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Economic analysis of dairy production among small and medium scale farmers in Karnataka: A case study of Bengaluru district

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ABSTRACT

A study on dairy production and processing by small and medium scale farmers was conducted in Bengaluru north. The survey showed that dairy production is characterized by low milk production as a result of the use of indigenous/local breeds of dairy cattle managed under pastoral production system. As influenced by urbanization there have been changes in the herd size around Bengaluru north. As agricultural lands pave way for non-farming uses, the land available for growing green fodder exclusively for dairy units which are relatively smaller in size with 2–5 animals per farmer, is shrinking. Even the cost of producing dairy products like milk varies from urban to rural areas. It is observed that the proportion of small dairy farmers was highest in all the three regions, viz. urban (72%), rural (63%) and transition (55%) areas of the Bengaluru north. This reveals that dairy was one of the major sources of livelihood for small farmers in the study area. Cost of labour was highest for all the groups of the dairy farmers in all the three regions followed by the cost of concentrates. The net revenue realized by all the three types of dairy units varied positively with herd size of the dairy farm. Thus, large sized dairy units availed the benefit of scale economies as income per cow was highest at ₹ 22,267, ₹ 23,837 and ₹ 24,870 in rural, transition and urban areas respectively. The net returns were found highest in crossbred cow followed by buffalo and local cow in all the three gradients of the study region.

Keywords: Cost and returns analysis, Milk production, Urbanization

The significance of dairying in a nation like India barely needs emphasizing. India has tremendous assets of animals, which assume a significant job in the national economy and furthermore in the financial improvement of a huge number of provincial family units. India has perhaps the biggest load of cattle and buffalo, i.e. more than 50% of the worlds and 20% of its dairy cattle (NDDB 2018).

The annual growth rate for milk production is increased about 6.62% in 2017–18 as compared to 2016–17. India ranks first in milk production, accounting for 18.5% of world production, achieving an annual output of 137.69 million tonnes during 2013–14 as compared to 187.70 million tonnes in 2018–19 (NDDB 2019).

Indian farming system is largely a mixed crop-livestock farming system, with the livestock sector appending farmstead earnings by providing employment, draught animals and manure. Incorporation of dairy with the crop has increased the earnings levels of different sizes of farmers (Reddy 1979) and integration of livestock with crop provides higher net returns (Kumara *et al.* 2015). Dairy industry occupies an significant position in Indian economy. It embraces the production of milk, its preparation for sale as well as manufacture of dairy products. Dairying has been deliberated as one of the activities aimed at alleviating the poverty and unemployment, especially in the rural areas, rain-fed and drought-prone regions. Dairying plays a foremost role in creating income and employment in rural areas and helps in utilizing surplus family labour (Gururaj *et al*. 2016) and also increase in farm household income and employment significantly, by integrating supplementary enterprises in the existing farming system (Sharma *et al*. 1991).

The study on economics of milk production has gained prominent role. Hence, the objective of the study is to assess the economics of milk production and compare between different herd sizes between three gradients of the Bengaluru north.

MATERIALS AND METHODS

The whole Bengaluru city conglomerate was separated into two transects, viz. Northern Bengaluru and Southern Bengaluru taking the Vidhana Souda as reference point which is located in the centre of the Bengaluru city. Each Northern and Southern transects were further divided into three layers, viz. rural, transition (peri-urban) and urban areas. The distinction of the three layers into rural, transition (peri-urban) and urban areas were made based on the percentage of built-up area and its linear distance from the centre of Bengaluru city.

Data was collected from four villages each from rural,

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transition and urban areas. The number of villages constituting a total of 12. Villages selected under urban region were Chikka Bommasandra, Allalasandra, Atturu, and Puttenahalli. From transition region, Sugatta, Addiganahalli, Bettahalasur and Harohalli were selected and from rural area Devrahalli, Sadenahalli, Varadanahalli and Kodihalli were selected. The purposive random sampling method was used for the selection of livestock farmer households and to analyze the cost and returns of milk production, the data was collected from 120 farmers. It includes 40 sample respondents from each rural, transition and urban areas of Bengaluru north. The sample was post stratified into three different categories, i.e. small (1–3), medium (4–5) and large (>5) herd size on the basis of possession of number of milch animals. The analytical tools used for the analysis of the objective are discussed in the present study.

