented the primary cost drivers across all strata. On average, combined dry and green fodder expenditures reached ₹28.94 per day for cows and ₹35.61 for buffaloes, while concentrate feed mixes accounted for ₹11.87 and ₹14.63. Veterinary charges imposed a greater per-animal burden on small farms (₹0.83/day for cows and ₹1.02/day for buffaloes) than on large holdings (₹0.48/day), reflecting the inability of smallholders to capture bulk veterinary discounts. Fixed overheads (shed depreciation and capital interest) averaged ₹1.99 (cows) and ₹2.40 (buffaloes) per day across the aggregate sample.

Table 1: Production and Maintenance Cost per Milch Animal per Day (in ₹)

S.No.	Cost Components	Small Cow	Small Buffalo	Medium Cow	Medium Buffalo	Large Cow	Large Buffalo	Overall Cow	Overall Buffalo
1.	Dry & Green Fodder	29.70	36.31	36.86	45.06	19.53	23.87	28.94	35.61
2.	Concentrates	12.81	15.66	17.60	21.51	4.62	5.65	11.87	14.63
3.	Labour Charges	3.21	3.93	1.36	1.66	10.31	12.60	4.78	5.92
4.	Veterinary Charges	0.83	1.02	0.64	0.78	0.48	0.48	0.66	0.74
5.	Mineral & Misc. Items	0.26	0.32	0.30	0.37	0.06	0.08	0.21	0.26
A	Total Variable Cost (1–5)	46.81	57.24	56.76	69.38	35.00	42.68	46.46	57.16
B	Total Fixed Cost	2.28	2.76	2.14	2.61	1.51	1.84	1.99	2.40
C	Grand Total Cost (A + B)	49.09	60.00	58.90	71.99	36.51	44.52	48.45	59.56

4.2 Annual Cost Structure and Percentage Composition

The itemized annual expenditure presented in Table 2 underscores the heavy dominance of variable operational costs in dairy farming, comprising 95.90% of total costs for cows and 95.98% for buffaloes.

- **Fodder and Nutrition:** Dry fodder accounted for 39.65% (₹7,012.40) of annual costs for cows and 39.76% (₹8,644.30) for buffaloes. Green fodder contributed 20.07% (₹3,549.33) and 20.02% (₹4,353.32), respectively. In total, roughages

absorbed approximately 60% of the enterprise's annual budget.

- **Concentrate Feeding:** Compound feed mixes (cereal grains, oil cakes/*khali*, and pulse bran/*choker*) represented 24.50% (₹4,332.34) of cow maintenance costs and 24.56% (₹5,338.65) of buffalo maintenance costs.
- **Labour Economics:** A pronounced structural difference emerged in human labour utilization. Large farms depended heavily on hired permanent and casual labour, with labour absorbing 28.23%

(₹3,762.29) of cow costs and 28.30% (₹4,598.36) of buffalo costs. Conversely, small and medium enterprises relied on unpaid family labour, resulting in lower out-of-pocket labour outlays.

- Capital Depreciation and Interest: Annual fixed costs averaged ₹725.82 (4.10%) for cows and

₹874.85 (4.02%) for buffaloes, reflecting modest capital investments in milking machines and structural housing among sample households.

Table 2: Production and Maintenance Cost per Milch Animal per Annum (in ₹)

S. N o.	Particulars	Small (Cow)	%	Small (Buff)	%	Medium (Cow)	%	Medium (Buff)	%	Large (Cow)	%	Large (Buff)	%	Overall (Cow)	%	Overall (Buff)	%
1.	Dry fodder	7,08 2.64	39 .53	8,65 6.56	39 .53	8,87 7.76	41 .30	10,8 50.59	41 .30	4,93 1.04	37 .00	6,02 6.83	37 .09	7,01 2.40	39 .65	8,64 4.30	39 .76
2.	Green fodder	3,76 0.78	20 .99	4,59 6.51	20 .99	4,57 8.71	21 .30	5,59 6.20	21 .30	2,19 7.20	16 .49	2,68 5.47	16 .53	3,54 9.33	20 .07	4,35 3.32	20 .02
3.	Concentrate	4,67 6.17	26 .10	5,71 5.32	26 .10	6,42 3.63	29 .88	7,85 1.10	29 .88	1,68 6.44	12 .66	2,06 1.20	12 .69	4,33 2.34	24 .50	5,33 8.65	24 .56
a.	Grainger	1,87 0.47	10 .44	2,28 6.13	10 .44	2,56 9.45	11 .95	3,14 0.44	11 .95	674. 57	5. 06	824. 48	5. 07	1,73 2.93	9. 80	2,13 5.46	9. 82
b.	Khali (Oil Cake)	1,16 9.04	6. 52	1,42 8.83	6. 52	1,60 5.91	7. 47	1,96 2.77	7. 47	421. 61	3. 16	515. 30	3. 17	1,08 3.08	6. 12	1,33 4.66	6. 14
c.	Chunni / Choker	1,63 6.66	9. 13	2,00 0.36	9. 13	2,24 8.27	10 .46	2,74 7.88	10 .46	590. 25	4. 43	721. 42	4. 44	1,51 6.32	8. 57	1,86 8.53	8. 59
4.	Mineral material	96.5 2	0. 54	117. 97	0. 54	110. 22	0. 51	134. 71	0. 51	22.5 0	0. 17	27.5 0	0. 17	78.2 6	0. 44	94.4 1	0. 43
5.	Labour charges	1,17 2.25	6. 54	1,43 2.75	6. 54	496. 30	2. 31	606. 59	2. 31	3,76 2.29	28 .23	4,59 8.36	28 .30	1,74 6.35	9. 87	2,16 2.50	9. 95
6.	Veterinary charges	304. 27	1. 70	371. 89	1. 70	233. 05	1. 08	284. 84	1. 08	174. 22	1. 31	174. 22	1. 07	240. 78	1. 36	271. 71	1. 25

