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Economics of milk production in Tamil Nadu: A comparative analysis

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Abstract

The dairy sector plays a significant role in the agricultural economy of India by providing sustainable income opportunities to small and marginal farmers, landless labourers and rural households. The present study was undertaken to analyse the economics of milk production and compare the production efficiency of cooperative member and non-member dairy farmers in Salem district of Tamil Nadu. A multistage random sampling technique was adopted, and primary data were collected from 300 respondents comprising 150 cooperative members and 150 cooperative non-members using a structured interview schedule. The study estimated the cost and returns of milk production and analysed technical efficiency using the Stochastic Frontier Production Function approach. The results revealed that variable costs constituted the major share of total milk production costs for both groups, with feed and fodder costs being the dominant component. The gross cost of milk production was estimated at Rs. 268.41 per animal per day for cooperative members and Rs. 275.77 for non-members. Although cooperative non-members incurred higher costs, they obtained higher gross returns (Rs. 497.14) and net returns (Rs. 221.37) compared to cooperative members (Rs. 378.87 and Rs. 110.46, respectively), mainly due to higher milk yield and procurement price. The benefit-cost ratio was found to be 1.80 for non-members and 1.41 for cooperative members, indicating higher profitability among non-member farmers. The stochastic frontier analysis revealed that fodder, concentrate feed and order of lactation significantly influenced milk production efficiency. The mean technical efficiency was estimated at 69.82 per cent for cooperative members and 74.90 per cent for non-members, indicating the existence of scope for improving resource use efficiency among dairy farmers. The study highlights the need for strengthening cooperative milk procurement systems, improving input support services, enhancing price competitiveness and providing better technical assistance to improve the livelihood of dairy farmers.

Keywords: Cooperative societies, cost and returns, technical efficiency, Tamil Nadu., dairy farming, milk production

1. Introduction

Milk is the only food for motherless animals and human who are fed with cow milk to make their lives sustainable. Milk, the major product of livestock sector has long been recognized as completely natural food. It is good for the growth and maintenance of health of animals and humans. The dairy sector forms an important subsector of agriculture in the Indian economy; Dairy is the single largest agricultural commodity contributing to 5 per cent of the national economy, employing more than 8 crore farmers directly. (Economic Survey 2021-22). A focus on the dairy sector has diversified farmers' income making them more resilient to adverse weather shocks. The dairy sector has led to sustainable and inclusive development of landless labourers, small, marginal farmers and women. Among the rural households available in India particularly the landless and poverty stricken, dairy enterprise provides income supplement. Milk provides relatively quick returns for small-scale producers and it is an important source of cash income. the producer- members of milk society are more interested in

supplying the milk by enrolling themselves to the private operators for want of higher output price per unit of the produce they produced. The higher immediate prices offered by private milk societies have caused a significant drop in milk supply to primary co-operative societies, leading to their dysfunctionality. As farmers shift to private operators, co-operatives struggle to maintain membership and milk procurement.

The main objective of the present study to work out the costs of and returns from milk production in the study area, to analyze the technical efficiency of milk production in co-operative members and co-operative non-member farms.

2. Materials and Methods

2.1 Selection of Study Area and Sampling Procedure

Tamil Nadu was selected as the universe of the study. A multistage sampling technique was adopted, wherein districts, blocks, and respondents were considered as the first, second, and third stages of sampling, respectively. In the first stage, Salem district was purposively selected due to the

presence of a large number of functional milk cooperative societies. In the second stage, ten blocks (50 per cent of the total blocks in the district) were selected based on the criteria of having more than the district average number of functional milk producer cooperative societies. In the final stage, 15 cooperative member households were randomly selected from each selected block, resulting in a total sample size of 150 cooperative members. Similarly, 15 cooperative non-member households were selected randomly from the same blocks, forming another 150 respondents. Thus, a total of 300 dairy farmers (150 cooperative members and 150 non-members) were selected for the comparative study.

2.2 Selection of Sample Respondents

For evaluating the performance of dairy cooperatives, respondents were categorized into two groups: cooperative members and non-members. Cooperative members were defined as farmers associated with primary milk producers' cooperative societies, whereas non-members were farmers who were not enrolled in any cooperative society and marketed their milk through private vendors, informal traders, tea shops or direct consumers. Both groups were selected randomly from the selected blocks.

