Economics of Milk Production *vis-a-vis* Marketing Channels - A Study in the Northern Transect of Bengaluru District, Karnataka

P. D. SHIVAGANGAVVA, G. S. MAHADEVAIAH AND G. N. NAGARAJ

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru - 560 065

E-mail : Spdoddamani3005@gmail.com

ABSTRACT

The study focuses on the dairy production pattern, economics of milk production and factors influencing milk production in the northern transect of Bengaluru district. The data was collected from 150 randomly selected dairy farmers from rural, transition and urban areas. Since marketing channels influence price realized by farmers, the data was analyzed for 4 different channels, *viz.,* directly selling to consumers, middlemen, shopkeepers and milk producers' co-operative society (KMF), which are labelled as channel-I, II, III and IV, respectively for local and cross-bred cows. The total cost of milk production per day was highest for crossbred cow in urban area (₹ 157.56) and lowest in rural areas (₹ 47.08). This is due to high input cost, since farmer has to buy all the inputs for the dairy activity. Similarly, the highest total cost per day for local cow was ₹ 63.21 in channel-IV and ₹ 53.00 in channel-II in transition and rural areas, respectively. The average milk yield of local cows was found to be 4 litres in transition while crossbred cow was about 9 litres in rural. This is due to higher productivity of the crossbred cows. In the case of local cow, net returns per day was the highest in channel-II (₹ 45) and lowest of ₹ 19.70 per day per animal in channel-III of transition area. Selling to the middle man was profitable than shop keeper because of less marketing cost. The net returns per day were ₹ 125.33 in channel-I, ₹ 184.99 in channel-II and ₹ 152.38 in channel-IV in transition, rural and urban areas respectively for cross-bred cows. The results of the Cobb-Douglas production function showed that milk production was influenced by herd size, fodder cost and transition area dummy. Hence, when there is increase in the herd size milk production also increases.

Keywords: Milk production, Marketing channels, Net returns, Bengaluru

DAIRY farming is an important subsidiary enterprise in India. It is an integral part of rural and transition farm families and plays an important role in income augmentation of small farmers and agricultural labours. Milk production in India is increasing at the rate of 6.28 per cent annually and the total production was 165.4 million tonnes (GoI) during 2016-17 which is highest in the world. The consumption of milk is rising due to increase in the purchasing power of people, urbanization, changing food habits and lifestyles. The per capita availability of milk in India was 355 gms/day in 2016-17 while World average is below 300 gms/day. This sector enhances livelihoods and nutrition security for the landless and marginal farmers. India with diverse agro climatic conditions, soil types and resource availability provides varied opportunities for dairy development. The organized milk marketing is through dairy cooperatives network, while unorganized and independent dairy is also thriving despite stiff competition. Dairy cooperatives ensure inclusiveness and livelihoods for small holders, especially women.

Dairy farming is prompted by ease of milk marketing and high profitability in the periphery of urban areas. The transition farms have gained more attention because of easy access to market. Market participation is a market related activity which promotes the sale of produce (Kumar, 2003). The decision of milk producers to participate in milk marketing to sell milk is influenced by a number of factors *viz.*, volume of milk production, household consumption, market information, road connectivity, price realized, availability of dairy market infrastructure, membership of milk cooperative societies etc. (Jaiswal, 2014). There are various alternatives for disposal of milk. It

may be formal *viz.,* dairy co-operatives and private dairy plants or informal which includes milk vendors, local consumers, tea shops, etc. For an overall development and welfare of dairy sector, the participation of smallholder milk producers is very important. Household market participation is an important strategy for poverty alleviation and food security in developing countries.

Rapid urbanization of rural areas surrounding Bengaluru urban conglomerate is effecting changes in the structure of dairy enterprise in the locality. As dairy enterprise will have potential for generating additional income, employment opportunities and subsistence of small farm family. The present study was undertaken with an overall objective of profitability of milk production and factors influencing milk production across different marketing channels.

Objectives

a. To analyze the net profit realized across different modes of milk disposal.

b. to understand the factors influencing milk production.