Depreciation on the shed has been worked out by the straight line method and the life of shed assumed as 10 years.

Junk value is the value of shed commands once the utility of the shed is over.

The amortized value of initial investment was obtained from the following expression.

$$\text{Compounded value of earlier investment} = \text{Historical investment} \times (1+i)^{(\text{present year–year of purchase})}$$

$$\text{Amortization} = \text{Compounded value} \times$$

where 'i' is interest rate and 'n' is number of years of amortization.

Interest on fixed capital has been worked out at 10% per annum and gross cost was obtained by adding total variable cost and total fixed cost and net cost was obtained deducting the imputed value of dung from the total cost. Gross income was obtained from sale of milk, sale of animals and sale of male calf.

RESULTS AND DISCUSSION

In the given study, attempt was made to estimate cost and returns from milk production of crossbred cow, local cow and buffalo maintained by small, medium and large farmers in rural, transition and urban areas of Bengaluru north.

Share of crossbred cow, local cow and buffalo to the total milch population in the rural-urban interface of Bengaluru north: The highest proportion to the total milch population in rural area was contributed by crossbred cow (61.45%) followed by buffalo (19.55%) and local cow (18.99%). To the total milch livestock population in the transition area, the highest proportion was contributed by crossbred cow (70.13%) followed by buffalo (15.58%) and local cow (14.29%). To the total milch livestock population in the urban area, the highest proportion was contributed by crossbred cow (81.20%) followed by buffalo (10.26%) and local cow (8.55%). In the dairy, the proportion of local cows was least as compared to crossbred cows and buffaloes, although the local cows are resistant to different kind of diseases and can withstand different kinds of climatic conditions; they were less preferred over the crossbred cows as their milk yielding capacity is extremely low when compared to crossbred cows like H F.

Table 1. Share of crossbred cow, local cow and buffalo to the total cattle population

Type of animal	Rural (n=40)		Transition (n=40)		Urban (n=40)	
	No. of animals	Proportion (%)	No. of animals	Proportion (%)	No. of animals	Proportion (%)
Local cow	34	18.99	22	14.29	10	8.55
Crossbred cow	110	61.45	108	70.13	95	81.20
Buffalo	35	19.55	24	15.58	12	10.26
Total	179	100.00	154	100.00	117	100.00

Economics of dairy unit in rural-urban interface of Bengaluru north: The average herd size varied from 2 milch animals (small dairy unit) to 7 milch animals in the large dairy unit in the three regions of Bengaluru north. The proportion of small farmers was highest in the urban area of about 72% and it was more than 50% in both rural and transition areas (Table 2). This reveals that dairy was one of the major sources of livelihood for small farmers in the study area.

In the rural area, within the variable cost, the highest percentage was constituted by labour cost irrespective of the size of the dairy unit. Out of the total cost, the percentage share of labour cost was highest in small-sized dairy (32.19%) followed by large (31.20%) and medium (31.12%). As the size of the dairy unit increases, the share of fixed cost was decreased. The share of total fixed cost in the total cost was highest in small units (6.12%) followed by medium (5.45%) and large (4.63%).

The total net revenue obtained was ₹ 41,958, ₹ 84, 514 and ₹ 1, 55,870 in the small, medium and large dairy farms respectively. The returns per cow were highest in the large-sized dairy units with ₹ 22,267 followed by medium (₹ 21,129) and small (₹ 20,979). The returns per rupee of investment were also highest in the large-sized dairy units. In the transition area, the labour cost constituted the highest share in the milk production. To the total cost of milk production highest labour cost was found in the small-sized dairy units (32.93%) followed by large (31.46%) and medium (31.04%) size dairy units. The percentage share of fixed cost has been decreased as the size of the dairy unit increased. The share of fixed cost was highest in the small units of about 6% followed by medium (4.68%) and large (3.80%) due to the fixed cost remains same as the level of production increases.

The returns per cow were highest in the large-sized dairy units (₹ 23,837) followed by medium (₹ 21,688) and small (₹ 21,034). The returns per rupee of investment were also highest in the case of large-sized dairy units (1.50) followed by medium (1.46) and small (1.41).