7.	Variable Cost (1-6)	17,092.66	95.39	20,891.02	95.39	20,719.67	96.38	25,324.04	96.38	12,773.70	95.85	15,573.58	95.84	16,959.47	95.90	20,864.88	95.98
8.	Fixed Cost	825.37	4.61	1,008.79	4.61	778.04	3.62	950.94	3.62	552.54	4.15	675.33	4.16	725.82	4.10	874.85	4.02
9.	Grand Total (Cost C)	17,918.03	10.00	21,899.81	10.00	21,497.71	10.00	26,274.98	10.00	13,326.24	10.00	16,248.91	10.00	17,685.29	10.00	21,739.73	10.00

4.3 Productivity and Unit Cost of Milk Production

Table 3 provides an evaluation of lactation performance relative to per-litre production costs across farm sizes.

Lactation productivity exhibited a consistent direct correlation with operational herd size. Average lactation milk yield stood at 1,560.64 litres for cows and 1,684.43 litres for buffaloes. Large farms achieved the highest yields (1,811.68 litres for cows and 1,860.82 litres for buffaloes), outperforming medium (1,545.53 L and 1,677.15 L) and small holdings (1,361.36 L and 1,479.37 L).

Because fixed overheads and bulk feed procurement costs were distributed across higher volume outputs, unit production costs decreased steadily as herd size expanded. The average cost per litre was ₹12.77 for cows and ₹14.70 for buffaloes. Large dairy operators produced milk at substantially lower unit costs (₹11.09/litre for cows and ₹13.48/litre for buffaloes) than smallholders (₹13.16 and ₹14.80) and medium producers (₹13.91 and ₹15.67). The higher unit cost observed in buffalo milk across all farm sizes reflects greater dry matter intake requirements and longer intercalving intervals, which were partially offset by higher market sale prices based on milk fat content.

Table 3: Per-Litre Cost of Milk Production per Lactation

Category	of Species	/ Total Maintenance Cost per Milk Lactation (₹)	Yield per Cost of Milk Production Lactation (Litres)	per Litre (₹)
Households	Animal Type			
Small Farms	Cow	17,918.03	1,361.36	13.16
	Buffalo	21,899.81	1,479.37	14.80
Medium Farms	Cow	21,497.71	1,545.53	13.91
	Buffalo	26,274.98	1,677.15	15.67
Large Farms	Cow	13,326.24	1,811.68	11.09
	Buffalo	16,248.91	1,860.82	13.48
Overall Average	Cow	17,685.29	1,560.64	12.77
	Buffalo	21,739.73	1,684.43	14.70

4.4 Gross Revenue, Net Returns, and Input–Output Dynamics

The net financial profitability and operational efficiency of the dairy enterprise are detailed in Table 4.

Gross daily receipts averaged ₹153.66 per cow and ₹220.57 per buffalo. Across all categories, buffaloes

generated consistently higher daily revenues than cows due to their elevated fat percentage, which commands premium farm-gate pricing in local informal and formal markets. Net returns per animal per day averaged ₹105.21 for cows and ₹161.01 for buffaloes across the entire sample, peaking on large

commercial farms at ₹141.43 and ₹198.77, respectively.

The input–output ratio, which serves as a standard metric of capital efficiency in livestock economics, confirmed positive returns across all operational strata. Large farms achieved the highest input–output ratios

(1:3.22 for cows and 1:3.50 for buffaloes). The overall weighted input–output ratios settled at 1:3.17 for cows and 1:3.70 for buffaloes, demonstrating that dairy production in the Nizamabad district remains economically viable and capable of generating substantial value over invested capital.

