

**SUPPLY CHAIN MANAGEMENT OF DAIRY
ENTERPRISE IN RURAL-URBAN INTERFACE OF
BENGALURU NORTH**

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PALB 7125

**DEPARTMENT OF AGRICULTURAL ECONOMICS
UNIVERSITY OF AGRICULTURAL SCIENCES
BENGALURU - 560 065**

2019

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Thesis submitted to the

UNIVERSITY OF AGRICULTURAL SCIENCES, BENGALURU

in partial fulfillment of the requirements

for the award of the degree of

MASTER OF SCIENCE (Agriculture)

in

AGRICULTURAL ECONOMICS

BENGALURU

AUGUST, 2019

*Affectionately
Dedicated to
my Beloved Family*

**DEPARTMENT OF AGRICULTURAL ECONOMICS
UNIVERSITY OF AGRICULTURAL SCIENCES
GKVK, BENGALURU - 560 065**

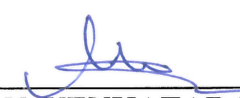
CERTIFICATE

This is to certify that the thesis entitled “**SUPPLY CHAIN MANAGEMENT OF DAIRY ENTERPRISE IN RURAL-URBAN INTERFACE OF BENGALURU NORTH**” submitted by **Ms. SOWJANYA, T. S. ID No. PALB 7125** in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS** to the University of Agricultural Sciences, GKVK, Bengaluru is a record of *bona-fide* research work done by her during the period of her study in this University under my guidance and supervision and the thesis has not previously formed the basis for the award of any other degree, diploma, associateship, fellowship or other similar titles.

Bengaluru
August, 2019

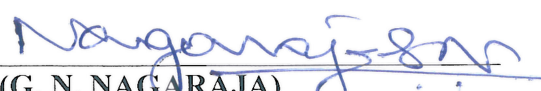

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ACKNOWLEDGEMENT

Acknowledgement is the most forgotten word in this world. I may not be able to acknowledge all the persons who made this journey so memorable and wonderful, but I am indebted to all those who shaped my life in every possible way.

My parents Shri. Shankaraiah, T. P. and Smt. Manjula, T. M. are the backbone of my success and the sole inspiration of my life. I deep heartedly acknowledge their love and affection and I owe it for my lifetime. I am very much thankful to God for blessing me with such a wonderful brother Chandan Raj on whom I rely on in my hard times, family and my cousins who are always there for me in all situations with loads of love and affection.

I place my deep sense of gratitude with at most sincerity and profound indebtedness to my guide and chairman of my Advisory Committee, Dr. M. N. Venkataramana, Professor, Department of Agricultural Economics, UAS, Bengaluru for his valuable guidance, untiring patience, cooperation and moral support throughout my study period.

With immense pleasure and deep respect, I express heartfelt gratitude to Dr. H. Loksha, Professor, Department of Agricultural Economics, UAS Bengaluru, Dr. T. N. Venkatareddy, Associate Professor (Retd.), Department of Agricultural Marketing, Co-operation and Business Management, GKVK, Bengaluru and Dr. G. N. Nagaraja, Dean Agri (Retd.), CoA, GKVK, Bengaluru, for their precious suggestions, teaching, critical evaluation of the manuscript and guidance as members of my Advisor Committee.

I'm indebted to all my teachers, Dr. G. S. Mahadevaiah, Dr. K.B. Umesh, Dr. Srikantha Murty, Dr. Murtuza Khan, Dr. G.M. Gaddi, Sri Mallikarjuna Swamy, Mr. Honnaiah, Mr. Jagannath Olekar and Dr. Anjan Kumar for being the lighthouses in this hard journey. I am grateful to Dr. M. R. Girish and Dr. Mamatha Girish for their support.

I am very thankful to my classmates **Srinivasa, Devaraj, Kokare, Harika, Kiran, Radha, Sindhu reddy and Thejaswi**, for making two years an unforgettable journey.

I am thankful to be blessed with my dearest friends **Apeksha, Syed Bilal, Pavithra, Vinutha and Sainath** who made these two years the most memorable one. I also extend my gratitude towards my beautiful friends **Chai, Yashu, Krishnaveni, Apoorva, Bindu and Pooja** who are an important part of my life. I am lucky to have dear juniors **Archita, Rachana, Kavitha, Bhagya and Sowmya** who helped me personally in this journey.

I extent my special thanks to some of my seniors **Vijju akka, Shobha akka, Kavya akka and Pavithra akka** for their academic and moral support.

I also have been highly fortunate in having many friends whose hands were evident at every moment of tension, anxiety and achievements. I am ever grateful to all my **GKVK friends and others** for their unconditional love and support.

I was privileged to have a great group of beloved senior friends who were always to offer unconditional help when needed. I thank **Ashwini akka, amruta akka, Bhavya akka, Merlin akka, Hamsa akka, Deepa akka, Afrin akka, Sangeeta akka, Akshata akka, Sangamesh anna, Arnab anna, Uday anna, Anupama akka, Ashok anna and others** for your valuable guidance, love and support during my college days.

I wish to express thanks to all the supporting staff of the Economics department **Smt. Sujatha Devi, Sri. Narasimha Murthy and Sri. Devraj** for their support and help during my course of work.

Any omission in this brief acknowledgement does not mean lack of gratitude.

Bengaluru

August, 2019

(Sowjanya, T. S)

SUPPLY CHAIN MANAGEMENT OF DAIRY ENTERPRISE IN RURAL-URBAN INTERFACE OF BENGALURU NORTH

SOWJANYA, T. S

ABSTRACT

The present study was undertaken in Bengaluru North to examine the supply chain management of dairy enterprise by collecting data randomly from 150 farmers, of which 40 dairy farmers each from rural, transition and urban areas and 30 non-dairy farmers. The formal supply chain involves few large processors and co-operatives which collect and market bulk milk on behalf of farmers, while the informal supply chain involved farmers, transporters and traders selling raw milk directly to consumers and hotels. The cost of concentrates was the highest in all three regions. Total cost and gross returns were highest in urban area, i.e., ₹ 2,46,452 and ₹ 3,70,407, respectively. The returns per rupee of investment was 1.48, 1.49 and 1.50; dairy enterprise generated around 206, 257 and 270 man-days of employment yearly in rural, transition and urban area, respectively. Number of female members, irrigated land and availability of cattle-shed have significant positive influence in selection of dairy enterprise. Women play a major role in dairy enterprise than men and take major decisions relating to production aspects rather than financial aspects. Average cost incurred on four major crops per acre was the higher for non-dairy farmers (₹ 1,04,422) and the average net returns was higher for dairy-farmers (₹ 50,676). The synergic effect in terms of additional net benefit realised by dairy farmers over non-dairy farmers was ₹ 68,078 per household and it was ₹ 16,061 per acre.

August, 2019

Department of Agricultural Economics
GKVK, Bengaluru

(M. N. VENKATARAMANA)
Major Advisor

**ಬೆಂಗಳೂರು ಉತ್ತರದ ಗ್ರಾಮೀಣ, ಅರೆನಗರ ಮತ್ತು ನಗರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಹೈನುಗಾರಿಕೆ ಉದ್ಯಮದ ಪೂರೈಕೆ
ಸರಪಳಿ ನಿರ್ವಹಣೆ**

ಸೌಜನ್ಯ, ಟಿ. ಎನ್.

ಸಾರಾಂಶ

ಪ್ರಸ್ತುತ ಅಧ್ಯಯನವನ್ನು ಬೆಂಗಳೂರು ಉತ್ತರದ ಗ್ರಾಮೀಣ, ಅರೆನಗರ ಮತ್ತು ನಗರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಹೈನುಗಾರಿಕೆ ಉದ್ಯಮದ ಪೂರೈಕೆ ಸರಪಳಿಯ ನಿರ್ವಹಣೆಯನ್ನು ಪರೀಕ್ಷಿಸಲು ಕೈಗೊಳ್ಳಲಾಯಿತು. ಅಧ್ಯಯನಕ್ಕೆ ಬೇಕಾದ ದತ್ತಾಂಶವನ್ನು 120 ಹೈನುಗಾರಿಕೆ ರೈತರಿಂದ, ತಲಾ 40 ಗ್ರಾಮೀಣ, ಅರೆನಗರ ಮತ್ತು ನಗರ ಪ್ರದೇಶಗಳಿಂದ ಮತ್ತು 30 ಹೈನುಗಾರಿಕೆಯೇತರ ರೈತರಿಂದ ಸಂಗ್ರಹಿಸಲಾಯಿತು. ಪಚಾರಿಕ ಹೈನುಗಾರಿಕೆ ಸರಪಳಿಯು ಕೆಲವು ದೊಡ್ಡ ಸಂಸ್ಕಾರಕಗಳು ಮತ್ತು ಸಹಕಾರಿಗಳನ್ನು ಒಳಗೊಂಡಿರುತ್ತದೆ, ಇದು ರೈತರ ಪರವಾಗಿ ಹಾಲನ್ನು ಸಂಗ್ರಹಿಸಿ ಮಾರಾಟ ಮಾಡುತ್ತದೆ, ಆದರೆ ಅನೌಪಚಾರಿಕ ಹೈನುಗಾರಿಕೆ ಪೂರೈಕೆ ಸರಪಳಿಯಲ್ಲಿ ರೈತರು, ಸಾಗಣೆದಾರರು ಮತ್ತು ವ್ಯಾಪಾರಿಗಳು ಕಚ್ಚಾ ಹಾಲನ್ನು ನೇರವಾಗಿ ಗ್ರಾಹಕರಿಗೆ ಮತ್ತು ಹೋಟೆಲ್‌ಗಳಿಗೆ ಮಾರಾಟ ಮಾಡುತ್ತಾರೆ. ಪಶು ಆಹಾರ ವೆಚ್ಚವು ಇತರೆ ವೆಚ್ಚಗಳಿಗಿಂತ ಹೆಚ್ಚಾಗಿರುತ್ತದೆ. ನಗರ ಪ್ರದೇಶದಲ್ಲಿ ಒಟ್ಟು ವೆಚ್ಚ (ರೂ. 2,46,452) ಮತ್ತು ಆದಾಯವು (ರೂ. 3,70,407) ಹೆಚ್ಚಾಗಿರುತ್ತದೆ. ಗ್ರಾಮೀಣ, ಅರೆನಗರ ಮತ್ತು ನಗರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಒಂದು ರೂಪಾಯಿ ಹೂಡಿಕೆಯಿಂದ ಕ್ರಮವಾಗಿ 1.48, 1.49 ಮತ್ತು 1.50 ಆದಾಯವು ಬಂದಿರುತ್ತದೆ ಹಾಗೂ ಹೈನುಗಾರಿಕೆಯಿಂದ ಈ ಪ್ರದೇಶಗಳಲ್ಲಿ ಕ್ರಮವಾಗಿ 206, 257 ಮತ್ತು 270 ಮಾನವ-ದಿನಗಳ ಉದ್ಯೋಗ ಸೃಷ್ಟಿಯಾಗುತ್ತದೆ. ಕುಟುಂಬದಲ್ಲಿ ಮಹಿಳಾ ಸದಸ್ಯರ ಸಂಖ್ಯೆ, ನೀರಾವರಿ ಭೂಮಿ ಮತ್ತು ಕೊಟ್ಟಿಗೆ ಲಭ್ಯತೆಯು ಹೈನುಗಾರಿಕೆ ಉದ್ಯಮದ ಆಯ್ಕೆಯಲ್ಲಿ ಗಮನಾರ್ಹ ಸಕಾರಾತ್ಮಕ ಪ್ರಭಾವವನ್ನು ಬೀರುತ್ತದೆ. ಮರುಷರಗಿಂತ ಮಹಿಳೆಯರು ಹೈನುಗಾರಿಕೆ ಉದ್ಯಮದಲ್ಲಿ ಪ್ರಮುಖ ಪಾತ್ರ ವಹಿಸುತ್ತಾರೆ ಮತ್ತು ಹಣಕಾಸಿನ ವಿಷಯಗಳಿಗಿಂತ ಉತ್ಪಾದನಾ ವಿಷಯಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಪ್ರಮುಖ ನಿರ್ಧಾರಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುತ್ತಾರೆ. ನಾಲ್ಕು ಪ್ರಮುಖ ಬೆಳೆಗಳಿಗೆ ಎಕರೆಗೆ ಸರಾಸರಿ ವೆಚ್ಚವು ಹೈನುಗಾರಿಕೆಯೇತರ ರೈತರಿಗೆ (ರೂ. 1,04,422) ಅತ್ಯಧಿಕವಾಗಿದೆ ಮತ್ತು ಹೈನುಗಾರಿಕೆ ರೈತರಿಗೆ (ರೂ. 50,676) ಸರಾಸರಿ ನಿವ್ವಳ ಆದಾಯವು ಹೆಚ್ಚಾಗಿದೆ. ಹೆಚ್ಚುವರಿ ನಿವ್ವಳ ಲಾಭದ ಸಹಕ್ರಿಯೆಯ ಪರಿಣಾಮವು ಹೈನುಗಾರಿಕೆ ರೈತರ ಪ್ರತಿ ಮನೆಗೆ ರೂ. 68,078 ಗಳಾಗಿರುತ್ತದೆ ಮತ್ತು ಇದು ಎಕರೆಗೆ ರೂ. 16,061 ಆಗಿರುತ್ತದೆ.