Table.2 Economics of dairy unit in rural-urban interface of Bengaluru north (₹/year)

Particular	Rural						Transition						Urban					
	Small	%	Medium	%	Large	%	Small	%	Medium	%	Large	%	Small	%	Medium	%	Large	%
Proportion		63		20		17		55		30		15		72		19		9
Average herd size	2		4		7		2		4		7		2		5		6	
Variable cost																		
Cost of dry fodder	10,345	10.36	22,341	11.97	39,468	12.35	11,554	11.37	23,456	12.42	40,122	12.07	14,887	12.73	27,886	11.20	33,124	11.36
Cost of green fodder	14,546	14.56	25,432	13.63	44,576	13.95	13,255	13.05	25,865	13.30	46,122	13.87	18,564	15.88	35,886	14.41	42,331	14.52
Cost of concentrates	28,569	28.60	54,876	29.40	92,884	29.07	28,708	28.26	56,554	29.95	98,969	29.77	30,155	25.79	60,112	29.85	89,114	30.56
Labour cost	32,155	32.19	58,082	31.12	99,708	31.20	33,455	32.93	58,623	31.04	104,588	31.46	36,889	31.55	80,122	32.18	92,334	31.66
Veterinary cost	1,564	1.57	3,245	1.74	6,345	1.99	1,892	1.86	3,459	1.83	6,874	2.07	2,155	1.84	4,225	1.70	5,332	1.83
Miscellaneous cost	455	0.46	954	0.51	1,845	0.58	485	0.48	985	0.52	2,245	0.68	989	0.85	1,345	0.54	1,623	0.56
Interest on variable cost at 7%	6,134	6.14	1,154	6.19	19,938	6.24	6,254	6.16	11,826	6.26	20,924	6.29	7,255	6.21	15,666	6.29	18,470	6.33
Total variable cost	93,768	93.88	176,475	94.55	304,764	95.37	95,603	94.12	180,768	95.32	319,844	96.20	110,894	94.85	239,468	96.17	282,328	96.81
Fixed cost																		
Amortized cost of animal	3,055	3.06	5,334	2.86	7,889	2.47	3,144	3.10	4,689	2.48	7,122	2.14	3,255	2.78	4,899	1.97	5,122	1.76
Amortized cost of building	2,154	2.16	3,122	1.67	4,221	1.32	2,256	2.22	2,592	1.37	3,346	1.01	2,178	1.86	2,262	1.20	2,341	0.80
Depreciation cost	345	0.35	788	0.42	1,342	0.42	365	0.36	764	0.40	1,022	0.31	398	0.34	854	0.34	989	0.34
Interest on fixed capital at 10%	555	0.56	924	0.50	1,345	0.42	576	0.57	804	0.43	1,149	0.35	583	0.50	801	0.32	845	0.29
Total fixed cost	6,109	6.12	10,168	5.45	14,797	4.63	5,976	5.88	8,085	4.68	12,639	3.80	6,016	5.15	9,542	3.83	9,297	3.19
Total cost	99,877	100.00	186,643	100.00	319,561	100.00	101,579	100.00	188,853	100.00	332,483	100.00	116,910	100.00	249,010	100.00	291,625	100.00
Gross returns																		
Returns from milk	135,645	95.64	2,60,122	95.93	456,334	95.98	137,334	95.66	264,448	95.90	478,993	95.93	158,223	96.04	358,443	96.35	421,664	95.65
Returns from Manure	4,235	2.99	7,885	2.91	13,665	2.87	4,255	2.93	7,899	2.90	14,668	2.94	4,366	2.65	8,233	2.54	12,336	2.80
Returns from sale of male calf	1,955	1.38	3,150	1.16	5,432	1.14	2,058	1.42	3,259	1.20	5,680	1.14	2,155	1.31	4,124	1.11	6,844	1.55
Total gross returns	141,835	100.00	271,157	100.00	475,431	100.00	143,647	100.00	277,992	100.00	499,341	100.00	164,744	100.00	372,015	100.00	440,844	100.00
Total net returns	41,958		84,514		155,870		42,068		86,753		166,858		47,834		123,005		149,219	
Returns per cow	20,979		21,129		22,267		21,034		21,688		23,837		23,917		24,601		24,870	
Returns per rupee investment	1.42		1.45		1.49		1.41		1.46		1.50		1.41		1.49		1.51	

N Small (1–3 milch animals); Medium (4–5 milch animals) and Large (>5 milch animals).