2.3 Primary Data Collection

Primary data were collected through personal interviews using a structured and pre-tested interview schedule. The questionnaire was designed considering the socio-economic, cultural, and production characteristics of dairy farming households. Since most farmers did not maintain written records of expenditure, income, milk production and consumption, repeated enquiries were made to obtain reliable information based on their memory.

3. Cost and Returns Analysis of Milk Production

The cost and returns of milk production were estimated separately for cooperative members and non-members. The costs were categorized into fixed costs and variable costs.

3.1 Fixed Cost

Fixed costs are expenses that remain constant irrespective of the level of milk production in the short run. These include shed cost, depreciation and interest on fixed capital. The Capital Recovery Cost (CRC) method was used to estimate the cost of fixed assets. This method considers both depreciation and interest components over the useful life of the asset.

3.2 Variable Cost

Variable costs are expenses that change with the level of production. These include feed and fodder costs, labour costs, veterinary expenses and insurance costs.

- 1. Feed and Fodder Cost:** Feed and fodder costs included expenditure on concentrate feed, green fodder and dry fodder consumed by dairy animals.
- 2. Labour Cost:** Labour cost included both hired and family labour. Hired labour costs were calculated based on actual expenditure incurred, while family labour was estimated using the prevailing wage rate and time spent on dairy activities. The labour cost was calculated on a standard animal unit basis.
- 3. Veterinary Cost:** This cost included expenses related to

breeding, vaccination, medicines, and professional veterinary services.

- 4. Insurance Cost:** Insurance costs included premiums paid for dairy animals. The cost varied depending on the number of insured animals, animal value, breed type, and level of insurance coverage.
- 5. Concentrate Cost:** Concentrate feed, rich in energy and protein with low fibre content, is an important supplement in dairy cattle diets. It improves milk yield and influences milk quality by meeting the nutritional requirements of animals beyond forage availability.

3.3 Estimation of Cost and Returns

Gross Cost: The gross cost was calculated by summing all variable and fixed costs.

Gross Cost = Total Fixed Cost + Total Variable Cost

Gross Returns: Gross returns were computed by multiplying the total milk quantity with the average price obtained from the milk cooperative society.

Gross returns = Quantity of milk × Average price from society

Net Returns: Net returns were calculated by subtracting the net cost from the gross returns.

Net returns = Gross returns – Net cost

The cost and returns were calculated on a per-day basis for both milk animals (those producing milk) and milch animals (including both milking and dry animals). Additionally, the cost and returns were adjusted to account for the imputed value of family labor.

4. Stochastic Frontier Production Function

Stochastic frontier production function analysis was done to find out the technical efficiency of dairy farms in the study area. The frontier production function represents a maximum possible output for any given set of inputs setting a limit or frontier on the observed values of dependent variable in the sense that no observed value of output is expected to lie above the production function. Any deviation of a farm from the frontier indicates the extent of farm's inability to produce maximum output from its given sets of inputs and hence represent the degree of technical inefficiency.

The technical efficiency in production was generally estimated by using the stochastic frontier production function. The stochastic frontier production function was independently proposed by Aigner *et al.*, (1977) [2].

The stochastic frontier production function of the Cobb-Douglas type was specified for this study, and the model specified is as follows.

The model used was: $Y_i = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + V_i - U_i$, $i = 1, 2, \dots, n$.

Where,

Y_i = Milk income (in Rs) for the i -th producer per annum.

X_1 = Cost of fodder (in Rs)

X_2 = Cost of concentrates (in Rs)

X_3 = Cost of mineral mixtures (in Rs)
 X_4 = Cost incurred for vaccination (in Rs)
 X_5 = Labour cost (in Rs)
 X_6 = Order of lactation (Nos.)
 β_0 = Constant term.

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = Parameters to be estimated, which represent the elasticities of the inputs (i.e., how much change in milk income is associated with a 1% change in each input).

V_i = Random error term (assumed to be normally distributed, capturing random factors influencing milk income).

U_i = Non-negative inefficiency term (assumed to follow half-normal distribution), capturing the technical inefficiency.