ಆಗಸ್ಟ್, 2019

ಕೃಷಿ ಅರ್ಥಶಾಸ್ತ್ರ ವಿಭಾಗ

ಕೃ.ವಿ.ವಿ., ಗಾಕೈವಿಕೆ, ಬೆಂಗಳೂರು

(ಎಂ. ಎನ್. ವೆಂಕಟರಮಣ)

ಪ್ರಧಾನ ಸಲಹೆಗಾರರು

Economic benefits and Employment generated by Dairy enterprise in Rural-Urban Interface of Bengaluru North



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Introduction

Livestock are a vital natural resource of livelihood security for hundreds of million people, as livestock not only provide poor people with employment, food, income and many inputs for agriculture but also act as catalytic agent that transform subsistence farming into income generating enterprises, allowing poor people to improve their standard of living.

Livestock provides livelihood to two-third of rural population and provides employment to 8.8 per cent of population in India. Total livestock population of India is 512.05 million out of that Karnataka contributes 27.7 million and Karnataka ranks 10th in the country in milk production.

Crop-livestock production diversification not only aimed to optimum usage of inputs, but also reduces risk in areas with erratic rainfall and frequent crop failures.

Objective

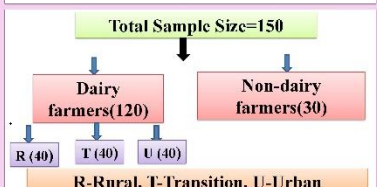
To examine the economic benefits and employment generated by dairy enterprise in rural-urban interface of Bengaluru north.

Methodology

Study area: Rural-Urban Interface of Northern Bengaluru.



Fig. 1: Map showing study area, i.e., Bengaluru North



Data source: The primary data was collected by personal interview method.

Analytical tools: Tabular analysis, measures of central tendency, economic measures viz., costs, returns and descriptive statistics were used.



Data Collection

Results

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	(%)	No. of animals	(%)	No. of animals	(%)
Local cow	24	13.41	12	8.33	10	8.06
Crossbred cow	126	70.39	117	81.25	108	87.10
Buffalo	29	16.20	15	10.42	6	4.84
Total	179	100.00	144	100.00	124	100.00
Average	4.4(~4)		3.6(~4)		3.1(~3)	

Table 2: Economic benefits from dairy enterprise in rural-urban interface of Bengaluru north

Particulars	Rural (n=40)		Transition (n=40)		Urban (n=40)	
	Rs.	%	Rs.	%	Rs.	%
Variable Cost						
a) Cost of dry fodder	21707	9.67	22153	9.49	23023	9.34
b) Cost of green fodder	28504	12.70	29293	12.55	30262	12.28
c) Cost of concentrates	70511	31.42	75338	32.29	77925	31.62
d) Labour cost	65845	29.34	67302	28.84	69608	28.24
e) Veterinary & miscellaneous	3814	1.70	4015	1.72	3943	1.60
g) Interest on variable cost at 7 %	13327	5.94	13867	5.94	14333	5.82
Total variable cost	203707	90.77	211969	90.84	219094	88.90
Total Fixed cost	20376	9.23	21380	9.16	27359	11.10
Gross cost	224083	100	233349	100	246452	100
Total gross returns	332708		347199		370407	
Total net returns	108625		117437		123608	
Cost per animal	50928		64819		79613	
Net returns per milch animal	24688		32621		38328	
Returns per rupee of investment	1.48		1.49		1.50	



Fig 1: Activity-wise employment generation by dairy enterprise (man days/annum)

Discussion

- Share of crossbred cow, local cow and buffalo to the total livestock population in rural, transition and urban areas was indicated in the Table 1.
- To the total livestock population, percentage share of crossbred cow was highest in all the three regions of the Bengaluru north i.e. in the rural (61.45%), transition (70.13%) and in the urban area (81.20%).
- To the total livestock population, percentage share of crossbred cow was highest in all the three regions of the Bengaluru north i.e. in the rural (70.39%), transition (81.25%) and in the urban area (87.10%).
- In table.2 it can be seen that the percentage share of cost of concentrate was highest in all three areas.
- Total net returns were highest in the urban (Rs. 1,23,608) followed by transition (Rs. 1,17,437) and rural (Rs. 1,08,278) areas of Bengaluru north.
- Returns per rupee of investment was highest in the urban(1.50) followed by transition (1.49) and rural (1.48) areas of Bengaluru north.
- Fig 1 indicating the activity-wise employment generation by practicing dairy farming. Highest employment of 343 man-days was observed in the urban region of Bengaluru North.

Summary

Net income per animal was highest in the urban area compared to rural and urban areas. The reason behind which could be utilization of higher amounts of concentrates and furthermore in urban area they sell milk through private parties and few of them sell directly to the consumers, because of this average milk price was highest in urban area when compared to rural and transition areas.

In urban area the dairy farming has created higher employment compared to rural and transition areas.

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I INTRODUCTION

The dairy industry actively contributes to the economies of several regions, communities and countries. An increasing worldwide demand is noticeable at present, and the dairy industry is globalizing. It is increasing the intensity and scope of the global dairy trade. Dairy farming is a way of life for many local communities across the globe. Dairy farmers are an integral part of local economy and dairy farmers provide employment for others in the community. Furthermore, every dairy farm has a much bigger economic multiplier effect, providing work for local veterinary officers, mechanics, feed and other suppliers. Milk and dairy products play a vital role in a healthy and a balanced diet. Milk is a rich source of calcium that is easily absorbed by the body. Calcium, along with other nutrients that are present in dairy products, namely, protein, phosphorus and magnesium are essential to build strong bone.

Global milk production was 828.50 million tonnes with growth rate of 2.1 per cent per annum with its value amounting to 292 billion USD (2016). On a global scale, milk value accounts for 8.9 per cent of the total worth of agricultural commodities. Approximately 150 million people in the world depend on dairy farms for their livelihood. In the world, around six billion people consume milk and its products. It is an indispensable part of the nourishment and it assumes key part in the supportability of rural areas. Thus, the scope of dairy industry is increasing and hence the intensity of global dairy trade.

Dairy development in India has twin objectives: 1) Increasing total milk supply on commercial basis and, 2) Diversifying agricultural structure by developing dairy farming as a principal or supplementary occupation that would help farmers to increase the income of small and marginal farmers or landless labourers. Dairy industry occupies an important place in the Indian economy. It has embraced the production of liquid milk, its preparation for sale and also manufacturing of dairy products.

India is blessed with largest cattle population in the world and India is the largest producer as well as the consumer of milk in the world. Dairy is a highly specialized field today which involves production, collection, storage, processing, value addition and

distribution of milk and milk products. There are 190.9 million of cattle and 108.7 million of buffaloes which accounts for 16 per cent and 57 per cent of the total world livestock population, respectively (Anonymous, 2012). Dairy sector is one of the growing industries in India with a growth rate of 4.2 per cent annually and the production of 165.4 million MT in 2016-17 (18 per cent of the world milk production), which is worth rupees 5000 billion. Thus, there is tremendous scope to increase productivity of cattle by practicing improved breeding technologies, feeding practices and health management. Dairy sector is an important source of livelihood and provides supplementary income to 60 to 70 per cent of the farmers located in rural areas. Nearly, 70 million families throughout the country involved in dairy farming. Among which, 60 per cent of the milch animals are owned by small, marginal and landless farmers (Bhasin, 2004). The Indian dairy sector is characterized by a very large number of small herds. India has an extensive government supported dairy cooperative structure. Most of the milk produced (over 80%) is distributed as liquid milk for home consumption or manufacturing of traditional products like ghee, paneer and sweets.

A very large population in India who are unskilled and less literate depend upon agriculture for their livelihoods. As agriculture is seasonal in nature, it could provide employment to a maximum of 180 days in a year. The marginal farmers and land less labourers depend upon livestock for utilizing their labour in off-seasons. The dairy provides employment to 8.8 per cent of the India's population. Return from dairy realized by farmers mainly depend upon the inputs like feed, fodder, veterinary services supplied and output (milk) obtained.

Overall, Indian dairy sector is showing a turbulence with new product launches, shifting of the brands and the entry of new players. This will also encourage many global players to enter Indian market. Livestock rearing is an easy business. Animals provide milk year-round. Dairy farming breaks even in the first year, dairy farming can be done being dependent on labourers. The change in family structures, growth of disposable incomes, a greater number of women joining dairy work force and the focus on healthy, nutritious and quality products are likely to result in demand for a shift towards dairy products that are not just functional and convenient but also meet the consumers' aspirational needs.

In Karnataka about 65 per cent of the population mainly depend on farming for their livelihood. At the same time farmers also practice dairying as supplementary and complementary enterprise which gives persistent income especially during crop failures. Karnataka stands ninth in cattle and buffalo population in the country contributing 4.3 per cent to the total cattle population. Karnataka owns 1.3 million crossbred cows and 1.1 million indigenous cows with the milk production of 3.1 and 1.4 million tonnes, respectively. Crossbred cow population increased by 22 per cent since 1992 and indigenous cattle population has decreased by 4.5 per cent since 2000. In southern districts of Bengaluru, Mandya, Chikkaballapura, Ramanagara and Kolar 40 per cent of cattle are crossbred cows (Anonymous, 2016).

Crossbred cow population exhibited tremendous increment in urban and peri-urban regions of Mandya, Hassan, Tumakuru and Bengaluru. Since, the demand for milk is high in these areas crossbred cows are preferred because they are high milk yielders. Per capita availability of milk in Karnataka is 291 grams per day as against national average of 355 grams per day (2018). This signals that poor status of the dairy enterprise in Karnataka and it calls for attention to exploit the potential of the wealthy cattle population in Karnataka. Fodder cultivation was restricted to the unproductive land which mainly depends on rainfall. The availability of feed and fodder was lower than the requirement.

Since dairying has been a traditional enterprise and endowed with better breeds of buffaloes and cattle, it throws good opportunity to diversify the agriculture in the state of Karnataka. Therefore, promoting the dairying enterprise can explore the possibilities of increasing the incomes and employment of marginal and small farmers to a greater extent. Furthermore, among all inputs that are required in production of milk, feed and fodder, constitute a larger part of total cost. Various studies have showed that feed is the major factor for enhancing milk yield and reducing the cost of milk production (Virk and Khirwar, 1984).

Women play an important and vital role in animal husbandry occupation as manager, decision makers and skilled workers. Increasing demand for milk and milk products in recent years intensifies dairy farming as profitable enterprise for rural woman.

The participation of women in dairy farm practices varies by region, culture and socio-economic status. The contribution of dairy farm women in terms of time and effort is not less than men. In India, women's involvement in livestock management is a long-standing tradition and livestock rearing has been as integral part of homestead farming system. Animal husbandry occupation is an important source of income among rural households. Most of the important tasks in animal husbandry activities are performed by dairy farm women besides fulfilling their responsibilities as home makers.

Bengaluru district produces 311 thousand tonnes of milk annually with the cattle population of 4,06,306 dominated by crossbred cattle. With better infrastructure facilities, better marketing facilities and veterinary institutions dairying is slowly turning to commercial scale. Per capita availability of milk is more in Bengaluru Rural (471 grams/day) than Bengaluru Urban (38 grams/day). Rapid urbanization in and around Bengaluru has led to the decrease in area under agriculture and this was also seen in case of area under fodder crops. Hence, farmers are facing a lot of problem regarding the availability of fodder (Anonymous, 2015).

Urbanization refers to the population shift from rural to urban areas that is the gradual increase in the proportion of people living in urban areas, and the ways in which each society adapts to the change. Urbanization is diffusing worldwide in rural areas and more so in developing countries like India. It was estimated that nearly 50 million people are added to the world's urban population and about 35 million to the rural population each year (Kalamkar, 2009). The share of world's population living in urban centres had increased from 39 per cent in 1980 to 46.6 per cent in 2000 (Pranati, 2006). The global rural population is now close to 3.4 billion and is expected to decline to 3.1 billion by 2050. It is predicted that about 86 per cent of the developed world and 64 per cent of the developing world will be urbanized by 2050.

Urbanization in India began after independence by adopting the socialist principles of mixed economy which boosted private sector in the country. In the past two decades, the level of urbanization has gone up by 27.80 per cent in 2001 to 31.20 per cent in 2011 and likely to increase more than 50 per cent by 2050. In relative terms, rural population

which was 89.14 per cent in 1901 had decreased by 20.3 per cent in the last eleven decades to about 69 per cent. On the contrary, the urban population had increased almost three-fold from 10.86 per cent in 1901 to 31.16 per cent in 2011.

Apart from the rural areas, the transition livestock farming is also common in Indian conditions and this comprises mostly the dairy animals. Transition is an area or a village or a habitation located in the perimeter of the urban areas having a partial or complete influence of urbanization (Puspha, 2006). Transition dairy farming expands the nutritional and the economic base of the transition areas through production, supply and marketing of milk and milk products and resulted in the increase in the entrepreneurial activities, increase in income and creation of employment opportunities. Public policies have focused strongly on dairy farming in the rural areas. Milch animals in the peripheral areas of large cities are reared to supply the milk to the urban areas and the cities, thereby generate employment and income to transition farmers. The increasing trend in milk consumption by urban dwellers favoured a greater number of transition dairy farmers around cities and towns (Staal and Shapiro, 1996).