METHODOLOGY

Bengaluru district is divided into north and south transect by taking Vidhana Soudha as the reference point as this state legislative building is historical and is located in the center of the city. Each transect is divided into three layers such as rural, transition and urban areas. The distinction of the area was made based on the percentage of build-up area and its linear distance from the city center. Up to about 20 to 25 km away from the city center building density was strongly correlated to the distance and beyond that, however, the two parameters were negatively correlated.

For the present study, 150 dairy farmers were randomly selected using a pre-tested structured schedule and study was taken up during 2017-18. Among 150 samples dairy farmers, 50 were selected from rural area, 50 from transition and 50 from urban area. Thus 150 dairy farmers were selected from 30 villages. The per unit cost and returns of milk production for both local and crossbred cows were estimated using farm management cost concepts. Four milk marketing channels were identified in the study *viz*., directly selling to consumers, middle men, shopkeepers and milk producers' co-operative society (KMF), which are labelled as channel-I, II, III and IV, respectively (Fig.1). One-way ANOVA was used to test whether statistically significant differences existed between channels with respect to selected indicators pertaining to the performance of dairy farms

Cost and return concept

Fixed Cost: It included depreciation of cattle shed assuming 10 per cent rate on initial investment and amortization of cattle at 7 per cent per annum.

Variable Cost: This cost included feed, fodder, labor, and other miscellaneous costs. Feed and fodder costs were worked out by multiplying quantities of feeds
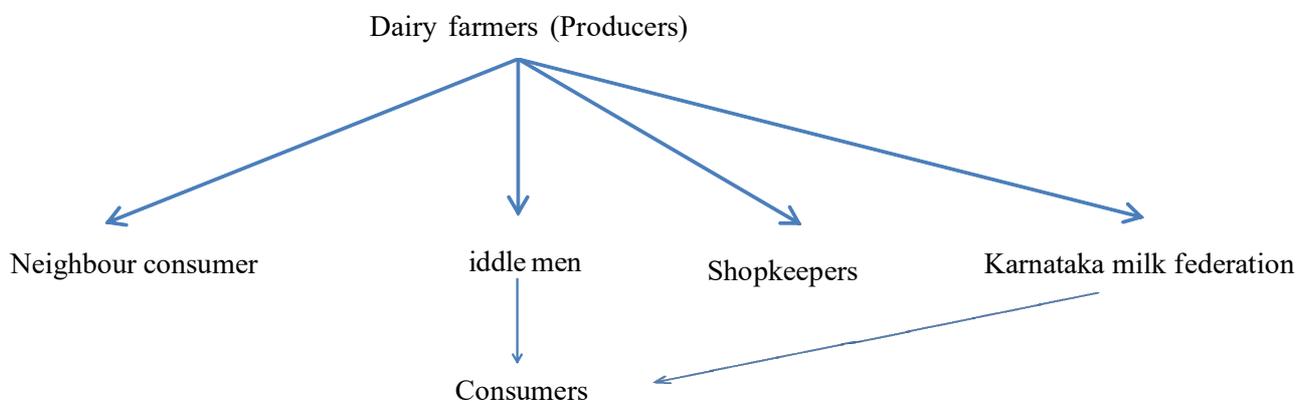

Fig. 1 : Flow chart of milk disposal from the dairy farmers

and fodder supplied to animals with their respective market prices. Similarly, the hired labor was calculated considering time utilized in various dairy activities and wages paid. In the case of family labor, the imputed value was taken as per the prevailing wage rate of casual labor in the study area. Miscellaneous cost included expenditure on artificial insemination (A.I.), vaccination, medicines, and repair charges of cattle shed, electricity and also other charges/fees of veterinary doctors.

Marketing cost: This included time taken in the morning as well as evening for sale of milk, milk given for quality checks and depreciation on utensils used for milk marketing.

Gross Returns: Gross returns were obtained by considering the income realized from milk at prevailing market prices, sale of manure and price subsidy by the milk cooperative.

Milk production function

Cobb-Douglas form of production function was used to study the relationship between milk production and associated factors. The specification of milk production function used in the study is as follows:

$$Y = A \prod_{i=1}^{L} x_i^{b_i} e^u \quad \text{……………1}$$

$$x_i = (x_1, x_2, x_3, x_4, \ldots \ldots x_n)$$

$$Y = \alpha \, x_1^{b1} . x_2^{b2} . \, x_3^{b3} . \, x_4^{b4} . \, x_5^{b5} . \, x_6^{b6} . \, e^u \quad \text{…………2}$$

$$\ln Y = \alpha_0 + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + b_5 \ln x_5 + b_6 D_1 + b_7 D_2 + \Sigma_i \quad \text{……………..3}$$

Where Y = Milk produced per animal per day (Rs.)