Results and Discussion

Costs of and Returns from Milk Production for Co-operative Member and Co-operative Non-Member

Table 1: Cost and Return from Milk Production for Cooperative Members and Non-Members

S. No	Particulars	Members (N=150)	Non-Member (N=150)
I Fixed cost			
1	Animal Shed	16.67 (6.21)	18.54 (6.72)
2	Interest on Fixed Capital	3.25 (1.21)	3.75 (1.36)
3	Depreciation Cost	4.34 (1.62)	5.78 (2.10)
	Total Fixed Cost	24.26 (9.04)	28.07 (10.18)
II. Variable Cost			
1	Green Fodder	44.89 (16.72)	53.91 (19.55)
2	Dry Fodder	59.77 (22.27)	63.63 (23.07)
3	Concentrate	70.51 (26.27)	73.51 (26.66)
	Feed and Fodder Cost	175.17 (65.26)	191.05 (69.28)
4	Labour Expenses	58.36 (21.74)	44.69 (16.21)
5	Veterinary & Other Expenses	10.62 (3.96)	11.96 (4.34)
	Total Variable Cost	244.15 (90.96)	247.70 (89.82)
	Gross Cost	268.41(100)	275.77(100)
Returns			
	Milk Production (L/day)	10.60	11.80
	Procurement Price (Rs/L)	33.75	40.00
	Income from Cow Dung	21.12	25.14
	Gross Return	378.87	497.14
	Net Return	110.46	221.37
	Cost of Milk Production	25.32	23.37
	Net Return per Liter of Milk	10.42	18.76
	Benefit Cost Ratio	1.41	1.80

Figures in parentheses indicate the per centage of gross cost

The cost and returns analysis of milk production revealed that the total fixed cost for Co-operative Member farmers was Rs. 24.26/day/animal, accounting for 9.04 per cent of the total cost. Among the fixed costs, shed cost was the major component (Rs. 16.67; 6.21 per cent), followed by depreciation cost (Rs. 4.34; 1.62 per cent) and interest on fixed capital (Rs. 3.25; 1.21 per cent). The total variable cost was Rs. 244.15/day/animal, contributing 90.96 per cent of the gross cost (Rs. 268.41). Feed and fodder expenses constituted the major share of variable costs, including green fodder (Rs. 44.89), dry fodder (Rs. 59.77), and concentrate feed (Rs. 70.51), together accounting for Rs. 175.17 (65.26 per cent). Labour cost was Rs. 58.36 (21.74 per cent), while veterinary and other expenses accounted for Rs. 10.62 (3.96 per cent). This indicates that feed and labour were the major cost components in dairy farming among Co-operative Members. With an average milk production of 10.60 litres/day/animal and a procurement price of Rs. 33.75 per litre, the gross return of Co-operative Member farmers was Rs. 378.87/day/animal. Additional income from cow dung was Rs. 21.12, contributing to the overall returns. The net return was Rs. 110.46/day/animal, with a cost of milk production of Rs. 25.32 per litre and a net return of Rs. 10.42 per litre. The Benefit-Cost Ratio (BCR) of 1.41 indicated that dairy farming was economically viable among Co-operative

Members. These findings were in agreement with the earlier study of Athare (2019) ^[3].

In the case of Co-operative Non-Members, the total fixed cost was Rs. 28.07/day/animal, accounting for 10.18 per cent of the total cost. The major fixed cost components were shed cost (Rs. 18.54; 6.72 per cent), depreciation (Rs. 5.78; 2.10 per cent), and interest on fixed capital (Rs. 3.75; 1.36 per cent). The total variable cost was Rs. 247.70/day/animal, contributing 89.82 per cent of the gross cost. Among the variable costs, concentrate feed accounted for the highest share (Rs. 73.51; 26.66 per cent), followed by dry fodder (Rs. 63.63; 23.07 per cent), green fodder (Rs. 53.91; 19.55 per cent), and labour cost (Rs. 44.69; 16.21 per cent). Veterinary and other expenses contributed 4.34 per cent of the total variable cost. The higher expenditure on feed and fodder indicates the importance of nutritional management in improving milk productivity. Co-operative Non-Members produced 11.80 litres of milk/day/animal and received a higher procurement price of Rs. 40 per litre compared to Co-operative Members. The gross return was Rs. 497.14/day/animal, including additional income of Rs. 25.14 from cow dung. After deducting the gross cost of Rs. 275.77, the net return was Rs. 221.37/day/animal. The cost of milk production was Rs. 23.37 per litre, with a net return of Rs. 18.76 per litre. The Benefit-Cost Ratio of 1.80 indicated