In rural areas dairying is practiced as the secondary occupation in general but recent trends have shown that farmers' reposing keen interest towards this practice. Crossbred cow, buffalo and indigenous cow all are contributing to the milk production with less productivity since the latter two types are genetically poor yielders than former. Further, farmers have less knowledge regarding management of crossbred cows.

Urban dairy farming consists of small holders and highly specialized, business-oriented firms. Urban dairy farmers have better knowledge regarding improved dairy management practices like milking, better feeding and health management. But farmers in these areas have lack of access to grazing land but they have better marketing opportunity. Mainly stall feeding is practised here.

Transition dairy farming was practised in areas where the density of human population is very high and area under crop production shrinking due to urbanization. The milk production is dominated by exotic cows (Holstein Friesian). This system includes

commercial dairy enterprise to the small dairy farmer (less than two cows) and greater business oriented.

Rapid urbanization of rural areas surrounding North of Bengaluru conglomerate is affecting changes in the structure of agriculture including dairy. There is a considerable variation in dairy production practices across rural and urban areas and consequently the economics of dairy production.

Scope of the study

For the success of dairy industry, an efficient supply chain management is a primary factor. Milk production is concentrated in rural area whereas consumption is concentrated in urban area. Milk being a perishable commodity, it requires time efficient supply chain. Thus, this study makes an attempt to capture the supply chain of dairy enterprise and the roles of the respective stakeholders.

The data regarding cost and returns of milk production in the study area was scanty and it is difficult to make any generalizations. Economics of dairy farming is important to producers, consumers and even policymakers to assess profitability of dairying to attract investment and to frame appropriate policies. Thus, this study focussed on the micro economic aspect of dairy farming in rural, urban and interface of North Bengaluru.

The possible factors that are influencing selection of dairy as an enterprise in the study area are identified and analysed. The relationship between important socio-economic characteristics of the farmer and selection of dairy is investigated. Most of the important tasks in animal husbandry activities are performed by dairy farm women besides fulfilling their responsibilities as home makers. Hence, the present study analyses the role of women in different dairy activities and their involvement in taking decision related to dairy enterprise.

Diversified and integrated systems of agriculture promote interactions over time and space. They also create opportunities for synergistic resource transfer between farming

and dairy. Thus, this study identifies the synergistic effects of dairy enterprise on the farm enterprise in comparison with the non-dairy farmers.

The specific objectives of the study are as follows,

1. To assess the role of stakeholders in dairy supply chain,
2. To examine the economic benefits and employment generated by dairy enterprise,
3. To analyse the socio-economic factors influencing in selection of dairy enterprise,
4. To analyse the role of women in dairy enterprise and
5. To assess the synergic effect of dairy farming on farm productivity and other issues.

Hypotheses

- The economic benefits and employment to the farmers of urban area are higher than that in rural area.
- Size of land holding and family size influence the herd size
- Women play a major role in dairy enterprise than men.
- Women take major decisions relating to production aspects rather than financial aspects.
- Farm productivity of dairy farmers is more compared to non-dairy farmers.

Limitations of the study

Although every effort was made to make this study as comprehensive as possible, it is subjected to the limitations inherent in a single research project, some of the limitations are indicated below:

1. Information collected was largely based on the expressed responses and perception of the respondents, their ability to recall and on data provided by them. Hence, complete freedom from individual bias and prejudices cannot be ruled out.
2. Due to the limitation of time and other resources, the study could not be extended beyond the selected samples size for qualitative and quantitative assessment.

3. The study was confined to selected areas of North Bengaluru. So, universal applicability of results cannot be claimed. In spite of the above limitations, due attention was given to make this investigation more useful and as deep and systematic as possible.

II REVIEW OF LITERATURE

2.1 Supply chain management, stakeholders and their roles

Inamke (1987) examined dairy co-operatives in Solapur district to evaluate the comparative benefits gained by milk producers. The study indicated that the beneficiaries of large sized societies gained more benefits in the form of milk marketing, cattle feed and loan facility than the small and medium sized societies.

Sree Devi (1992) studied that the members and officials have favourable attitude towards milk co-operatives. People availed several benefits from the co-operatives such as cattle feed, green fodder seeds, medicines, vaccination and artificial insemination facilities after becoming the members of the society, this had a positive impact on milk production i.e., milk production increased significantly.

Shiyani and Rajvir (1994) evaluated the performance of dairy co-operatives in saurashtra (Maharashtra). They found that among physical indicators, sale of cattle feed, number of animals treated by veterinary doctors were important while value of milk procured and sold, salary paid to staff, net income and total turnover were important among financial indicators.

Chahal (1996) in his study has analyzed the information gathered from individuals from milk makers' social orders, milk merchants who discarded milk to focuses appended to private milk plants and milk merchants who sold milk to the milk merchants, sweet shops and nearby clients. He has reasoned that the milk co-agents are assuming a positive job in the provincial milk advertise by giving intense challenge to the private brokers.

Singh and Singh (2007), in their investigation endeavoured to examine milk production, utilization, and marketing through the dairy co-operative, Bihar State Co-operative Milk Producers Federation Ltd. (COMPFED) and looks at the producer's share in the customer's rupee of milk marketed through dairy co-operatives. Around 83 percent of milk produced is sold and 17 percent is consumed in the project region. The producer's share in consumer's rupee declined from 67 per cent in 2006 to 59 per cent in 2008 which

should be expanded through productive administration of dairy plants and human resource. The co-operative functionaries got more advantages from expanded consumer rupee of milk. Thus, the dairy co-operatives appear to be hostile to producers who sold milk through institutional channels.

Prashanth (2010) examined the existing supply chain structure in procurement and distribution of Nandini milk to end users in Karnataka and the study revealed that the milk distribution channels of the KMF are very well established and milk from the main dairy is delivered to the consumers through agents, parlours and transporters-cum-distributors.

Kumar *et al.* (2011) examined smallholder dairy farmer's access to modern milk marketing in India. The study revealed that the traditional milk supply chain is dominant than modern supply chain for milk. The evolution of modern milk supply chain is dependent on the improvement of milk collection infrastructure facilities at farmer's doorstep, price incentives and bonus for quality produce.

Priyadarshini (2015) in their study found that on account of feed out of 120 sample milk producers surveyed, 110 (91.67 %) producers acquired the feed from the cooperative society. The number of dairy farmers selecting to buy inputs from different sources other than cooperative society was less. What's more, even the amounts acquired were likewise less. The method of marketing of milk by the sample milk producers to the diverse organizations demonstrated that the average milk quantity sold varied by the phase of the period of lactation. The total cost brought about in milk production was Rs. 42342.85 per annum and the gross returns from milk production were Rs. 52875 for every animal for every year. The net returns in milk creation /animal/annum were observed to be Rs. 10532.15 prompting benefit cost ratios of 1:1.25. The staggering expense of cow feed and absence of good quality concentrates, non-accessibility of emergency veterinary services and facility of artificial insemination, the mind-boggling expense of cross-breed animals, delayed payments and low prices, were the serious issues looked by the milk producers in production and marketing of milk.

Rajani (2015) conducted a study on value chain analysis in dairy enterprise in Belgaum district. In the study, all the producers found to avail artificial insemination service to their livestock from the milk cooperative society, availed feed at discount rate because of reasonable price and quality of the feed and also the veterinary services. They took society's help to get linked to the bank. It was found that half of the producers took fodder seeds and some participated in training programs as they felt that would increase their livestock management skills.

Uma Devi (2016) conducted a study on economics of milk and milk products supply chains in Prakasam district of A.P and found that the channel involving two intermediaries was efficient with the highest marketing efficiency for milk. The study also revealed the major constraints faced by wholesalers were transportation costs, variation in quality and quantity of milk and maintenance costs and that by retailers were high maintenance costs, transportation costs and availability of labour.

2.2 Economic benefits and employment generation

Natarajan (1990) observed that the major cost in milk production was cattle feed (20 per cent of total cost). He suggested that Agricultural Price Commission in consultation with Economic Ministries and Planning Commission to recommend, from time to time to the procurement and support prices of milk and milk products as done for other agricultural commodities. In addition, he reported that for better performance of dairy co-operative societies, four factors were important viz. high milk utilization, better milk marketing, distribution of cattle feed and credit for buying and technical assistance to milk producers through co-operatives.

Suguna (1994) analysed milk production and marketing in Visakhapatnam district of Andhra Pradesh. The study suggested that appropriate need-based technology should be developed, essential infrastructural facilities like adequate institutional finance, health cover, insurance and extension education should be provided for improving the quantity and quality of milk by the farmers.

Neeraj *et al.* (2004) studied the economics of milk production in Kanpur district of Uttar Pradesh. Two blocks and five villages from each block were selected randomly and the number of farmers were grouped into three size groups of less than one, 1-2 and above two hectares. The study revealed that the total maintenance cost of a cattle per lactation increased as farm size increased. The average maintenance cost per milch animal during a lactation period was Rs. 10,278. Large farmers had higher gross income from production of milk due to high utilization of feed concentrates by the large farmers. Input output ratio was high in the case of small farm and it was found to be 1.34.

Hossain *et al.* (2005) conducted a study on the small-scale dairy farming practice in Bangladesh. The results showed that the cost of rearing a crossbred cow was 67.50 taka per day and the net return per cow per day was 17.70 taka.

Dwaipayan *et al.* (2005) conducted a research on the economics of buffalo milk production in Tarai region of Maharashtra. The study showed that the returns mainly were the result of sale of milk, i.e., 97 per cent and remaining was from the sale of manure, i.e., 3.31 per cent. The total production cost of milk was high in the case of large farmers (4 & more than 4 ha) was Rs. 21,054, followed by medium farmers (2-4 ha) which was Rs. 20849, followed by small farmers (1-2 ha), landless (having no land) and the marginal farmers (<1 ha), i.e., Rs.19,773, Rs.19,047 and Rs.17,071, respectively. The total returns so obtained was more in large farmers (Rs.20,237) followed by small farmers (Rs.19,513), medium farmers (Rs. 19,144), landless (Rs.18,338) and marginal farmers (Rs.17,225).

Khan (2006) made a study on economic analysis of milk production in West Bengal and observed that per litre cost of milk production was the highest for indigenous cow (Rs. 22.36) and the lowest for crossbred cow (Rs. 8.78). Net returns realized were the highest in case of buffalo (Rs. 2.88). But there were negative returns in case of the indigenous cow.

Parmar *et al.* (2010) revealed that 75 per cent of total cost of milk production was shared among feed, fodder and labour cost. The cost per litre of milk production was found highest in the case of buffalo (Rs. 13.50), followed by indigenous cow (Rs. 11.35) and

crossbred cow (Rs. 7.8) and net profit realized per year was the highest in crossbred cow (Rs. 3,472) compared to buffalo (Rs. 2,076) and indigenous cow (Rs. -2,433).

Gururaj (2014) conducted a study to examine the employment generated from dairy farming. The study showed that the average employment from irrigated area was more, i.e., 175.12 man days / annum which is more than that of 150.2 man days / annum in non-irrigated area. It was also found that adult female contributes more labour compared to other members in the family irrespective of area and herd size.

Priyanka and Chandel (2016) studied the economics of milk production and cost elasticity in Sirsa district of Haryana. The analysis showed that fixed cost for local cows was the highest (21.3 %), followed by buffalo (19.23 %) and crossbred cow (15.95 %). The variable cost was the highest for crossbred cow (84.21 %) than buffalo (80.77 %) and local cow (80.21 %). Finally, cost per litre milk production was the highest in case of local cows (Rs. 33.50) followed buffalo (Rs. 32.43) and crossbred cow (Rs. 20.81). Per litre returns were the highest for crossbred cow (Rs. 5.20), followed by buffalo (Rs. 3.67) and negative in the case of local cow (Rs. -0.20).

Raju *et al.* (2016) conducted a study to analyse the costs and return of milk production in Rajasthan, which revealed that production of milk in India is concentrated mainly on small farmers in rural region as a subsidiary activity to agriculture. The overall revenue can be increased, by reducing the cost of production. The average production cost per litre of milk was Rs. 14.27 and the average net return per litre milk was Rs. 8.28. The overall input-output ratio was 1.58. The cost C was worked out to be Rs. 18,67,600 per dairy farm and Rs. 3,33,450 per cow and the net income per dairy farm was Rs. 10,53,012 and Rs 18,804 per milch animal. The average milk yield of desi cow was 8.20 litre. It was 15.80, 11.53 and 10.50 litres for Holstein Friesian, jersey cow and buffalo, respectively.

Pathania and Amita (2016) made a study on the economic analysis of milch animals in Jaisinghpur tehsil of Himachal Pradesh. The study concluded that of the total cost, feed and fodder together constituted 76.48 per cent and 83.82 per cent of the total cost on marginal and small farmers, respectively. Human labour which costs was 18 and 13 per

cent for marginal and small farmers, respectively. Finally, per litre cost was Rs. 31 and Rs. 32, respectively, for marginal and small farmers.

2.3 Socio-economic factors influencing selection/ adoption of an activity

Orhan *et al.* (2010) analysed the socio-economic factors in the dairy farming of Antalya province of Turkey. The results of the study indicate that there are relationships between experience in dairy farming, family size and raising crossbred cows with the higher daily milk yield. A relationship between the age of the farmer, farm size and experience in dairying with the number of milch cows was also found. According to the results of the study factors that are looked out did not have any influence on being a member of the milk union.