Table 4: Daily Costs, Returns, and Input–Output Ratios per Milch Animal (in ₹)

S.No.	Particulars	Small (Cow)	Small (Buff)	Medium (Cow)	Medium (Buff)	Large (Cow)	Large (Buff)	Overall (Cow)	Overall (Buff)
1.	Total Cost (₹/day)	49.09	60.00	58.90	71.99	36.51	44.52	48.45	59.56
2.	Gross Return (₹/day)	138.43	199.20	149.61	218.85	177.94	243.29	153.66	220.57
3.	Net Return (₹/day)	89.34	139.20	90.71	146.86	141.43	198.77	105.21	161.01
4.	Input–Output Ratio	1 : 2.82	1 : 3.32	1 : 2.54	1 : 3.04	1 : 3.22	1 : 3.50	1 : 3.17	1 : 3.70

4.5 Milk Disposal Channels and Marketed Surplus
Analysis of post-production utilization indicated that out of total daily milk production:

- Domestic Retention: Approximately 15.00% was retained for direct household liquid consumption.
- Home Processing: About 10.00% was converted into traditional indigenous dairy products, predominantly ghee and curd (*dahi*).
- Marketed Surplus: The remaining 75.00% was sold as liquid milk through commercial channels.

Total Fluid Milk Production (100.00%)

Home Retention & Value Addition (25.00%)

- Direct Domestic Fluid Consumption: 15.00%
- Home Processing (Ghee, Curd/Dahi): 10.00%

Marketed Surplus (75.00%)

- Direct Sales to Local Consumers: 50.00%
- Local Vendors, Hotels & Halwais: 20.00%
- Organized Dairy Plants & Cooperatives: 30.00%

Among the marketed surplus portion, direct-to-consumer sales accounted for 50.00%, informal commercial outlets (hotels, tea vendors, and sweet shops/*halwais*) absorbed 20.00%, and organized procurement networks (cooperative dairy collection centers and private processors) captured 30.00%.

Direct sales to consumers yielded the highest realization prices, though organized procurement provided greater volume stability during the flush winter season.

V. CONCLUSION AND POLICY IMPLICATIONS

5.1 Conclusion

This empirical investigation into the dairy sector of Nizamabad district confirms that milk production is a profitable rural enterprise that provides continuous liquidity to farming households. Buffalo rearing generates higher absolute gross and net financial returns than cow rearing due to market price premiums tied to fat content.

The study highlights pronounced economies of scale: large commercial farms achieved lower per-litre production costs and higher lactation yields than small and medium holdings. Feed and fodder constitute the single largest cost center, absorbing nearly 84% of total variable maintenance expenditures. While smallholders rely heavily on unpaid family labour, commercial dairy farms incur substantial cash expenses on hired labour (over 28% of annual costs). Favorable input–output ratios across all farm sizes

confirm the sector's economic resilience, underscoring its capacity to act as a rural buffer against crop failures in northern Telangana.

5.2 Policy Recommendations

To address the empirical bottlenecks identified across the study area, the following policy interventions are recommended:

- **Nutritional Security via Community Fodder Banks:** Given that roughages and concentrates represent the bulk of maintenance costs, the State Department of Animal Husbandry should support the cultivation of high-yielding perennial fodder crops (e.g., Super Napier, CO-4) along canal commands and tank foreshores. Establishing village-level silage banks will help smooth seasonal green fodder deficits during dry summer months.
- **Institutional Credit and Breed Improvement:** High initial livestock costs restrict smallholder expansion. Targeted credit facilitation through the Kisan Credit Card (KCC) for Animal Husbandry and subsidized capital assistance via NABARD schemes should be expanded to assist smallholders in acquiring quality graded Murrah buffaloes and disease-resistant crossbred cows.
- **Decentralized Preventive Veterinary Services:** Small producers face higher per-animal veterinary expenses. Deploying mobile veterinary clinics and offering doorstep artificial insemination (AI), periodic deworming, and vaccination services through Gram Panchayats will help reduce intercalving intervals and improve herd health.
- **Strengthening Formal Procurement and Cold Chains:** Expanding bulk milk cooling units (BMCUs) under the Telangana Vijaya Dairy Federation and rural cooperative societies will ensure transparent fat-and-SNF digital testing, reducing smallholder dependence on intermediary milk vendors.
- **Formation of Dairy Farmer Producer Organizations (FPOs):** To help smallholders achieve the operational efficiencies enjoyed by large commercial units, dairy-focused FPOs should be established. Aggregating feed purchases and investing in shared local chilling and curd/ghee processing infrastructure will capture

greater value-added margins for primary producers.

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