X_1 = Herd size

X_2 = Cost of fodder (Rs.)

X_3 = Cost of feed (Rs.)

X_4 = Cost of labor (Rs.)

X_5 = Cost of medical expenses (Rs.)

X_6 = Karnataka Milk Federation (Yes=1, No=0)

D_1 = Urban

D_2 = transition

A = Constant

u = Random error term assumed to follow normal distribution with zero mean and constant variance

bi = Co-efficient

RESULTS AND DISCUSSION

Economics of milk production in transition area

The average herd size of local dairy cows in transition area of Bengaluru was smaller as compared to cross-bred farms (Table 1).The maintenance cost of a milching animals comprised of cost on feeds and fodder, human labour, depreciation on fixed assets and miscellaneous recurring expenses. The overall maintenance cost of local milk cows per day per animal in different channels was estimated to be ₹ 45.93, 52.93 and 63.21 in channels –II, III and IV, respectively and Channels-I was not existed. Cost of feeds and fodder were the major items of expenditure accounting for about 52 to 56 per cent of the total cost in the case of local cows, while it accounted for 44 to 70 per cent among crossbreds. The average milk yield per local cow in channel-II was found to be 4 litres per day. The average net return was found to be highest in channel-II for local cows when compared to the other channels.

The total cost of maintenance of crossbred dairy cow in different type of channels was estimated to be ₹ 107.25, 69.16, 84.31and 72.04 in channel-I, II, III and IV respectively, per animal per day. The share of highest total fixed cost, total variable cost, and marketing cost in the total cost was ₹ 14.93 in channel-II, ₹ 94.65 in channel-I and ₹ 3.10 in channel-IV. The average milk yield of crossbred dairy cow was found to be highest in channel-I (8.89 litres per day). The cross-bred cow could generate a maximum of ₹ 125.33 per day net return in channel-I. Channel-I is more profitable because it involved less cost when compare to other channel. The findings of the study is in line with (Kumawat, 2016).

TABLE 1

Cost of and returns from milk production of local cow and crossbred cow across different
marketing channels in Transition of Northern transect

(Rs/animal/day)

Sl. No.	Particulars	Local cow			Crossbreed cow			
		Channel-II	Channel-III	Channel-IV	Channel-I	Channel-II	Channel-III	Channel-IV
		Value	Value	Value	Value	Value	Value	Value
	Herd Size	3.00	2.00	3.00	5.00	4.00	5.00	4.00
	Fodder	19.12	19.50	29.92	17.39	17.43	12.40	18.17
	Feed	7.05	8.50	5.04	38.36	13.37	50.00	14.82
	Labour	6.55	7.50	4.27	27.55	8.52	7.75	13.93
	Miscellaneous	2.63	3.44	8.53	11.35	13.30	5.42	9.71
A	Total Variable Costs	35.35	38.94	47.76	94.65	52.61	75.57	56.63
B	Fixed Costs	9.53	9.99	9.42	11.10	14.93	7.35	12.31
C	Marketing Costs	1.04	4.00	6.03	1.50	1.62	1.39	3.10
	Total Cost (A+B+C)	45.93	52.93	63.21	107.25	69.16	84.31	72.04
	Milk Production(l)	4.00	3.50	3.00	8.89	8.86	7.67	6.82
	Milk Sale(l)	3.50	2.50	2.50	8.52	7.50	7.17	5.97
	Price/l	26.00	28.00	24.00	27.00	25.00	29.00	24.00
	Price Subsidy(Rs.)	0.00	0.00	33.06	0.00	0.00	0.00	33.33
	Sale of Manure(Rs.)	0.00	2.63	2.63	2.63	3.25	0.00	8.23
	Returns from milk(Rs.)	91.00	70.00	60.00	229.95	187.50	207.83	143.26
	Gross Returns	91.00	72.63	95.68	232.58	190.75	207.83	184.82
	Net Returns	45.07	19.70	32.48	125.33	121.59	123.53	112.77