Arayesh (2011) made an attempt to identify the factors influencing the participation of agricultural cooperative members. The results showed that the variables are economic, managerial, political and social factors show positive effect over the dependent variable of participation of agricultural cooperative members.

Sharma and Sarishty (2012) in their study found that employees of both public and private banks perceive relationship with co-workers, the work, good work condition and job security are the most important motivational factors. Employees of private banks often change their workplace compared to public banks as they find job security is more in public banks.

Belay *et al.* (2012) conducted a research. results of analysis showed that certain socio-economic characteristics of the respondents were found to be significantly related to dairy management practices. Education level was negatively correlated with the oestrous detection ($r = -0.270$; $P < 0.05$). Methods of manure disposal was negatively correlated with experience in dairy production ($r = -0.346$, $P < 0.05$). Culling practice was negatively correlated with level of education (-0.277 , $P < 0.05$), household size ($r = -0.307$, $P < 0.05$) and experience in dairy farming ($r = -0.027$, $P < 0.05$). production of milk per farm was correlated positively with education level of the dairy farmer ($r = 0.282$, $P < 0.05$). Traditional

veterinary treatment was negatively correlated with size of the household ($r = -0.283$, $P < 0.05$).

Mazen and Haitham (2013) analysed the factors influencing the adoption of e-learning in Jordan: An Extended TAM Model using factor analysis technique. The findings revealed that in the adoption of e-learning in Jordan, students have a very significant role as stakeholders. While, the variable Attitude contributes to about 57 per cent of the variance in the e-learning prediction, the factor Patronised contributes only about 28 per cent of the variance in the e-learning prediction. Furthermore, the results show an obvious recommendation is the need to make the users engage in a more determined manner.

Chitrambigai, *et al.* (2013) in their study on factors influencing the farmers entering into contract Japanese quail farming, the factor analysis results showed that out of the seven variables considered, the variables of creating infrastructure and averting price fluctuation have higher factor loading in the first dimension whereas remunerative price and removal of exploitation by the middlemen had the highest factor loading on second dimension.

Xaba and Masuku (2013) in their study on factors influencing the choice of marketing channel by vegetable growers in Switzerland. The study indicated that farmer's age, education level and quantity of production of baby corn were significant factors of the choice of selling vegetables to market channels instead of selling them to other -wholesale market channel. The age of the producer, distance between the area of production and the market, membership in farmer's organization and marketing agreement are also important determinants of their choice of using non-wholesale market channel to other- wholesale market channel.

Kumar *et al.* (2016) compared the socio-economic status of members of dairy co-operatives and private dairies in Rajasthan and the results showed that higher productivity of milch cattle relies upon the higher knowledge and adoption of feeding, breeding, aspects such as health care and management of the milk production practices. Total yield of milk in the last lactation of buffaloes, crossbred and local cows and of the individual from private dairy was 1,068.98, 1,226.86 and 914.34 litres, respectively. While on account of the

individual from dairy co-operatives total milk yield in the last lactation of buffaloes, crossbred and local cows and were 1,230, 1,326.66 and 1,133.8 litres, respectively. Total quantity of milk produced in the last lactation among the dairy co-operative respondent's cattle was found much higher than the private dairies. Average milk yield was observed to be notably higher on account of animals owned by dairy co-operative respondents than that of private dairies at 5 % probability level. Dairy expansion services, training, veterinary services, cattle feed and other dairy development programs started by dairy co-operatives which prompted generous improvement in the milk production of co-operative dairy farmer's cattle were observed to be the significant causes behind this distinction.

Sultana *et al.* (2016) studied the socioeconomic determinants of milk production in Bangladesh. The study revealed that off-farm income, age of farm owner and training had a negative influence, but experience in agricultural activities had positive impact. And the conclusion says that socio-economic factors affecting milk production are highly linked with adoption of efficient management decision tools that will direct the farmers to allocate resources effectively for enhancing the production of milk.

Gunaseelan, *et al.* (2017) in their investigation uncovered that the coefficient of multiple determination (R^2) was observed to be was 0.669, demonstrating 66.90 percent of variation in adoption level of peri-urban dairy ranchers was because of the consolidated impact of all the independent factors. The regression analysis likewise clarified that the factors, family income, and financial inspiration had positive and significant (1 % level) impact on the variability in the selected dimension of peri-urban dairy ranchers. The factors viz., education and milk production demonstrated positive and noteworthy (five percent level) towards the adoption level of peri-urban dairy ranchers. Therefore, it is reasoned that an increase in family income, economic motivation, training, and milk production brought about an increase in the level of adoption of peri-urban dairy ranchers as for their co-efficient estimates.

2.4 Role of women

Pushpa (2008) conducted a study on gender analysis in dairy farming practices. The findings of the research indicated that greater part of daily animal husbandry activities

mainly performed by females except sale of milk and fodder collection. Male members had participation in the occasional animal husbandry activities. Majority of both male and female respondents had medium level of informal sources of information, mass media exposure and extension contact. Decisions of feeding, marketing and breeding were taken by males except management practices. With respect to control over the resources and its benefits were majorly controlled by male members. In the case of knowledge about improved practices such as feeding, breeding, health care and management the percentage of respondents were 63.82 (64.70 % male and 62.94 % female), 57.94 (61.76 % male and 54.12 % female), 61.18 percent (60.00 % male and 62.35 % female) and 67.35 (61.77 % male and 72.94 % female). Practically, every factor of both male and female respondents was positively correlated with knowledge level except age, milk consumption and family size.

Golla *et al.* (2011) focus in their publication on the economic dimension of empowerment. The authors define economic empowerment of women as follows: “A woman is economically empowered when she has both the ability to succeed and advance economically and the power to make and act on economic decisions.” According to this definition there are two interrelated components; the first is economic advancement in terms of economic gains and success and the second is power and agency regarding decision-making and control over resources. These components enhance each other and lead eventually to greater economic empowerment of women.

Nataraju (2012) conducted a study to know the participation of women in dairy farming. The results showed that majority of the women involved in cleaning cow shed (57.50 %), selecting the breeds (56.67 %) and washing the cows (55.00 %). About half (50.00 %) of the women respondents were involved in selling of dairy products followed by vaccinating the animals (40.83 %) and treatment of animals in ailment/infertility management (40.00 %). The characteristics such as education, income, livestock possession, dairy experience, mass media participation, extension participation, social participation and risk orientation had significant and positive relationship with their participation in dairy farming.

Kathiriya *et al.* (2013) in their study about 30 activities of dairy farming were considered and they were classified under six categories as feeding, breeding, health care, management, processing and marketing & miscellaneous. The results showed that participation of women was highest in taking care of pregnant cows (91.66 %) which is followed by taking them for diagnosis (90.83 %). It also revealed that 90 per cent of the women were involved in milking while 89.16 per cent women took care of young and new born animals. They actively involved in cleaning of sheds (89.16 %), feeding (87 %) and disposal of animal waste (86.66 %). Their involvement was least in maintenance of farm record (52.5 %) and getting credits from banks (49.16 %).

Pandey *et al.* (2014) in their study on role of Indian dairy co-operatives in empowering women by adopted propensity score matching to examine the impact of National Dairy Plan (NDP) and concluded that it had a positive impact on women's participation in decisions related to selling milk. A typical woman in an NDP household is six per cent more likely to demand fair wages for public works and the women were found to be five per cent more likely to participate in the village level infrastructure discussion.

Anika (2014) in their study assessed gender inequality based on the role performance of women in dairy activities and their involvement in decision making. Respondents' ascertained access to factors such as finance, inputs, benefits, marketing and involvement in development programmes were investigated. The women in the family spent 5.17 hrs out of the total average of 6.76 hrs for dairy activities. The roles seem to be strictly gender oriented. The women participation in decision making was poor with the apparent degree being around 20 percent.

Dohmwirth (2014) measured the impact of dairy co-operatives on the economic empowerment of rural women in Karnataka, the women empowerment agriculture index revealed that the economic gains provided by the co-operatives may not always lead to greater empowerment for women but more participatory management are required in order to enhance gender equality.

Kavithaa and Vimal (2016) conducted a study in Erode District of Tamilnadu to investigate the role of farm women in basic decision-making process in dairy activities. The discoveries of the study uncovered that rural women were dominated in decision making process in non - financial exercises like the development of the shed, treatment of cattle, vaccination and deworming, management of infant calves, sick and pregnant cattle, milking and processing of milk, usage of dung. Likewise, it is clear from the study that rural farm women were less dominated in decision making exercises with respect to monetary aspects, so it is necessary to make them aware about money related guidelines, credits, insurance of animals and marketing structure.

Usha and Prem (2016) in their paper attempts to evaluate the decision-making ability of women in rural areas and second to discover the elements influencing decision making power of rural women. Decisions related to land, regarding purchase/sale and choosing animals to rear. Female basic decision is limited fundamentally to management of animals. Arranging for fodder and sale/consumption of milk are where female having a key role in areas that are a piece of their household chores. Their role in basic decisions with respect to monetary and agricultural activities is very negligible. The study shows size of landholding, age and education of women, family type and caste are the elements influencing decision making power of women.

Shazia (2017) undertake a study in North and South of Bengaluru to examine the effect of urbanization on the status of women over a rural-urban interface. The investigation demonstrated that the vast majority of the women involved in non-farm activities contrasted with farm activities. They observed that there is a shift in income creating exercises of women from customary to non-ranch action. In the north of Bengaluru, 47 per cent of urban women were under high empowerment category while just 20 per cent of transition women and 13 per cent of rural women were under high empowerment classification. In the south of Bengaluru 40 percent of urban ladies were under high empowerment condition while 17 per cent of transition and just 10 per cent of rural ladies were under high empowerment class. Women were seen diversifying their employment from traditional income generating activities to non-farm activities, it's more in case of urban gradients.

2.5 Synergies to optimize farm income

Steinfeld (1988) revealed that livestock is important for crop production as it provides manure and work whereas their products namely, milk and meat contribute to household income and their consumption. Furthermore, livestock also is a significant asset in terms of wealth and security.

Chan (2003) in his study observed that the combination of crop and livestock activities helped the small farmers to use manure as a substitute to fertilizer for crops and by-products of crop as feed for cattle.

Agbonlabor *et al.* (2003) in their study reported that the farming system that combines livestock and crop enterprises in a supplementary and complementary manner.

Obi *et al.* (2007) observed in their study that IFS is useful as it recycles the waste and renew the resources and provides essential means of production like feed, fertilizer and the fuel that make farming operations ecologically sustainable and economically viable.

Zainab (2010) observed from their study that through resource reallocation maximum increase in net income was 178 per cent for small holders, while it was 189 per cent and 5 per cent of higher income for medium and large farmers, respectively. The synergies of different enterprise mix showed that as the integration increases the synergy contributed to the farming systems also increased. It was observed that synergy involved in Crop + Dairy system allowed the farmer to increase net returns by 47 per cent more than the crop system alone.

Vinod *et al.* (2012) analysed the Integrated Crop-Livestock Farming Systems. The results showed adopting some sustainable management practices can enhance production while conserving the environment; Wastes, residues and by-products of one component act as resources for the others; and Poor farmers having the traditional knowledge that is needed to combine crop production and livestock, but because of limited access to knowledge, inputs and assets, few adopt an integrated farming system.

Patel *et al.* (2015) inferred from their study that the crop- livestock integration has helped small farmers who are provided with very less land holding and few heads of cattle to diversify production, to enhance money income, to improve the quantity and quality of the food produced and efficient use of unutilized resources. In this type of integration, the visible feature is their synergy. This system represents the increased crop yield, reduced erosion, nutrient recycling and soil biological activity and also intensifies land use. More sustainable production can be achieved with highly improved crop-livestock integrated system.

Nataraju (2016) analysed the integrated farming system and the results revealed that farming systems like diary + crop, dairy + sericulture, diary + crop + sericulture, crop + small ruminants + sericulture shows complementary relationship among all enterprises, whereas crop + sericulture sub systems show competitive relationship among crop + dairy + sericulture and crop + small ruminants + sericulture systems. Furthermore, diary + sericulture system shows supplementary relationship among enterprises.

Kavyashree (2016) analysed the existing farming systems and their synergic effects in augmenting the farm income of farmers. The study indicated that the irrigated farmers realized more income in all type of systems, in which Crop + Dairy + Small ruminants' system was relatively profitable (1:2.6) of non-irrigated IFS farmers compared to that of irrigated IFS farmers (1:2.5). In all the farming systems, farmers at all the times included pulses and food crops to meet their needs of family consumption. It also revealed that as there is increase in integration, the synergies of the farming system also increased. Of the total net income from all systems, share of synergistic income has more than 50 per cent of existing farming system in both irrigated and unirrigated farmers.

Paul *et al.* (2017) in their study explores synergies between livestock farming and landscape conservation. It is observed that it provides with the benefits to make farmers more reliant on their own resource base and less so on purchasing inputs (thereby reducing their costs); under the right circumstances it will be a direct source of income, and; it improves the attractiveness of rural area and provide basis for other rural developmental activities from which the farmers can directly or indirectly get benefited.