Table 3. Economics of crossbred cow, local cow and buffalo in rural-urban interface of Bengaluru north (₹/animal/year)

Particular	Crossbred cow						Local cow						Buffalo					
	Rural	%	Transition	%	Urban	%	Rural	%	Transition	%	Urban	%	Rural	%	Transition	%	Urban	%
Variable cost																		
Cost of dry fodder	5,446	7.98	5,544	7.99	5,812	7.66	1,953	8.53	2,045	8.91	2,053	8.18	2,334	7.87	2,409	8.00	2,512	7.33
Cost of green fodder	7,068	10.36	7,211	10.40	7,831	10.32	2,851	12.45	2,776	12.10	3,063	12.21	3,657	12.34	3,828	12.71	4,092	11.94
Cost of concentrates	19,166	28.09	19,468	28.07	21,889	28.85	4,554	19.89	4,589	20.00	5,162	20.58	5,924	19.99	6,061	20.13	7,544	22.02
Labour cost	25,142	36.85	25,272	36.43	27,677	36.47	9,645	42.12	9,631	41.98	10,055	40.08	13,106	44.22	13,078	43.43	14,688	42.87
Veterinary cost	1,433	2.10	1,593	2.30	1,634	2.15	185	0.81	201	0.88	253	1.01	377	1.27	398	1.32	422	1.23
Miscellaneous cost	907	1.33	986	1.42	1,046	1.38	104	0.45	112	0.49	114	0.45	162	0.55	183	0.61	192	0.56
Interest on variable cost at 7%	4,141	6.07	4,205	6.06	4,612	6.08	1,350	5.90	1,355	5.91	1,449	5.78	1,789	6.04	1816	6.03	2,095	6.11
Total variable cost	63,303	92.77	64,279	92.67	70,501	92.91	20,642	90.14	20,709	90.28	22,149	88.30	27,349	92.27	27,773	92.24	31,545	92.07
Fixed cost																		
Amortized cost of animal	2,451	3.59	2,482	3.58	2,622	3.46	1,059	4.62	1,042	4.54	1,085	4.33	1,151	3.88	119	3.98	1,205	3.52
Amortized cost of building	1,189	1.74	1,248	1.80	1,324	1.74	841	3.67	822	3.58	1,022	4.07	921	3.11	914	3.04	936	2.73
Depreciation cost	842	1.23	892	1.29	945	1.25	152	0.66	165	0.72	546	2.18	122	0.41	141	0.47	329	0.96
Interest on fixed capital at 10%	448	0.66	462	0.67	489	0.64	205	0.90	203	0.88	283	1.13	219	0.74	225	0.75	247	0.72
Total fixed cost	4,930	7.23	5,084	7.33	5,380	7.09	2,257	9.86	2,232	9.72	2,936	11.70	2,291	8.14	2,337	7.76	2,717	7.93
Total Cost	68,233	100.00	69,363	100.00	75,881	100.00	22,899	100.00	22,941	100.00	25,085	100.00	29,640	100.00	30,110	100.00	34,262	100.00
Gross Returns																		
Total milk yield (litres)	3,056		3,093		3,218		918		931		956		1,237		1,243		1,296	
Returns from milk	91,700	94.49	92,799	94.68	102,860	94.93	27,611	90.09	27,954	89.89	31,731	90.74	37,110	91.84	37,290	91.86	44,064	92.35
Returns from Manure	3,504	3.61	3,477	3.55	3,539	3.27	2,171	7.08	2,274	7.31	2,396	6.85	2,408	5.96	2,418	5.96	2,745	5.75
Returns from sale of male calf	1,845	1.90	1,742	1.78	1,958	1.81	867	2.83	869	2.79	841	2.41	891	2.20	886	2.18	906	1.90
Total gross returns	97,049	100.00	98,018	100.00	108,357	100.00	30,649	100.00	31,097	100.00	34,968	100.00	40,409	100.00	40,594	100.00	47,715	100.00
Total net returns	28,816		28,655		32,476		7,750		8,156		9,883		10,769		10,484		13,453	
Returns per rupee investment	1.42		1.41		1.43		1.34		1.36		1.39		1.36		1.35		1.39	

In the urban area, within the variable cost the highest percentage was incurred by labour cost irrespective of the size of the dairy unit. The share of labour cost in the total cost of milk production was highest in medium-sized dairy unit (32.18%) followed by large (31.66%) and small (31.55%). The main reason was that the labour requirement increases with increase in the herd size. The second major share incurred was the cost of concentrates irrespective of the size of the dairy unit. The cost of concentrates was highest in the large-sized dairy units (30.56%) followed by medium (29.85%) and small (25.79%). This was due to the higher requirement of concentrates in the large-sized dairy farms.