Economics of milk production in rural area

The average herd size of local dairy cows in rural Bengaluru was smaller than that of cross-bred farms (Table 2).The maintenance cost of a milk animal comprised of cost on feeds and fodder, human labour and depreciation on fixed assets and miscellaneous recurring expenses. The overall maintenance cost of local milching cow per day per animal in channel-II was estimated to be ₹ 53.00. The cost of feeds and fodder were the major items of expenditure accounting for about 70 per cent of the total cost in the case of local cows. While it accounted for 14-28 per cent among crossbreeds. The average highest milk yield per local cow in channel-II was found to be 3.50 litres per day. As far as returns from dairy animals are concerned, the highest net returns were ₹ 29.50

TABLE 2

Cost of and returns from milk production of local cow and cross bred cows across different marketing channels in Rural area of Northern transect

(Rs/animal/day)

Sl. No.	Particulars	Local cow	Crossbreed cow			
		Channel-II	Channel-I	Channel-II	Channel-III	Channel-IV
		Value	Value	Value	Value	Value
	Herd Size	1.50	4.00	5.18	8.00	7.00
	Fodder	12.82	20.54	11.02	32.89	19.24
	Feed	15.25	9.84	8.43	35.00	6.01
	Labour	6.25	7.6	3.84	9.10	10.15
	Miscellaneous	5.71	12.33	10.30	9.57	14.71
A	Total Variable Costs	40.03	50.31	33.60	86.55	50.12
B	Fixed Costs	9.86	13.29	11.91	9.38	13.03
C	Marketing Costs	3.12	2.79	1.57	1.34	5.10
	Total Cost(A+B+C)	53.00	66.38	47.08	97.27	68.25
	Milk Production(l)	3.50	6.07	9.62	8.87	8.10
	Milk Sale(l)	3.00	5.61	8.79	8.33	7.55
	Price/l	24.00	23.00	26.00	27.00	25.00
	Price Subsidy(Rs.)	0.00	0.00	0.00	0.00	25.62
	Sale of Manure(Rs.)	10.50	0.00	3.49	0.05	34.41
	Returns from milk(Rs.)	72.00	128.96	228.58	224.78	188.77
	Gross Returns	82.50	128.96	232.07	224.83	248.80
	Net Returns	29.50	62.58	184.99	127.56	180.55

per animal per day in channel-II. It could be inferred that feed and fodder being the major cost items of cattle maintenance, they had profound effect on the economics of milk production.

The total cost of maintenance of crossbred dairy cows in different type of channels were estimated to be ₹ 66.38, 47.08, 97.27 and 68.25 in channel-I, II, III and IV, respectively, per animal per day. The share of highest total fixed cost, total variable cost, and marketing cost in the total cost was ₹ 13.29 in channel-I, ₹ 86.55 in channel-III and 5.10 in channel-IV. The highest average milk yield of crossbred dairy cows was found to be 9.62 liters per day in channel-II. The crossbreed cows could generate highest net return of

₹ 184.99 per day in channel-II. The findings of the study is in line with (Kumawat, 2016)

Economics of milk production in urban area

The average herd size of cross-bred in urban Bengaluru is presented in Table 3. The maintenance cost of a milk animal comprised of cost on feeds and fodder, human labor and depreciation on fixed assets and miscellaneous recurring expenses. The overall maintenance cost of crossbreed cows was estimated to be ₹ 157.36 and 66.18 in channel- II and IV, respectively, per animal per day. The share of highest total fixed cost, total variable cost, and marketing cost in the total cost were ₹ 12.94, 148.55 and 3.17 in

TABLE 3

Cost and returns from milk production of crossbred cows across different marketing channels in Urban of Northern transect