III METHODOLOGY

In this chapter, a detailed description of the study area, sampling frame, database and the method of analysis employed is presented under the following headlines:

3.1 Description of the study area

3.2 Sampling framework and database

3.3 Analytical tools and techniques

3.1 Description of the study area

3.1.1 Geographical feature of Karnataka

Karnataka comprises of 30 districts, of which 12 districts are located in northern part of the State and rest in southern part of the State. The State is surrounded by Arabian Sea in the west, the State of Maharashtra in the north, Andhra Pradesh and Tamil Nadu in the east and Kerala in the south. It is situated between 110°.05' and 180°.50' North latitude and 740° and 780°.30' East longitude in the southern plateau. Karnataka has a population of 6.11 crore with a rural population of 3.75 crores (61 %) and the urban population of 2.36 crores (39 %), with density of 319 persons per sq.km and with rate of literacy 55.98 per cent. Karnataka is the eighth largest State in India occupying a geographical area of 190.50 lakh ha with the forest cover of 30.75 lakh ha.

3.1.2 Geographical features of Bengaluru

Bengaluru is the third most populated city and capital of the Indian State of Karnataka. It is called as Silicon City, the Garden City, the IT hub of the nation. Bengaluru city lies in the southeast of the South Indian State of Karnataka. It is in the heart of the Mysore Plateau at an average elevation of 920 m (3,020 ft.). It is positioned at 12.97 °N 77.567 °E and covers an area of 1741 km² (673 mi³). Majority of the geographical area of the city of Bengaluru lies in the Bengaluru urban district and the surrounding rural areas are a part the Bengaluru Rural district. The region comprising the Bengaluru urban and rural districts is known as the Bengaluru. The urban district consists of four taluks namely

Anekal, Bengaluru north, Bengaluru south and Bengaluru east. The rural district consists of four taluks namely Devanahalli, Doddaballapur, Nelamangala and Hoskote.

Table 3.1 Demographic features of study area

(2011 census)

I Demographic features			
Sl. No.	Particulars	Bengaluru Rural	Bengaluru Urban
1	Geographical area (sq km)	2298	2208
2	Total population (No.)	990923	9621551
3	Rural population (No.)	722179	871607
4	Urban population (No.)	268744	8749944
5	Male population (No.)	509172	5022661
6	Female population (No.)	481751	4598890
7	Literacy rate (%)	77.9	87.7
8	Male literacy rate (%)	84.8	91.0
9	Female literacy rate (%)	70.6	84
10	Sex ratio	945	916
11	Decadal population growth (%)	16.45	35.09
12	Population density (km ²)	431	4378
13	Average rainfall (mm/year)	978	885
14	Actual rainfall (mm/year) (2011)	1423.3	1342.5
II Livestock profile			
1	Cattle population (crossbreed) (No.)	126832	98485
2	Cattle population (local) (No.)	152035	28954
3	Total cattle population (No.)	278867	127439
4	Buffalo population (No.)	28672	11254
5	Sheep (No.)	141695	80106
6	Goat (No.)	94575	41096
7	Pigs (No.)	2027	4522
8	Poultry birds (No.)	4110696	242127

Source: District Census Handbook, Bengaluru, 2014

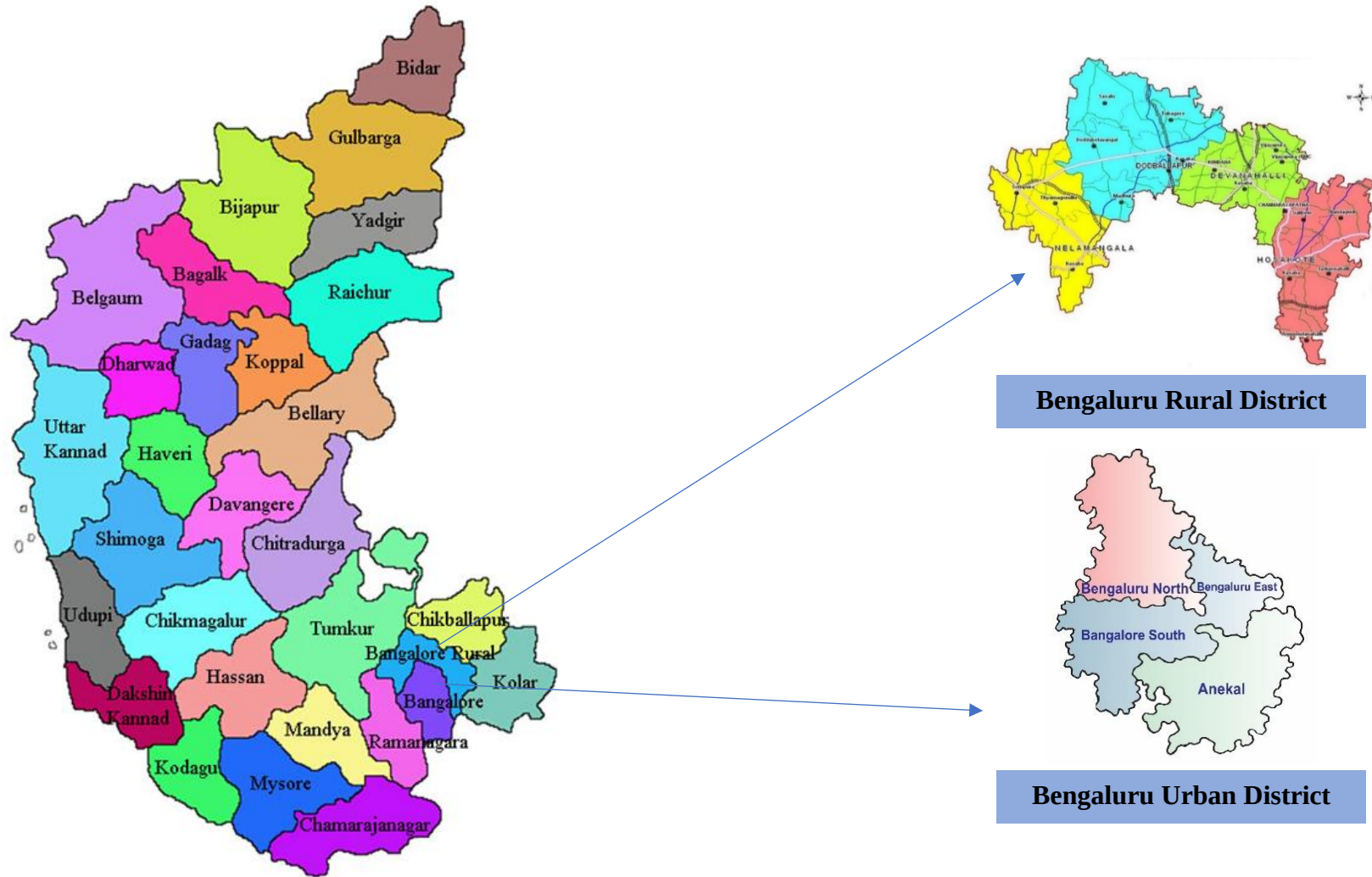


Fig. 3.1: Map showing the study area

3.2 Sampling frame work

3.2.1 Sampling method

3.2.1.1 Primary data collection

The whole Bengaluru city conglomerate was separated into two transects namely, 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 namely 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.

The building of the state legislature, Vidhana Soudha ($12^{\circ}.979' \text{ N}$, $77^{\circ}.59065' \text{ E}$) was used as the reference point to measure the linear distance from the centre of the city. Up to about 20 to 25 km away from the centre of the city, the building density was strongly correlated to distance (the closer to the city centre, the higher the percentage of built-up area). Beyond that, however, the two parameters were negatively correlated.

To classify the region into Rural-Urban Index, a simplified Survey Stratification Index (SSI) was developed. The SSI takes into account the percentage of built-up area in a defined per meter around a village. Secondly, rather than tracing travel paths along a given steen network, the SSI refers to the linear distance between a village centre and the city centre. Both building density and distance were investigated separately before they were combined to calculate the SSI.

Combined Survey Stratification Index (SSI): The distance to the centre and the built-up area are considered as a proxy for urbanisation. Since, a high value of distance correlates to low urbanisation, whereas a high value of density indicates high urbanisation, the non-built-up area (100% minus percentage of built-up area) was used for constructing the SSI. This brings both variables to a common scale, in which low values correspond to urban character, and high values to rural character. The SSI is thus defined inversely as compared to the URI. Both the variables were normalised to a scale of 0–1 using the formula.

$$Z_i = (X_i - \min(X)) / (\max(X) - \min(X))$$

Where, Z_i is the normalised variable, X is the distance or non-built-up area, $\min(x)$ is the minimum value in transect, $\max(x)$ is the maximum value in transect.

$$SSI = \sqrt{((Z_i \text{ distance})(Z_i \text{ non} - \text{built} - \text{up area}))}$$

The villages having SSI value nearer to zero were considered as the urban area, the villages having SSI value nearer to one were considered as the rural area.

Northern Bengaluru was purposefully selected for the study. Three villages randomly each from rural, transition and urban areas were selected constituting a total of nine villages. Villages selected under urban region were Chikka Bommasandra, Allalasandra and Atturu. From transition region, Sugatta, Addiganahalli and Tarahunase were selected and from rural area Devrahalli, Sulakunte and Kodihalli were selected.

The purposive multistage random sampling method was used for the selection of livestock farmer households. The purposive multistage random sampling method was used for the selection of livestock farm households. The sample frame consists of 150 farmers, of which 40 dairy farmers each from rural, transition and urban areas and 30 non-dairy farmers of northern Bengaluru were selected randomly from above listed villages irrespective of herd size.

3.2.2 Nature and source of data

In order to address each objective of the study, primary data was collected from the selected dairy and non-dairy farmers. For this a schedule was developed and pretested in the study area. Data was collected through personal interview method. The information collected from the farmers pertained to information on land holdings, asset position, cropping pattern, livestock holdings and related data. Further, the information on milk production and selling price, cost and returns, labour utilization under various dairy operations, role of women in specific dairy activities, cost and returns of major crops grown were also collected. The information collected was pertained to agriculture year 2017-18.



Plate 3.1: Primary data collection from sample respondents in the study area

3.2.2.1 Classification of farmer respondents

For the purpose of data analysis, the sample respondents were post-stratified as landless, small, medium and large farmer categories by standardizing the land holding size of the farmer respondents. This classification was based on the SFDA (Small Farmers Development Agency) criteria taking into consideration of land ownership of farmers as given in the below Table 3.2

Table 3.2: Classification of farmer respondents based on landholding

Type of farmer	Land holding (ha)
Landless	---
Marginal	<1
Small	1-2
Medium	2-5
Large	>5

3.3 Supply chain management in dairy

The dairy supply chain comprises the individual or firms that involved in milk production, transportation, processing (packaging & storage) and delivery of milk and milk products to final consumer through addition of maximum value at lowest possible cost.

The formal supply chain is dominated by few large processors and cooperatives which bulk and market milk on behalf of farmers, while the informal supply chain involves farmers, transporters and traders selling raw milk and occasionally pasteurised milk directly to consumers, hotels and kiosks.

Kiosk: A kiosk is a small building or structure from which people can buy milk and milk products. They are commonly known as milk parlours in India, which are normally located near bus stops, railway stations, airports, malls, etc.

3.4 Analytical tools and techniques

To achieve the stated objectives, collected data was classified, tabulated and analysed with the help of statistical tools and techniques. A brief description of statistical tools and techniques used in the study is given below.

3.4.1 Chi -Square test

The Chi-square test was used to know whether there is a significant difference in the socio-economic characteristics in different areas of the study region. For this, null and alternative hypothesis were formulated. The null hypothesis constructed as a hypothesis of no difference. The alternative hypothesis was constructed as having significant difference among socio-economic characteristics across three areas of the study region.

The chi-square test statistic was obtained as depicted below.

$$\chi^2 = \sum \frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}}$$

$$\text{Expected value} = \frac{\text{Row total} * \text{column total}}{\text{Sample size}}$$

Observed value is the value obtained from the sample. The estimated chi-square value was compared with critical table value with appropriate level of significance and degrees of freedom. If the estimated value is greater than table value, it was inferred that there was significant difference between the three areas of the study region or it can be inferred that the groups belong to different populations having difference in their socio-economic variables.

3.4.2 Garrett ranking technique

To capture the reasons for taking up dairy enterprise, the Garrett ranking technique was used. Sample farmers ranking were converted into percentages and scores based on Garret table.

The Garrett formula used for this analysis is outlined below.

$$\text{Per cent position} = \frac{100 * (R_{ij} - 0.50)}{N_j}$$

Where, R_{ij} = Rank given for i^{th} item in j^{th} factor.

N_j = Number of items ranked in j^{th} factor.

The per cent position of each rank was converted into scores by referring the table given in Garrett and Woodsworth (1969). Then for each factor, scores of individual sample respondents were summed up and divided by the total number of respondents for whom score were gathered. The mean scores for all the factors were ranked, following the decision criterion, the higher the value the more important the factor.

3.4.3 Tabular analysis

The data was tabulated to work out the total cost of inputs of labour, feed and fodder, veterinary expenses, investment pattern and total returns from the sale of milk produced, consumption, marketed surplus, disposal of milk across the three gradients. The socio-economic indicators of sample household of different gradients, cost and returns of major crops of dairy and non-dairy farmers were also studied by using means and percentages.

3.4.4 Measure of central tendency

To analyse the first objective to document the degree of livestock activity, measures of central tendency such as mean, percentages and related measures were used. The measure of central tendency was used to know the average income generated by different livestock enterprises and crop enterprises.