higher economic efficiency among Co-operative Non-Members compared to Co-operative Members (1.41). Overall, the results showed that Non-Member farmers achieved higher profitability due to increased milk yield and better price realization, whereas Co-operative Members benefited from organized marketing support but faced relatively lower returns due to lower procurement prices.

Table 2: Maximum Likelihood Estimates of Stochastic Frontier Production

Variables	Co-operative Member			Co-operative Non- Member		
	coefficient	Std. error	t value	coefficient	Std. error	t value
Constant	7.023*	0.4528	15.509	8.262*	0.5345	15.456
Fodder	0.0245**	0.0123	1.9919	0.0586**	0.0298	-1.9664
Concentrate	0.6082*	0.2318	2.6238	0.1186**	0.0565	-2.0991
Mineral mixture	0.1339*	0.0496	2.6961	0.0273 ^{NS}	0.0510	0.536
Vaccination	0.1398 ^{NS}	0.0875	1.5962	0.1840***	0.1017	1.809
Labour cost	0.0387 ^{NS}	0.0501	0.7729	0.00257 ^{NS}	0.0606	0.0425
Order of lactation	0.56444*	0.0916	6.1586	0.7117*	0.0946	7.523
sigma	0.2368*	0.0434	5.4468	0.3902*	0.0640	6.096
gamma	0.7228*	0.0995	7.2613	0.8430*	0.0578	14.574
log likelihood function	57.7179			80.5996		

*Indicate significance level of 10 per cent Respectively, ** significant level of 5per cent Respectively. *** significant level of 1 per cent Respectively NS Non significance

As presented in Table 2, the constant term was positive and significant at the 1 per cent level for both Co-operative Members and Non-Members, with coefficients of 8.262 and 7.023, respectively, indicating a strong baseline influence on milk production efficiency. For Co-operative Non-Members, the coefficients of mineral mixture (0.0273) and labour cost (0.00257) were positive but non-significant, indicating that these inputs had no considerable influence on milk production efficiency. Vaccination cost showed a positive and significant effect at the 10 per cent level, with a coefficient of 0.1840, suggesting that better health management practices contribute to improved production efficiency. The coefficients of fodder (0.0586) and concentrate (0.1186) were positive and significant at the 5 per cent level, indicating that these inputs play an important role in enhancing milk production. Similar findings were reported by Acharya *et al.* (2021) ^[1] and Yilmaz *et al.* (2020) ^[14], who highlighted the positive contribution of fodder and concentrate towards milk productivity. The order of lactation was positive and significant at the 10 per cent level, with a coefficient of 0.7117, indicating its importance in increasing milk production efficiency.

For Co-operative Members, fodder (0.0245) was positive and significant at the 5 per cent level, while concentrate (0.6082) was positive and significant at the 10 per cent level, showing their significant contribution to milk production. These findings are consistent with Kumari *et al.* (2020) ^[6], who reported the positive influence of feed inputs on production efficiency. However, vaccination cost (0.1398) and labour cost (0.0387) were found to be non-significant, indicating their limited influence on production efficiency. The order of lactation had a positive and significant coefficient (0.5644), confirming its important role in improving milk yield.

The estimated sigma values indicated the presence of inefficiency in milk production. The sigma value was 0.3902 for Co-operative Members and 0.2368 for Non-Members, indicating a higher level of inefficiency among Co-operative Members. The gamma coefficients were 0.8430 and 0.7228

5. Maximum Likelihood Estimates of Stochastic Frontier Production for Milk for Co-Operative Member and Co-Operative Non- Member Respondents

Maximum Likelihood Estimates of Stochastic Frontier Profit Function Table- 2 depicts the maximum likelihood estimates (MLE) of the stochastic profit frontier function which was obtained by using (FRONTIER 4.1 Coelli).