(Rs/animal/day)

| Sl. No. | Particulars | Crossbreed cow | |
| | | Channel-II | Channel-IV |
		Value	Value
	Herd Size	3.00	5.00
	Fodder	62.30	19.65
	Feed	5.08	8.47
	Labour	67.38	11.29
	Miscellaneous	13.80	10.67
A	Total Variable Costs	148.55	50.08
B	Fixed Costs	8.13	12.94
C	Marketing Costs	0.68	3.17
	Total Cost(A+B+C)	157.36	66.18
	Milk Production(l)	8.14	7.51
	Milk Sale(l)	7.84	6.83
	Price/l	26.00	27.00
	Price Subsidy(Rs.)	0.00	28.98
	Sale of Manure(Rs)	1.21	5.09
	Returns from milk(Rs.)	203.78	184.49
	Gross Returns	204.99	218.57
	Net Returns	47.63	152.38

channel-II and IV, respectively. Cost of feeds and fodder were the major items of expenditure accounting for about 42 per cent of the total cost in the case of crossbreed cows. The highest average milk yield of crossbred dairy cows was found to be 8.14 litres per day in channel-II. These crossbreds were found generating a net return of ₹ 152.38 per day in channel-IV. The findings of the study is in line with (Kumawat, 2016).

The study revealed that the total cost of milk production in the case of cross-bred cows was found to be the highest in urban area and lowest in rural area. This

TABLE 4

Determinants of milk production in north transect of Bengaluru.

Variables	co-efficient		t value
Intercept	0.89		1.5
Herd Size	0.85	*	9.07
Fodder	0.14	**	2.27
Feed	0.01		0.07
Labor	0		0.04
Medical	0.05		1.59
D1	0.17		0.42
D2	-0.22	**	-1.98
KMF member	0.03		0.26
Coefficient of determination	0.56		
Adjusted R2	0.53		
F value	19.79		
No. of observation	150		

Note:* indicates 1%level of significance, ** indicates 5% level of significance

was due to higher fixed costs, and expenses on feed and fodder as compared to local cows and also in urban area. Producers have to buy everything compare to rural area. In rural area farmers can grow fodder but not in urban area. Another important thing is marketing cost is more in channel-IV which might be due to opportunity cost of labor and sample taken for testing which did not existe in other channels.

A one-way ANOVA was performed on the data, and the results are presented in Table 5. The results show that statistically significant differences between channels with respect to selected indicators of dairy viz. total variable cost, total cost, marketing cost, prices, milk production, sales and returns per cow.

Factors influencing milk production

The variables were analysed for their importance in influencing the milk production directly. The results of Cobb-Douglas analysis revealed that herd size was the most important variable in influencing milk yield

TABLE 5
One - Way Analysis of Variance - Dependent Variables

	Mean Square			
	Between Groups	Error		F-value
Herd Size	15.40	13.15		1.171
Total Variable cost	12172.65	1870.99	*	6.506
Total Fixed cost	2.17	2.13		.980
Marketing cost	53.35	5.98	*	8.915
Total cost	12042.16	1894.68	*	6.356
Price of milk	23.36	5.93	**	3.942
Milk Production	39.08	16.37	***	2.387
Milk Sell(l)	44.56	18.33	***	2.431
Revenue from milk	37595.63	12373.13	**	3.038
Net Returns	54936.06	14168.09	**	3.877

across the rural urban gradient of local and crossbred cows as indicated by positive and statistically significant regression coefficient. On an average, one per cent increase in the number of animals resulted in an increase of milk production by 0.85 per cent. Fodder was observed to be the next important variable influencing the milk production which was statistically significantly at 5 per cent level. The dummy variable (D2) to reflect influence of transition area found to be negative and significant. This indicated that production of milk significantly differed in urban and transition area (Table 4). Further it was found that the farm located in transition area reported 22 per cent lesser milk yield value when compare to rural farm.

The results of the study clearly indicated that cost of feed was the major component of total variable cost followed by labour wages and fixed cost. Marketing cost was more in channel-IV compared to other channels. Price of milk is an important factor which decides the choice of marketing channels for sale of milk. Net returns from milk production was higher for crossbred than local cows. Net returns realized by farmers is more in channel-II in rural area which indicates that sale of milk to middleman was more profitable compared to other channels. Among various items of expenditure, input cost was more compared to other costs, hence there is a need to have necessary policy initiatives to increase the profitability of milk production. The quantum of price incentive (subsidy ₹ 4/litres) has to be increased and government has to expand the modern milk supply chains and promote quality of milk produced. Expenditure on fodder and herd sizes were the important determinants of milk production. Therefore, these factors have to be considered by policy makers and dairy cooperatives in order to increase the profitability of milk production.

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