3.4.5 Economic measures to assess the economics of milk production

The economics of milk, sheep and goat production among farmers in the three layers of Bengaluru was assessed using economic measures as described below. The costs incurred in the production were categorized as given below.

1. Variable costs

a. Cost of feed and fodder

In case of purchased feed and fodder, the cost was worked out on the basis of actual rate at which feed and fodder were purchased. For the own grown fodder, quantity used for feeding were computed in monetary terms taking into consideration the market value of fodder and feed.

b. Cost of labour

The actual amount paid in cash and kind to the hired labour was recorded on the basis of prevailing wage rates. In case of family labour, imputed value of family labour considered. For the purpose of analysis, the female labour employed for various activities of livestock were converted into equivalent man days by multiplying each female labour day with 0.67 and were treated along with mandays.

c. Cost of veterinary services

The cost incurred in veterinary services for the livestock was considered

d. Marketing costs

Costs incurred by the farmer in transportation of animal and commission charges paid in the marketing were taken into consideration.

e. Miscellaneous charges incurred in the production were also taken into consideration.

f. Interest on variable cost was computed at the rate of 7 per cent per annum on the assumption that farmers borrowed funds from the bank to meet working expenditure.

2. Fixed costs

Fixed costs include amortization of initial investment made which includes investment on animal, equipment and depreciation of shed.

Depreciation of shed was arrived at using expression given below.

a. Depreciation

Depreciation on the shed has been worked out by the straight-line method.

The life of shed assumed as 10 years.

$$\text{Depreciation} = \frac{\text{Purchase value} - \text{Junk value}}{\text{Life of shed (years)}}$$

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

b. Amortization of investment on equipment and animals

Some of the large farmers in the urban transition layers had milking machines. Hence, while estimating fixed cost, this investment was also considered. The investment made in different years was compounded to the year 2017 by considering the interest rate of 10 per cent. The amortized value of initial investment was obtained from the following expression

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

$$\text{Amortization} = \text{Compounded value} \times \frac{i}{1-(1+i)^n}$$

Where 'i' is interest rate.

'n' is number of years of amortization.

c. Interest on fixed capital

The interest on fixed capital has been worked out at 10 per cent per annum on the assumption that the farmers have borrowed the funds from the bank for the initial investment.

3. Total cost

Total cost was obtained by adding total variable cost and total fixed cost.

4. Income.

a. Income from sale of milk

The income from sale of milk calculated by multiplying quantity of milk sold with price under different modes of marketing like direct, dairy and private aggregates.

b. Income from sale of animals

The income from sale of animals were considered

c. Income from dung

Dung value was computed based on the prevailing market value of the dung.

d. Income from sale of male calf

The number of male calves sold was valued based on the prevailing market value of the male calf.

5. Net returns

It was calculated by deducting total cost from total income.

$$\text{Net returns} = \text{Total Income} - \text{Total cost}$$

6. Net returns per animal

The net returns per animal was calculated by taking the ratio of total income by the size of herd.

$$\text{Net returns per animal} = \frac{\text{Total return}}{\text{Number of animals}}$$

7. Returns per rupee of investment

It was worked out by dividing net returns by total cost.

$$\text{Returns per rupee of investment} = \frac{\text{Gross returns}}{\text{Total cost}}$$

3.4.6 Employment generation by dairy enterprise

Data on participation of men, women and children in various activities were collected through interview method with the help of pre-tested schedule. Time spent on various dairy related activities were recorded separately, men, women and children in each household. Total activity-wise employment generated was calculated by converting into man days, i.e., one women day is equated to 0.67 man days ($3\text{women} = 2\text{men}$) and child day was equated to 0.5 man days ($4\text{ children} = 2\text{ men}$) for the present study. Total employment generated to each type of labour viz. men, women and child, is estimated in number of labour days spent per annum per household (1 labour day = 8 hrs of work).

3.4.7 Logit model

In statistics and econometrics logit model is the regression model where the dependent model is categorical. Logit model was developed by statistician David Cox in 1958. The binary logistic model is used to estimate the probability of a binary response based on one or more predictor variables. In economics it is termed as qualitative response/ discrete choice model.

Logistic regression is used widely in many fields, including the medical and social sciences. Logistic regression measures the relationship between the categorical dependent variable and one or more independent variables by estimating probabilities using a logistic function which is the cumulative logistic distribution. Unlike ordinary linear regression, however logistic regression is used for predicting binary dependent variables rather than a continuous outcome. In addition, linear regression may make nonsensical predictions for a binary dependent variable.

Logistic regression is used to predict the odds of being a case based on the values of the independent variables(predictors). The odds are defined as the probability that a particular outcome is a case divided by the probability that it is a non-case. In this study the farmer's preference for dairy enterprise was analysed using logistic regression.

In the present study the variables chosen for the logit analysis are mentioned below;

Selection of dairy among farmers is taken as a dependent variable. Age, number of male members, number of female members, education, availability of cattle shed, area under rainfed and irrigated conditions, family income and experience in farming are considered as independent variables.

3.4.8 Economics of major crops

Averages and percentages were used to study the economics of principal crops. Different concepts of costs and returns used in the study are presented in this section. In the present study all calculations pertaining to the economics of principal crops were made on per acre basis.

Inputs and cost concepts

The total costs were analysed as below:

- a. Variable Costs
- b. Fixed Costs
- c. Marketing Costs
- d. Cost of cultivation
- e. Total cost

a. Variable costs: The variable costs included cost of seeds, manure, fertilizers, wages of human, machine and bullock labour, plant protection chemicals, irrigation etc, interest on operating capital and repair & maintenance charges.

i. Seedlings: The cost of purchased seedlings/seed was based on the actual amount paid by the farmers.

ii. Farm yard manure: The prevailing price per tonne was used to impute the value of farmyard manure produced on the farm.

iii. Fertilizers and plant protection chemicals: The cost of fertilizers and plant protection chemicals was based on the actual prices paid by the farmers including the cost of transportation and other incidental charges, if any.

iv. Labour: The cost of hired labour was calculated at the prevailing wage rates paid per day (8 hours) in the study area for men, women and bullock and machine labour during the study period. The cost of family labour (human, animal and machinery) was calculated considering the prevailing market rate in this region through imputation. For the purpose of analysis, the female labour employed for various activities of livestock were converted into equivalent man days by multiplying each female labour day with 0.67 and were treated along with mandays.

v. Irrigation cost: Prevailing rate of renting the water for irrigation was considered.

vi. Interest on operating capital: The working capital consists of the expenditure on labour, seedlings, farm yard manure, fertilizers and plant protection chemicals, irrigation and other materials used in production process. Interest on operating capital was calculated at the rate of 7 per cent per annum (the rate at which commercial banks advance short term loans) and was apportioned to the crop based on the duration of the crop.

vii. Repair and maintenance charges: Repair and maintenance charges of implements and machinery used in the cultivation were computed on the basis of actual expenses incurred by the respondents. The amount was apportioned based on the usage and acreage.

b. Fixed costs: These include depreciation on farm implements and machinery, interest on fixed capital and land revenue.

The measurement and definitions of fixed cost components are as follows.

i. Depreciation charges: Depreciation on each capital equipment and machinery owned by farmers and used in crop cultivation was calculated using the straight-line method as

$$\text{Depreciation} = \frac{\text{Purchase value} - \text{Junk value}}{\text{Life of shed (years)}}$$

The average life of the asset as indicated by the experts (Agricultural Engineers) was used in the computation of the depreciation. The depreciation cost of each equipment was apportioned to the crop based on its percentage use.

ii. Interest on fixed capital: Interest charges on fixed capital were calculated at the rate of 10 per cent, as the fixed deposits in commercial banks would fetch this rate of interest. The items considered under fixed capital are implements and machinery. Interest was considered on the value of these assets after deducting the depreciation for the year.

iii. Land revenue: Actual land revenue paid by the farmers was considered.

iv. Rental value of land: In the study area, the practice of leasing in and leasing out was quite common. Hence, the lease rate of the area was considered as rental value of land in the present study.

c. Marketing costs: The actual marketing charges incurred by the farmers in marketing of crop produce were considered. These marketing costs include cost of packing, loading and unloading charges, hamali charges, transportation costs, wastage, market cess and miscellaneous charges.

d. Cost of cultivation: It is the sum of variable costs and fixed costs and expressed on per hectare basis.

e. Total cost: Total cost is the sum of cost of cultivation per hectare and cost of marketing the produce.

Output and returns: In most of the crops, the output included the main yield of the crop only and in some cases, it included by-product also.

Per hectare returns were calculated by using the below mentioned procedure.

i. Net returns on variable costs: It is the gross returns minus variable costs.

ii. Net returns on cost of cultivation: It is the gross returns minus total cost.

iii. Net returns on total cost: It is the gross returns minus cost of cultivation plus marketing cost.

iv. Returns per rupee of expenditure: Worked out by taking the ratio of gross returns to total cost

$$\text{Returns per rupee of investment} = \frac{\text{Gross returns}}{\text{Total cost}}$$

3.4.9 Synergistic effect of dairy on farm productivity

The per acre cost and returns from major crops grown in common in the study area, such as, ragi, maize, tomato and potato for dairy and non-dairy farmers were calculated, separately. Using tabular analysis, additional net benefit over non-dairy farmers from above mentioned crops was calculated by subtracting net returns of non-dairy farmers from that of dairy farmers. Then average was calculated to see net benefit per acre and the net benefit per household was calculated by multiplying respective per household land holding size, which was considered as synergic effect of dairy on farm productivity.

IV RESULTS AND DISCUSSION

The primary data collected from the sample respondents were analysed using appropriate statistical and economic tools described in the methodology chapter. The empirical results and discussion pertaining to those results are presented in this chapter under the following headings.

4.1 Socio-economic profile of the sample dairy households

4.2 Role of stakeholders in the dairy supply chain

4.3 Economics of milk production and employment generated by dairy enterprise

4.4 Socio-economic factors influencing in selection of dairy enterprise

4.5 Role of women in dairy enterprise

4.6 Synergic effect of dairy farming on farm productivity

4.1 Socio-economic profile of the sample dairy households

Understanding of socio-economic profile of the sample dairy farmers is a pre-requisite to infer about their impact on the decision-making process which in turn influences the profitability of the dairy enterprise. Thus, it is quite pertinent to throw light on the basic socio-economic profile of the sample dairy farmers before proceeding to the discussion of the major findings of the study.

The land is the main resource base for the dairy farmers, which also determines the size of the production activity. Educational status determines the level of family labour availability and adoption of improved dairy farming practices, respectively. An attempt is made in this section to document the important socio-economic characteristics of the sample dairy farmers.

4.1.1 Gender-wise distribution of sample respondents

The distribution of sample respondents by gender is presented in table 4.1. The results showed that about 85 per cent of the sample respondents engaged in dairy activity were male and remaining (15 %) were female in North of Bengaluru. The results of Chi

square test revealed that there was no significant difference in the sample respondents in the study area.

4.1.2 Type of family

The size of the family is an important demographic feature of the household. The size of the family has direct influence on the labour force and consequently on the supply of labour force in the rural labour market. As a result of rigorous implementation of family planning programmes and other population control measures, the rate of growth of population has reduced which in turn lead to reduction in the size of the family. The type of family in different gradients was not statistically significant as revealed by the Chi square test.

The details of distribution of sample respondents by family size are furnished in table 4.1. The number of joint families was only 23 (42 %), 18 (33 %), 12 (30 %) in rural, transition and urban areas, respectively. The results showed that the majority of the families were nuclear in all the three layers of North Bengaluru (64.67 %).

4.1.3 Distribution of sample respondents by educational status

Education was one of the important indicators of social development which can evaluate the status of an individual. Particulars of distribution of sample respondents by educational status are presented in table 4.1. It could be seen from the table that more than three fourth of the sample respondents in all three layers of North of Bengaluru were literates (89.33 %). The number of degree and above educated sample respondents were more in the case of transition area (21.82 %) as compared to rural and urban areas in both North of Bengaluru.

4.1.4. Main sources of livelihood

It was evident from the table 4.1 that in Bengaluru North, dairy was the main source of income for about 33, 38 and 33 per cent of sample respondents in rural, transition and urban areas, respectively.

Table 4.1: Socio-economic features of sample farmers**(Number)**

Particulars	North Bengaluru			
	Rural (n=55)	Interface (n=55)	Urban (n=40)	Total
Distribution of sample respondents by gender				
Male	46 (83.64)	45 (81.82)	36 (90.00)	127 (84.67)
Female	9 (16.36)	10 (18.18)	4 (10.00)	23 (15.33)
Chi- Square (P value)	0.988 ^{NS}			
Type of family				
Joint	23 (41.82)	18 (32.73)	12 (30.00)	53 (35.33)
Nuclear	32 (58.18)	37 (67.27)	28 (70.00)	97 (64.67)
Chi- Square (P value)	0.130 ^{NS}			
Educational status				
Illiterate	9 (16.36)	4 (7.27)	3 (7.50)	16 (10.67)
Primary education	15 (27.27)	16 (29.09)	6 (15.00)	37 (24.67)
High school	12 (21.82)	17 (30.91)	15 (37.50)	44 (29.33)
PUC	11 (20.00)	6 (10.91)	9 (22.50)	26 (17.33)
Graduation & above	8 (14.55)	12 (21.82)	7 (5.83)	27 (18.00)
Chi- Square (P value)	0.275 ^{NS}			
Sources of livelihood				
Agriculture	20 (36.36)	12 (21.82)	0 (0.00)	32 (21.33)
Agricultural labour	7 (12.73)	9 (16.36)	0 (0.00)	16 (10.67)
Dairy	18 (32.73)	21 (38.18)	18 (32.73)	57 (38.00)
Business	1 (1.82)	3 (5.45)	4 (7.27)	8 (5.33)
Employment	9 (16.36)	9 (16.36)	12 (21.82)	30 (20.00)
Others	0 (0.00)	1 (1.82)	6 (10.91)	7 (4.67)
Chi- Square (P value)	0.630 ^{NS}			

Note: 1. Figures in parentheses represents percentage to total

2. NS= Non Significant

Agriculture and employment were the major sources of income of transition and urban sample respondents in north of Bengaluru. There was no significant difference in the sources of income in different layers of North Bengaluru as revealed by the Chi-square test.

