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Economics of milk production in Maharashtra: A case study

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Abstract

The Vidarbha and Marathwada regions of Maharashtra State were selected for the study that examined the profitability of milk production as a whole and its numerous operational and managerial aspects. This region was chosen purposively since it produces less milk and has lower productivity compared to the rest of the state. In the years 2021 and 2022, 410 milk producers were randomly categorised into three groups: small (1-3 milch animals), medium (4 to 5 animals), and large (6 animals or more). Primarily, data was collected from these producers and tabular data analysis was carried out. The daily maintenance cost per milch animal of Rs. 150.75 for buffalo, Rs. 133.23 for crossbred cows, and Rs. 49.64 for local cows, out of all the different cost components, the greatest amount was spent on feed, which ranged from 66.24% for local cows, 61.64% for crossbred cows, and 64.80% for buffalo. Crossbred cows had the lowest average cost per liter of milk production at 23.75 rupees, while local cow buffalo had the highest at 42.10 rupees, buffalo at 33.23 rupees. When looking at net return per milch animal, the highest was Rs. 129.16 for buffalo, followed by Rs. 41.26 for crossbred. Rearing of local cow incur a loss of Rs. 3.39 per milch animal per day.

Keywords: Gross cost, net return, production cost

Introduction

Dairy farming has a significant role in the national economy, particularly in rural areas, given that 85 percent of India's milk production is contributed to by small unorganized milk producers. More than seventy million rural households rely on the dairy products produced by smallholder farmers. Animal distribution is more equitable than land distribution. Based on land and livestock data from NCAP (2002), small and marginal farmers own 71% of cattle, 63% of buffalo, and 66% of small ruminants. This indicates that for impoverished rural populations, dairying offers more employment opportunities and income prospects than agricultural production. The livestock owners are about 85 percent are marginal and small milk producer, which is noteworthy. Even among policymakers, crop income surpasses livestock income, despite the fact that dairying offers more potential for poverty alleviation (Birthal & Taneja, 2006) [1]. Small and marginal producers are able to reduce risk and uncertainty through the dairy industry, which also provides a sustainable livelihood for impoverished individuals residing in disadvantaged regions of the nation.

This study compares milk production costs and returns across herd sizes to determine breed profitability. Additionally, the study will analyze the profitability of local, crossbred, and buffalo breeds to establish their relative profitability. Milk production is of great economic importance due to the fact that it generates a return on investment for milk producers. Assessing the profitability of dairy enterprises at the producer level is predominantly contingent upon the returns and expenses linked to milk production. As a consequence, milk production cost and return calculations are implemented. By comparing the returns and expenses associated with milk production across various herd sizes, this study attempts to determine the relative profitability of each breed. Additionally, the study will conduct a comparative analysis of the profitability of various breeds, such as buffalo, crossbred cattle, and local cattle, to ascertain the relative profitability of each breed.

Methodology

The Vidarbha and Marathwada regions of Maharashtra State were selected purposively due to their comparatively reduced milk production and productivity in comparison to other regions within the state. Primarily, data was collected from milk producers from Bhandara and Yavatmal districts from the Vidarbha region and Nanded and Latur districts from Marathwada regions were selected randomly and collected 410 samples. In relation to the herd size of their livestock, approximately 52.20 percent of milk producers are categorized as small, 30.98 percent as medium, and 16.83 percent as large. Two districts from each regions (Marathwada and Vidarbha) were chosen for the research. Two blocks were selected at random from every district. Additionally, three villages were selected at random from each block. As a consequence, 410 individuals were chosen to partake in the study, and a comprehensive inventory of all households in relation to milch animals was conducted. Each household that produced milk was categorized into one of three livestock sizes: small (1-3 milch animals), medium (4-5 milch animals), or large (over 6 milch animals).

Cost of Milk Production

It is important to investigate the cost of milk production because it helps to understand the complex issues involved in milk production and serves as the foundation for milk pricing. The cost of producing milk also shows how effectively production was done. Both fixed and variable costs were included in the total cost of producing milk. This section tries to provide a concise explanation of these expenditures.

A. Fixed Cost: Fixed cost consist of interton fixed capital and depreciation It is the loss of an asset's value as a result of use, wear and tear, accidental damage, and time obsolescence. It is calculated separately for milch animals, cattle sheds, machinery, and equipment, considering the present value and useful economic life.

a) Depreciation: It is the depreciation of assets caused by normal wear and tear as well as technological obsolescence. The annual depreciation of milch animals, cattle sheds, and dairy equipment was calculated.