The returns per cow were highest in the large-sized dairy unit (₹ 24,870) followed by medium (₹ 24,601) and small (₹ 23,917) sized dairy units. The returns per rupee of investment were also highest in the large-sized dairy units (1.51) followed by medium (1.49) and small (1.41) size dairy units.

The total net returns, returns per cow and returns per rupee of investment were highest in the case of the large-sized dairy units as compared to that of small and medium-sized dairy units. This was mainly due to the economy of scale. As the size of the dairy unit increases, the return also increases. The findings were similar to the study by Demircan *et al.* 2006, Singh *et al.* 2007, Gupta *et al.* 2009, Sunil *et al.* 2016 and Shalini 2017.

Net income per cow was highest in the urban area compared to that of rural and transition area. The reasons for this could be the use of higher quantities of concentrates and also in urban area the farmers were majorly marketing their milk through private parties and some respondents directly sold milk to the consumers, due to this the average price per litre of milk was realised higher in urban areas compared to the farmers in the rural and transition areas, where the majority of the farmers were marketed their milk through Co-operative Societies.

In the total variable cost of milk production, labour cost was contributed highest share followed by cost of concentrates in the crossbred cow, local cow and buffalo. The total cost and total revenue were highest in the crossbred cow, followed by buffalo and local cow. Highest income was observed in the crossbred cow in the urban area of ₹ 32,476, followed by ₹ 28,816 and ₹ 28,655 in the rural and transition areas respectively. The income from buffalo was highest in the urban area of ₹ 13, 453 followed by ₹ 10,769 and ₹ 10,484 in the rural and transition areas respectively. Local cow generated the highest income of ₹ 9,883 in the urban area, followed by ₹ 8,156 and ₹ 7,750 in the transition and rural areas respectively (Table 3). The findings were similar with studies conducted by Kiresur 2002, Ram *et al*. 2009, Singh *et al*. 2012, (Basavarajappa and Chinnappa 2012.

The analysis gave rise to some interesting results that the cost of concentrates, green fodder and dry fodder was highest in the case of crossbred cow followed by buffalo and local cow. The studies conducted by Sunil *et al.* 2016, Dutt *et al.* 2009 and Umamageswari *et al.* 2017 were also of the same opinion that the productivity of animal was highest in crossbred cow followed by buffalo and local cow. The total milk yielding capacity, total cost, total income, net income and returns per rupee of investment found highest in crossbred cow followed by buffalo and local cow. The study conducted by Shah and Singh 1995 were expressed same opinion that the net revenue was not only higher, but also the total costs as well as total revenue were also much higher in the urban area of Bareilly district of Uttar Pradesh.

The total cost and total returns were highest in the large sized dairy units in the urban area than rural and transition areas. The net returns were found to be highest in the crossbred cow as compared to buffalo and local cow.

As agricultural lands pave way for non-farming uses, the land available for growing green fodder exclusively for dairy units which are relatively smaller in size with 2–5 animals per farmer, is shrinking.The total number of milch animals was more in rural areas compared to urban areas, as the availability of land for growing fodder, availability of irrigation facilities and free grazing lands are more in the rural areas but the net income per cow was highest in the urban area compared to that of rural and transition area and also. The total cost and total returns were highest in the large sized dairy units in the urban area than rural and transition areas. There is need provide subsidy for inputs like feed to decrease the cost of milk production and price policies favourable to the milk producers in order to increase the net profits. Looking to the average milk production of cows and buffaloes, it is recommended that better breeding practices should be made available to the milk producers of the study area so that milk yield can be improved. Dairy farmers should also be advised for meeting the requirements of feed by providing desired nutrients through feeding of green fodder which not only reduces intake of concentrates but also helps in reducing the cost of production.

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