4.1.5 Possession of household assets

It was evident from the table 4.2 that all the households in north of Bengaluru had Television, Fan and Mobile phones. Motor cycle was the other household asset possessed by most of the respondents in all three transects. Majority of sample households in urban areas had other household assets such as refrigerator compared to that of transition and rural areas.

Table 4.2: Possession of household Assets (Number)

Sl. No.	Particulars	North of Bengaluru		
		Rural (n=55)	Transition (n=55)	Urban (n=40)
1.	Television	55 (100)	55 (100)	40 (100)
2.	Furniture	6 (11)	6 (11)	12 (30)
3.	Refrigerator	11 (20)	15 (27)	22 (55)
4.	Fan	55 (100)	55 (100)	40 (100)
5.	Motor cycle	42 (77)	43 (78)	36 (90)
6.	Car	5 (9)	7 (13)	8 (20)
7.	Mobile phones	55 (100)	55 (100)	40 (100)

Note: Figures in parentheses represents percentage to the total respondents

4.1.6 Land holding details of dairy and non-dairy farmers

Livestock requires land resources mainly for grazing and fodder production. The land size also influences the size of holding of different livestock species as depicted in table 4.3. The dairy farmer's average land holding in rural area was found higher (1.64 ha) followed by transition area (1.32 ha). In case of the urban area, all livestock farmers were

landless. Non-dairy farmers owned on an average 1.48 ha in the rural area and 1.28 ha in the transition area.

In the rural area, the highest percentage of farmers were marginal (32.5 %), followed by small (25.0 %), medium (22.5 %), large (7.5 %) and landless (7.5 %). In the transition area, the highest percentage of farmers were marginal (37.5 %), followed by small (25 %), medium (15 %), landless (15 %) and large (7.5 %). But in the case of urban area, all livestock farmers were landless.

Table 4.3: Land holding details of dairy and non-dairy farmers across rural-urban interface of Bengaluru north

Sl. No	Farmer category	Rural		Transition		Urban	
Dairy farmers							
		n=40	Average land size (ha)	n=40	Average land size (ha)	n=40	Average land size (ha)
1.	Landless	3 (7.50)	-	6 (15.00)	-	-	-
2.	Marginal	13 (32.50)	0.41	15 (37.5)	0.42	-	-
3.	Small	10 (25.00)	1.36	10 (25.00)	1.66	-	-
4.	Medium	9 (22.50)	3.26	6 (15.00)	2.71	-	-
5.	Large	3 (7.50)	5.79	3 (7.50)	6.85	-	-
Average farm size		1.64		1.32		-	
Non-dairy farmers							
		n=15	Average land size (ha)	n=15	Average land size (ha)	n=0	Average land size (ha)
1.	Landless	-	-	-	-	-	-
2.	Marginal	4 (26.67)	0.67	5 (33.30)	0.31	-	-
3.	Small	8 (53.33)	1.24	6 (40.00)	1.03	-	-
4.	Medium	2 (13.33)	2.27	3 (20.00)	2.32	-	-
5.	Large	1 (6.67)	5.04	1 (6.70)	5.3	-	-
Average farm size		1.48		1.28		-	

Note: 1. Figures in parentheses represents percentage to the total sample size

2. Land was not possessed by urban farmers

In the case of non-dairy farmers in the rural area, the highest percentage of farmers were small (53.30 %), followed by marginal (26.67 %), medium (13.33 %) and large (6.73 %). In the transition area, the highest percentage of farmers were small (40 %), followed by marginal (33.30 %), medium (20.00 %) and large (6.70 %). But in the urban area, there were no non-dairy farmers.

Land size is an important factor in any land-based production enterprise like agriculture, livestock etc. The study area was nearer to the cities characterized by small land holdings for the needs of housing, construction of industries and other non-farm activities. The pressure of non-farm activities and increased value for land were the main reasons for less landholding size and landless in the urban areas.

4.1.7 Cropping pattern of sample dairy respondents

Table 4.4 and table 4.5 gives the cropping pattern details of the sample dairy and non-dairy respondents. Ragi was the major field crop grown by both categories of farmers, i.e., rural and transition covering 20.29 per cent and 28.55 per cent in case of dairy farmers and 20.37 and 29.48 per cent of the gross cultivated area in the case of non-dairy farmers. Fodder maize and vegetables were grown in all the seasons by the sample dairy farmers. Grapes was the major fruit crop grown in both the gradients, covering major share in cropping area by both categories of farmers. Tomato and potato were the major vegetable crops grown in the region. In transition area, as influenced by urban forces there was intensive cultivation of fodder maize, vegetables and fruit crops by both categories of farmers. The cropping intensity was more in rural area (118.64 %) than in transition area (113.25 %).

4.1.8 Details of livestock possession of dairy farmers

The livestock is an integral part of agriculture which supplements income during the slack agricultural period. Decrease in cultivable land, erratic rainfall and frequent borewell failures due to depletion of groundwater further enhanced the importance of livestock in the sustainable livelihood of the farm families.

Table 4.4: Cropping pattern of sample dairy farmers (ha)

Sl. No.	Crops	Rural (n=40)	Percentage	Transition (n=40)	Percentage
A.	Kharif				
1.	Ragi	17.92	20.29	15.72	28.55
2.	Maize	12.20	13.81	2.98	5.41
3.	Fodder maize	1.12	1.27	2.03	3.69
4.	Other field crops	4.20	4.75	1.47	2.67
5.	Tomato	7.66	8.67	2.43	4.41
6.	Other vegetables	10.67	12.08	5.28	9.59
7.	Annual flower crop	0.86	0.97	1.08	1.96
	Sub total	54.63	61.84	30.99	56.28
B.	Rabi				
1.	Potato	14.19	16.06	1.11	202
2.	Tomato	4.1	4.64	2.63	4.78
3.	Fodder maize	1.08	1.22	3.44	6.25
4.	Other vegetables	2.62	2.97	1.75	3.18
5.	Annual flower crop	0.60	0.68	0.35	0.64
	Sub total	22.59	25.57	9.28	16.85
C.	Summer				
1.	Fodder maize	0.52	0.59	0.67	1.22
2.	Tomato	2.71	3.07	0.83	1.51
3.	Other vegetables	2.71	3.07	1.55	2.82
4.	Annual flower crop	0.35	0.40	0.57	1.04
	Sub total	6.29	7.12	3.62	6.57
D.	Perennial				
1.	Grapes	3.74	4.23	4.54	8.25
2.	Other fruits	0.28	0.32	2.44	4.43
3.	Flower crop	0.81	0.92	4.19	7.61
	Sub total	4.83	5.47	11.17	20.29
Gross cropped area		88.34		55.06	
Net cultivated area		59.46		48.62	
Cropping intensity (%)		118.64		113.25	

Table 4.5: Cropping pattern of sample non-dairy farmers (ha)

Sl. No.	Crops	Rural (n=40)	Percentage	Transition (n=40)	Percentage
A.	Kharif				
1	Ragi	6.65	20.37	6.05	29.48
2	Maize	4.85	14.85	1.23	5.99
3	Other field crops	1.43	4.38	0.42	2.05
4	Tomato	2.6	7.96	0.98	4.78
5	Other vegetables	4.1	12.56	1.89	9.21
6	Annual flower crop	0.38	1.16	0.35	1.71
	Sub total	20.01	61.29	11.49	55.99
B.	Rabi				
1	Potato	5.32	16.29	0.42	2.05
2	Tomato	1.54	4.72	0.99	4.82
3	Other vegetables	1.39	4.26	1.95	9.50
4	Annual flower crop	0.23	0.70	0.13	0.63
	Sub total	8.47	25.94	3.48	16.96
C.	Summer				
1	Tomato	1.02	3.12	0.31	1.51
2	Other vegetables	1.04	3.19	0.83	4.04
3	Annual flower crop	0.13	0.40	0.21	1.02
	Sub total	2.36	7.23	1.36	6.63
D.	Perennial				
1	Grapes	1.4	4.29	1.7	8.28
2	Other fruits	0.11	0.34	0.92	4.48
3	Flower crop	0.3	0.92	1.57	7.65
	Sub total	1.81	5.54	4.19	20.42
Gross cropped area		32.65		20.52	
Net cropped area		28.82		18.62	
Cropping intensity (%)		113.29		110.20	

Table 4.6: Details of livestock possession and share of different livestock species to total livestock population across rural-urban interface of Bengaluru North

Type of animal	Rural (n=40)			Transition (n=40)			Urban (n=40)		
	No. of animals	Average per household*	Proportion (%)	No. of animals	Average per household*	Proportion (%)	No. of animals	Average per household*	Proportion (%)
Local cow	24	1	8.37	12	-	6.98	10	-	8.06
Crossbred cow	126	3	43.90	117	3	68.02	108	3	87.10
Buffalo	29	1	10.11	15	1	8.72	6	-	4.84
Bullock	10	-	3.48	4	-	2.33	-	-	0
Sheep	50	1	17.42	21	1	12.21	0	-	0
Goat	48	1	16.72	3	-	1.74	0	-	0
Total		7	100		5	100		3	100

*Rounded off to nearest integer.

Majority of the dairy farmers irrespective of the gradients possessed crossbred cows. It was observed that across all the gradients, population of indigenous cows was very low. Higher population of crossbred cows over indigenous cows and buffaloes in the study area was due to the fact that crossbred cows are higher milk yielders than the indigenous cows and buffaloes as these are genetically poor milk yielders and lactation period is short.

The share of different livestock species to total livestock population in rural, transition and urban areas of the study area is presented in table 4.6. In the rural area, crossbred cow constituted the highest share (43.90 %), followed by sheep (17.42 %), goat (16.72 %), buffalo (10.11 %), local cow (8.37 %) and bullock (3.48 %). In the transition area also, the share of crossbred cow was higher (68.02 %), followed by sheep (12.21 %), buffalo (8.72 %), local cow (6.98 %), bullock (2.33 %) and goat (1.74 %). In the urban areas, the total livestock inventory was constituted by local cows, crossbred cows, and buffaloes. The highest share was accounted by crossbred cows (87.10 %) and least share was by buffaloes (4.84 %) due to higher milk yielding capacity of crossbred cows.

The proportion of local cows was least as compared to crossbred cows and buffaloes, although the local cows are resistance 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 HF. The share of bullock was found to be least in rural and transition area was mainly because of the population of bullock is decreasing over the years. Sheep and goat were not found in the urban area, due to non-availability of free grazing land in the urban area.

4.1.9 Factors influencing in taking up dairy enterprise in the rural-urban interface of Bengaluru North

Table 4.7 shows that in the case of rural dairy farmers, the major reason for them to take up dairy enterprise is that they consider dairy as a source of income or their opinion is that this particular enterprise supplements their family income which took Garrett rank I, followed by nearby marketing facilities (II), fodder availability (III), dairy provides year-round income (IV), tradition (V), surplus labour availability in the family (VI) and bank loan availability (VII).

In transition area, the major reasons for taking up dairy as an enterprise were income from dairy supplements family income (I), year-round income (II), surplus labour availability (III), nearby marketing facilities (IV), fodder availability (V), tradition (VI) and availability of bank loan (VII). In urban area the major reason for taking up this enterprise was also source of income (I), followed by year-round income (II), nearby marketing facilities and opportunities (III), surplus availability of family labour (IV), availability of bank loan (V), tradition (VI) and fodder availability (VII).

When the Garrett scores and ranks were compared across the three transects of Bengaluru North, it was observed that, as dairy is one of the major sources of income for farmers and as it supplements family income, hence, dairy was taken up as an enterprise. Particularly in rural area availability of good marketing facilities, availability of fodder and surplus family labour play an important role. Whereas, in transition and urban areas year-round income, good marketing opportunities, surplus labour had their influence on farmers in selecting dairy as an enterprise.

Table 4.7: Factors influencing in taking up dairy enterprise in all three transects of Bengaluru North

Sl. No.	Particulars	Rural		Transition		Urban	
		Average Score	Rank	Average Score	Rank	Average Score	Rank
1	Source of income/ Supplement family income	74.7	I	75.6	I	78.0	I
2	Year-round income	49.9	IV	57.1	II	54.6	II
3	Nearby marketing facilities	57.2	II	46.4	IV	53.3	III
4	Surplus family labour availability	34.4	VI	55.2	III	49.8	IV
5	Bank loan	30.7	VII	32.6	VII	40.6	V
6	Tradition	45.1	V	38.4	VI	39.9	VI
7	Fodder availability	57.1	III	43.8	V	32.8	VII

4.2 Role of stakeholders in the dairy supply chain

Diverse group of stakeholders are involved in the Indian dairy industry. The formal value chain is dominated by few large processors and cooperatives which bulk and market milk on behalf of farmers, while the informal value chain involved farmers, transporters and traders selling raw milk and occasionally pasteurised milk directly to consumers, hotels and kiosks.