I. Depreciation on Milch Animals: For calculating depreciation on animals, economic life was considered and taken as:
Crossbred Cows - 8 percent (Productive life - 12.5 years),
Local cows - 10 percent (Productive life - 10 years),
Buffalos - 10 percent (Productive life - 10 years)

II. Depreciation on Cattle Shed and Dairy Equipment's: The straight-line method was used to compute depreciation on dairy equipment, storage, and Cattle shade

Appropriate	Percent
Pucca building	2
Semi-pucca building	5
Bullock cart	10
Chaff cutter	10
Milk can	20
Buckets	20

b) Interest on fixed capital: The fixed capital was the cost of dairy animals, cattle sheds, and dairy equipment used in milk production. The interest on fixed assets was calculated using the current bank interest rate of 10.5 percent. For the selected sample households, the annual interest rate was calculated per SAU and per day.

B. Variable Cost: The cost that fluctuates with output, like milk production, is known as a variable cost. Variable costs include things like feed costs, labor costs, veterinarian charges, and other costs like ropes, chains, energy, water, minor repairs, and other miscellaneous fees. By calculating the actual quantities used per lactating animal per day and multiplying the physical units by the corresponding market prices or the actual cost incurred, depending on whether the input was farm produced or purchased from the local market, the variable cost of inputs, specifically feed, labour, was determined.

I. Feed and Fodder Cost

Green fodder, dry fodder, and concentrate costs were calculated by multiplying the quantities of feeds and fodders consumed by animals by the prevailing prices in the study area.

II. Labour Cost

It included both family and paid labour (hired labour). The hired labour was calculated based on the type of work assigned and the wages paid. In the case of family labour, the imputed value obtained is determined by the amount of time spent dairying and the prevailing wage rate for casual labour in the study area.

III. Veterinary Cost

Costs for natural services, artificial insemination (A.I.), vaccinations, medications, and veterinary doctor fees were all included.

IV. Miscellaneous Cost

Repairs, electricity, water charges, purchase of milk can, bucket, rope, and other miscellaneous costs are examples. They were calculated on a per milch cow per day basis for the various types of milch cows kept by the sample commercial dairy farms.

C. Gross Cost: The total of fixed and variable costs is used to calculate the gross cost of milk production. This provides an overview of the total implicit and explicit costs associated with milk production.

Gross Cost = Total Variable Cost + Total Fixed Cost

D. Net Cost: The sample households' net cost of milk production was calculated by subtracting the imputed value of dung from the gross cost.

Net Cost = Gross Cost- The imputed value of dung

E. Cost of Milk Production: The cost of milk production per liter of milk was calculated by dividing the net cost per milch animal per day by the respective average milk yield per milch animal per day.

Gross Returns

Gross returns were obtained by multiplying the milk yield of an individual animal with respective prevailing prices in the study area, i.e.

Gross Returns = Quantity of milk X Market price of milk

Net Returns Net return was calculated by subtracting net cost from gross returns, i.e.

Net Returns = Gross Returns- Net Cost

Cost per Liter of Milk Production

To calculate the cost per liter of milk, divide the average net maintenance cost per animal per day by the average milk production per animal per day, i.e.

$$\text{Cost per Litre (Rs.)} = \frac{\text{Net cost per animal per day}}{\text{Total milk produced per animal per day}}$$

Results and Discussion

The analysis of the costs involved in the production of milk across all kinds of milch animals is an important component of bovine husbandry. The results are in line with the findings of Chand *et al.* (2017) [2], Meena *et al.* (2019) [7] and Rathore *et al.* (2020) [10].

Table 1: Cost of milk production of Local Cow on different herd size categories of sample households. (Rs/animal/day)

Cost Component	Herd Size Category							
	Small		Medium		Large		Overall	
	Cost / day	Share in TC (%)	Cost / day	Share in TC (%)	Cost / day	Share in TC (%)	Cost / day	Share in TC (%)
Dry Fodder	18.48	32.60	15.07	29.20	13.73	27.19	16.35	30.44
Green Fodder	12.87	22.71	11.24	21.78	12.58	24.91	12.28	22.86
Concentrates	6.33	11.17	7.81	15.13	6.97	13.80	6.95	12.94
Total Feed Cost	37.68	66.48	34.12	66.11	33.28	65.90	35.58	66.24
Labour Cost	14.07	24.82	12.80	24.80	12.83	25.41	13.39	24.93
Misc. Expenses	0.75	1.32	0.64	1.24	0.53	1.05	0.67	1.25
TVC	52.50	92.63	47.56	92.15	46.64	92.36	49.64	92.42
Depreciation	3.80	6.70	3.68	7.13	3.51	6.95	3.70	6.89
Interest on fixed Capital	0.38	0.67	0.37	0.72	0.35	0.69	0.37	0.69
TFC	4.18	7.37	4.05	7.85	3.86	7.64	4.07	7.58
Gross Cost	56.68	100.00	51.61	100.00	50.50	100.00	53.71	100.00