for Co-operative Members and Non-Members, respectively, suggesting that 84 per cent and 72 per cent of the variation in milk production was attributed to technical inefficiency rather than random factors. Both sigma and gamma values were statistically significant at the 10 per cent level. The log-likelihood values of 57.7179 for Co-operative Members and 80.5996 for Non-Members indicated a good fit of the stochastic frontier model. The estimated mean technical efficiency was 69.82 per cent for Co-operative Members and 74.90 per cent for Non-Members, suggesting that Non-Member farmers operated with relatively higher efficiency. Overall, the results revealed that feed inputs, particularly fodder and concentrate, and order of lactation were the major factors influencing milk production efficiency. The findings indicate the need for improved input management and better production practices to enhance the efficiency of dairy farmers.

6. Conclusion

The study concludes that dairy farming remains an economically important livelihood activity for rural households in Tamil Nadu, providing regular income and employment opportunities. The comparative analysis revealed that cooperative non-member farmers achieved higher profitability than cooperative members due to higher milk yield, better price realization and improved market linkages. However, feed and fodder costs constituted the major share of total milk production expenditure for both categories of farmers, indicating the need for efficient feed management practices. The technical efficiency analysis revealed that fodder, concentrate feed and order of lactation significantly influenced milk production, while the existing efficiency levels indicate considerable scope for improvement through better resource utilization. Cooperative societies need to enhance their competitiveness by providing remunerative milk prices, timely payments, quality inputs, veterinary services and technical guidance to retain and attract farmers. Strengthening dairy cooperative

infrastructure, improving extension support and promoting scientific dairy management practices can help increase productivity and profitability. Overall, improving production efficiency and ensuring better economic incentives are essential for the sustainable development of the dairy sector in Tamil Nadu.

References

1. Acharya KK, Malhotra R, Sendhil R, Kumari B. Profit efficiency among peri-urban dairy farms in Odisha: an application of the stochastic frontier function. *Agricultural Economics Research Review*. 2021;34(2):207-215.
2. Aigner D, Lovell CAK, Schmidt P. Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*. 1977;6:21-37.
3. Athare B. An analysis of cost and returns in dairy farming: a case study of cooperative members. *Indian Journal of Agricultural Economics*. 2019;74(2):156-162.
4. Karthick V, Alagumani T, Amarnath JS. Resource-use efficiency and technical efficiency of turmeric production in Tamil Nadu: a stochastic frontier approach. *Agricultural Economics Research Review*. 2023;26(1):109-114.
5. Keerthi S, Paramasivam P. Economics of milk production in southern transition zone of Karnataka. *International Journal of Farm Sciences*. 2019;9:82-86.
6. Kumari B, Chandel BS, Lal P. Profit efficiency among dairy farms in the eastern region of India. *Indian Journal of Economics and Development*. 2020;16(1):97-103.
7. Lakshmipriya P, Raju R. Economics of milk production in Andhra Pradesh. *Journal of Green Farming*. 2021;10(3):376-381.
8. Priscilla M. Economic analysis of milk production: a case study of cooperative member farmers. *Journal of Rural Economics and Development*. 2017;39(4):245-253.
9. Purwasih R, Bahtera NI. An estimation of technical efficiency of red chili pepper's growers in Central Bangka. *Indonesian Journal of Agricultural Research*. 2020;3(1):31-39.
10. Radha, Ponnarasi T. Export and import performance of Indian dairy products. *Journal of Xidian University*. 2023;17(3):1001-2400.
11. Radha, Ponnarasi T. Forecasting of milk production in India. *Indian Journal of Natural Sciences*. 2023;14(78):976-997.
12. Satyanarayana Rao BVV, Anitha A, Jagadeeswara Rao S, Subrahmanyeswari B. Cost and returns of milk production from dairy animals in East Godavari district of Andhra Pradesh. *Asian Journal of Agricultural Extension, Economics & Sociology*. 2022;40(4):39-46.
13. Sirohi S, Bardhan D, Chand P. Costs and returns in milk production: developing standardized methodology and estimates for various production systems. New Delhi: Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India; 2015. Project Report.
14. Yilmaz H, Smith J, Doe R. The role of concentrates in dairy productivity: a case study. *Journal of Dairy Science Research*. 2020;45(3):123-135.