Table 1, shows that the overall gross maintenance cost of a local cow was Rs 53.71 per day, varying from Rs 56.68 for small, Rs. 51.61 for Medium and Rs 46.64 per day for large farmers. The overall fixed costs were calculated to be Rs 4.07, whereas total variable costs were Rs 49.64. The feed costs accounted for 66.24 percent of total variable costs for overall categories

Table 2: Returns from milk production of Local Cow on different herd size categories of sample households. (Rs/animal/day)

Particulars of return from sale of milk	Small	Medium	Large	Overall
Average per litre cost of milk	41.08	42.83	43.54	42.10
Gross production cost of milk	56.68	51.61	50.50	53.71
Value of dung	10.00	10.00	10.00	10.00
Average net cost per animal per day	46.68	41.61	40.50	43.71
Average sale price of milk (Rs./litre)	31.50	31.50	31.50	31.50
Average milk yield per animal per day	1.38	1.21	1.16	1.28
Gross return per animal/day	43.47	38.12	36.54	40.32
Average net return per animal per day	-3.21	-3.50	-3.96	-3.39

Costs and returns from milking Crossbred Cow on herd size categories of Sample households.

The average gross maintenance cost for a crossbred milk cow for overall category was Rs. 145.82, ranging from Rs 126.80 for the small category, Rs. 151.56 for medium to Rs 161.56 for the large herd size category farmers, as shown in Table 3. The overall total fixed cost was worked out to be Rs. 12.59, and the total amount of variable expenses was worked out to be Rs. 133.23 for overall categories of herd size farmers. The overall share of feed cost to the total variable cost was 61.64 percent varying from 69.35 percent for small, 58.24 percent for medium category to 58.55 percent for large herd size category of farmers. Labour cost was found to other major component in variable cost its overall cost Rs 40.10 per day, highest for large category was found to be Rs 49.65 and lowest for small category was found to be Rs 25.74.

Table 3: Cost of milk production of Crossbred Cow on different herd size categories of sample households. (Rs/animal/day)

Cost Component	Herd Size Category							
	Small		Medium		Large		Overall	
	Cost / day	Share in TC (%)	Cost / day	Share in TC (%)	Cost / day	Share in TC (%)	Cost / day	Share in TC (%)
Dry Fodder	21.24	16.75	30.81	20.33	30.82	19.08	27.54	18.89
Green Fodder	27.98	22.07	27.29	18.01	26.64	16.49	27.35	18.76
Concentrates	38.72	30.54	30.17	19.91	37.14	22.99	35.00	24.00
Total Feed Cost	87.94	69.35	88.27	58.24	94.60	58.55	89.89	61.64
Labour Cost	25.74	20.30	46.08	30.40	49.65	30.73	40.10	27.50
Misc. Expenses	2.81	2.22	3.32	2.19	3.68	2.28	3.24	2.22
TVC	116.49	91.87	137.67	90.84	147.93	91.56	133.23	91.37
Depreciation	9.48	7.48	12.78	8.43	12.53	7.76	11.58	7.94
Interest on fixed Capital	0.83	0.65	1.11	0.73	1.10	0.68	1.01	0.69
TFC	10.31	8.13	13.89	9.16	13.63	8.44	12.59	8.63
Gross Cost	126.80	100.00	151.56	100.00	161.56	100.00	145.82	100.00

Table 4 shows that the average cost to produce one litre of milk was determined to be Rs 23.75 for overall category of farmers, with the small category costing Rs 22.60, medium category found to be Rs. 24.81 and the large category costing Rs. 23.59 per liter of milk production. Daily net returns were positive across the all categories, with the large category reporting the highest of Rs. 191.80 and the small category observing the least of Rs. 154.28 per animal per day.

Table 4: Returns from milk production of Crossbred Cow on different herd size categories of sample households. (Rs/animal/day)

Particulars of return from sale of milk	Small	Medium	Large	Overall
Average per litre cost of milk	22.60	24.81	23.59	23.75
Gross production cost of milk	126.80	151.56	161.56	145.82
Value of dung	16.00	16.00	16	16.00
Average net cost per animal per day	110.80	135.56	145.56	129.82
Average sale price of milk (Rs./litre)	28.00	28.00	28.00	28.00
Average milk yield per animal per day	5.51	6.11	6.85	6.11
Gross return per animal/day	154.28	171.08	191.80	171.08
Average net return per animal per day	43.48	35.52	46.24	41.26

Cost and Return of Milk production from Milch Buffalo on different Herd Size Categories of Sample Households

The overall gross maintenance cost for milch buffalo was calculated to be Rs 158.52 per day, ranging from Rs 156.96 for the small category, Rs. 158.35 for medium category to Rs 160.49 for the large category, as shown in Table 5

Table 5: Cost of milk production of Buffalo on different herd size categories of sample households. (Rs/animal/day)

Cost Component	Herd Size Category							
	Small		Medium		Large		Overall	
	Cost / day	Share in TC (%)	Cost / day	Share in TC (%)	Cost / day	Share in TC (%)	Cost / day	Share in TC (%)
Dry Fodder	42.83	27.29	45.24	28.57	47.97	25.83	43.24	27.28
Green Fodder	25.74	16.40	27.91	17.63	30.97	19.30	28.09	17.72
Concentrates	33.78	21.52	32.09	20.27	28.99	18.06	31.73	20.02
Total Feed Cost	102.35	65.21	105.24	66.46	107.93	62.65	105.05	64.80
Labour Cost	42.01	26.76	40.23	25.41	48.19	27.97	41.68	26.70
Misc. Expenses	1.83	1.16	1.83	1.16	3.73	2.17	2.41	1.49
TVC	146.19	93.14	147.30	93.02	159.85	92.79	150.75	92.99
Depreciation	9.92	6.32	10.17	6.42	11.44	6.64	10.47	6.46
Interest on fixed Capital	0.85	0.54	0.88	0.56	0.99	0.57	0.90	0.56
TFC	10.77	6.86	11.05	6.98	12.43	7.21	11.37	7.01
Gross Cost	156.96	100.00	158.35	100.00	160.49	100.00	158.52	100.00

Table 6: Return from milk production of Buffalo on different herd size categories of sample households. (Rs/animal/day)

Particulars of return from sale of milk	Small	Medium	Large	Overall
Average per litre cost of milk	32.64	34.54	32.53	33.23
Gross production cost of milk	156.96	158.35	160.49	158.52
Value of dung	20.00	20.00	20.00	20.00
Average net cost per animal per day	136.96	138.35	140.49	138.52
Average sale price of milk (Rs./litre)	56.00	56.00	56.00	56.00
Average milk yield per animal per day	4.74	4.58	4.94	4.78
Gross return per animal/day	265.44	256.48	276.64	267.68
Average net return per animal per day	128.48	118.13	136.15	129.16

Table 6 shows Total fixed costs were found to be Rs 11.37, while total variable costs were Rs 150.75 for the overall herd size category of milk producers. Labour cost was found to other major component in variable cost was found to be Rs 41.68 per day for overall category, highest for large category was found to be Rs 48.19 and lowest for medium category was found to be Rs 40.23. The average cost per litre of milk production was calculated to be Rs 33.23 for overall category. The highest daily net return was recorded for the large category of Rs. 136.15, and the lowest for the medium category was estimate of Rs. 118.13.

The average feed intake of buffalo was estimated to be the highest followed by crossbred cattle, with more than half coming from dry pasture. Greenery was scarce in summer and winter. Dual-purpose varieties, high-quality fodder crop seed, and small-scale fodder farm mechanization are priorities. Local cattle had the lowest net maintenance expenses and net returns, while crossbred cattle had the highest. Local, crossbred, and buffalo milk production costs Rs. 42.10, Rs. 23.75, and Rs. 33.23 per litre shown in Table. 6. According to income statistics, buffalo-herd dairy producers make more money. Maintaining of local cattle is not profitable in long run as prices are very low. Price often encourages producers to raise milk production, making dairying more profitable. The milk industry needs a basic support price strategy like crops. This will help relate milk production costs to milk quality, ensuring milk producers fair prices and incentives to produce high-quality milk.

It was observed from the study that green fodder, dry fodder, concentrate, and labour in the case of buffalo,

crossbred cows and local cows all have a positive impact on milk production. Important determinants of milk production in all milch species, green fodder and concentrate can go a long way towards increasing milk returns.

Conclusion

In the present study on economic analysis of milk production, it was found that the overall cost of milk production decreased as the herd size increased, while the overall net returns per litre of milk increased with the herd size Negative net returns from local cow milk production do not mean milk production is unprofitable in the research area. Most of the milk production expenses in the study do not enter farmers' accounts because 60% of the resources are either farm-owned and have lower opportunity costs or communal and farmers do not pay directly. Farmers aren't losing much. However, improving milk yield and offering better health care and extension services can boost dairy profitability.

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