4.2.1 Supply chain of the organized dairy sector

The organized dairy sector mainly pertains to the private dairies and dairy cooperatives which procure, process and market milk and milk products. In this channel, the milk produced is deposited by the dairy farmers in the collection centres at the village level and then the milk is pooled and is transferred to the chilling centres in the village level and bulk milk cooling units in the district level where the milk is chilled to 4°C. Then the chilled milk is filled into insulated tankers and is transported to the processing plants where the milk is tested for its quality and transferred into milk tankers. This milk received is then processed into various categories of liquid milk and processed/ value-added dairy products. Afterwards, the packaged milk is transported to the milk parlours or retail stores from where consumers purchase. In case of the value-added milk products which are having longer shelf life, they are transported to the distribution centres and carrying and forwarding agent (C& F agent). The C&F agent then supplies the required amount of stock to the various retail outlets and milk parlours and in turn consumers can buy the products.

4.2.1.1 Supplier of fodder

The non-dairy farmers sell by-products of their main crops as fodder to the dairy farmers. And also, the dairy farmers who are growing excess fodder to sell to other dairy farmers.

4.2.1.2 Veterinary aid

Sophisticated professionals and equipment, necessary to assist the veterinary services. The main purpose of veterinary services is to increase milk production by ensuring sound sustainable reproductive and overall health of cattle of farmers by proper

diagnosis of diseases of milch animals and new born calves through doorstep diagnostic facilities.

4.2.1.3 Supply of feed

a) Co-operative cattle feed plant

The co-operative cattle feed plants are preparing varieties of cattle feeds. They are by-pass cattle feed, Nandini Gold (Formerly Type-1) Cattle Feed, Urea Molasses Block, Area Specific Mineral Mixture, Calf Feed, Calf Starter and Bull Feed. Nandini Cattle feed is not only distributed to milk producers through co-operative societies but also to the dairy farms which are managed by organizations such as NDRI, UAS(Hebbal/GKVK), etc.

b) Private cattle feed manufacturers

They are involved in manufacturing of cattle feeds of different categories and they compete in the open market and the feed is distributed in the retail outlets. They are basically profit oriented organizations.

4.2.1.4 Labour required for dairy management

Labour is the key factor in agriculture and allied activities. Animal husbandry is also a labour intensive off-farm activity. Dairy farming involves family labour for regular dairy activities and hired labour in cases of large herd size and in repair and fixing the farm assets.

4.2.1.5 Milk producers

Milk producers supply milk to the milk cooperatives or private milk dairies regularly. Milk producers could be farmers (large, medium and small holders), landless labourers, and commercial dairy farms.

4.2.1.6 Milk co-operative societies and Private dairies

Milk co-operative societies and private dairies are the basic functioning units at the village level. They function in two shifts throughout the year. Every morning and evening, they buy the surplus milk from the member-producers.

a) Milk co-operative societies

Milk co-operative societies are involved mainly in two operations, namely, providing input services and milk trading. Input services include animal health coverage, breeding, supply of cattle feed, fodder development, clean milk production and extension services to producer members. Milk trading involves receiving and testing of milk, local milk sale, sending milk to milk union, payment to the producers and maintaining accounts and records.

b) Private milk dairies

Private milk dairies are also involved in collection of liquid milk from producers, testing of milk for its quality and regular payment for the producers. They dispatch the milk so collected to the processing plants.

4.2.1.7 Chilling and bulk cooling units

a) Chilling centres

Chilling centres are located at village levels, where milk is chilled to 4°C to prevent it from spoilage before sending to processing plants. They basically are installed to maintain minimum quality of milk which is collected on that particular day and milk societies can also collect milk at desired time and preserve milk by chilling.

b) Bulk cooling units

Union has started bulk cooling units of various capacities to facilitate chilling of milk, which helps in improving the quality of milk and as per suitability of time, milk of two to three times can be brought by single trip. Immediate cooling of milk lead to stop the growth of the microorganisms.

4.2.1.8 Transportation of chilled milk

There are well established routes operating under respective Unions which cover all the milk co-operative societies. Milk so pooled and chilled is transported to the

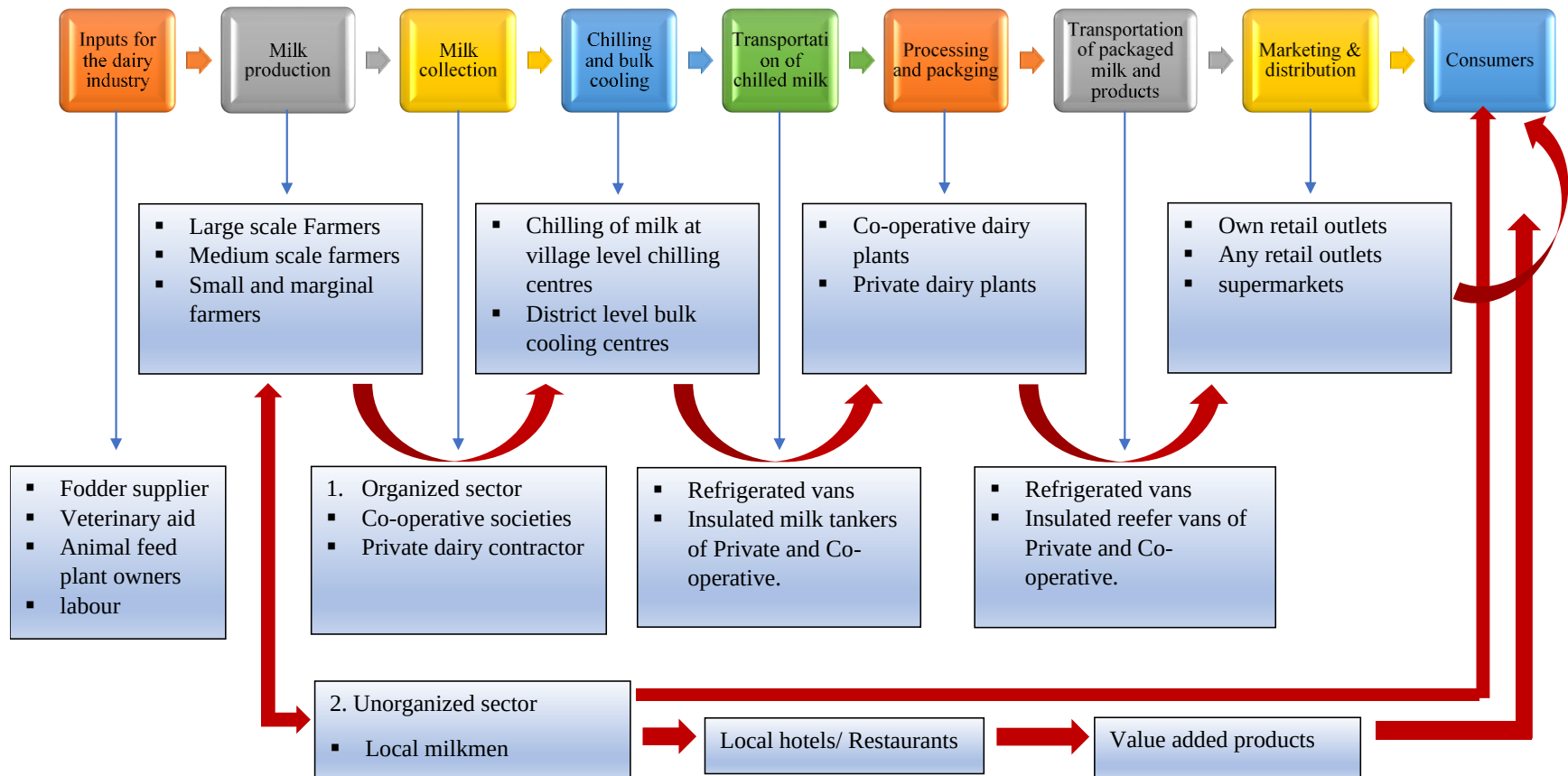


Fig. 4.1: Supply chain of Dairy industry in India

processing plants with the help of refrigerated vans in the case of small quantity and in case of large quantity through insulated milk tankers owned by co-operative or private dairies.

4.2.1.9 Processing plants

a) Processing

In both private and co-operative milk processing plants, the raw milk is either processed into pasteurised milk or other milk products. Various methods of separation, homogenization and pasteurization is done and later packed into different packs and liquid milk is available in different types. Otherwise, value addition is made and different milk products are prepared.

b) Packaging

Liquid milk is packed into sachets, which has lesser shelf life or into tetra packs, which have good keeping quality. Packing is done in consumer packs or in bulk packets according to the market demand. Value added products are packed according to their texture, shape, quantity and durability.

4.2.1.10 Transportation of packaged milk and products

Packaged milk and milk products are also transported using the refrigerated vans and insulated reefer owned by co-operative or private dairies. Transportation is done to various towns and cities, retail stores or their own milk parlours.

4.2.1.11 Marketing and distribution

This includes marketing strategies such as expanding retail network, creating brand awareness by participating in exhibitions, door to door campaign, organizing school visits and meetings with SHGs, collaborating with local NGOs. Promoting the product through bus back panels, posters, electronic media coverage, bill boards and radio. The products are distributed through own retail outlets, other outlets, supermarkets, etc.

4.2.2 Supply chain of the unorganized sector

The unorganized dairy sector in India is about 80 per cent and still the bakers and hotels dominate this section of the market. In this system the milk is directly sold to the consumers. The other mode is that milk is collected by the milkman from the farmers and then supplied to hotels or bakeries for further processing from whom the consumers buy the value added or processed milk products. These milkmen also supply milk directly to the consumers at their door steps.

4.2.3 Farmers participation in milk markets

Table 4.8 shows the number of households that sold milk to different channels. In rural area most of the farmers (92.50 %) sold milk through co-operative society and only 7.50 per cent farmers sold milk to local consumers. In transition area, farmers sold milk through all the three channels, i.e., 55 per cent of the farmers sold milk through co-operative societies, 30 per cent of the farmers sold milk to local consumers and 15 per cent of them sold milk to private dairies. In urban area, there were no co-operative societies, most of the farmers (95.00 %) sold milk directly to local hotels and consumers and five per cent of the farmers sold milk to private dairies.

Table 4.8: Number of households that sold milk to different channels in rural-urban interface of Bengaluru North

Sl. No.	Channels	Number of households that sold milk		
		Rural (n=40)	Transition (n=40)	Urban (n=40)
1.	Co-operative society	37 (92.50)	22 (55.00)	0 (0.00)
2.	Private dairies	0 (0.00)	6 (15.00)	2 (5.00)
3.	Local hotels/ consumers	3 (7.50)	12 (30.00)	38 (95.00)
	Total	40	40	40

Note: Figures in the parenthesis explains percentage to the total households

Table 4.9 reveals that in rural area, highest average quantity of milk is sold to co-operative societies (815 l), followed by local consumers (40 l). In transition area, highest quantity of milk was sold through co-operative societies (487 l), followed by local sales

(173 l) and private dairies (106 li). In urban area maximum quantity of milk is sold to local hotels (447 l), followed by private dairies (49 l).

Table 4.9: Average amount of milk sold per month in rural-urban interface of Bengaluru North

(in litres)

Sl. No.	Channels	Average quantity of milk sold (l)		
		Rural (n=40)	Transition (n=40)	Urban (n=40)
1.	Co-operative society	815	487	0
2.	Private dairies	0	106	49
3.	Local hotels/ consumers	40	173	447
	Total	855	766	496

4.3 Economics of milk production and employment generated by dairy enterprise

Economic analysis of milk production provides clues to the decision maker and aids the decision support system to understand whether or not farmers get remunerative return. Thus, the success of dairying is centred on the extent of its profitability and milk production is not an exception. Practicing dairy farming on commercial lines is, therefore, influenced by its relative profitability with that of crop production. At present scenario, the farmers are diversifying agriculture to achieve greater return. Individual families in the study area often do maintain crossbred cows since the milk yield was higher as compared to indigenous cows and buffaloes. But, the large-scale adoption of dairying was possible only when it is profitable. With this view, effort was made to work out the various costs and returns from milk production for the indigenous cows and crossbred cows.

In order to draw a comparative picture of economic aspects of dairying across rural, urban and interface of North Bengaluru, an attempt was made to examine the extent of profitability in dairying. The total cost was divided into variable and fixed costs. While variable costs cover feed and fodder costs, labour costs, veterinary costs and miscellaneous expenditure, the fixed costs included amortization of investment, cattle shed and equipment's and depreciation cost.

Table 4.10: Economics of milk production across rural-urban interface of Bengaluru north

Sl. No.	Particulars	Rural		Transition		Urban	
		Value	%	Value	%	Value	%
1.	Average herd size	4.4 ($\approx$ 4)		3.6 ($\approx$ 4)		3.1 ($\approx$ 3)	
2.	Variable cost						
a)	Cost of dry fodder	21707	9.67	22153	9.49	23023	9.34
b)	Cost of green fodder	28504	12.70	29293	12.55	30262	12.28
c)	Cost of concentrates	70511	31.42	75338	32.29	77925	31.62
d)	Labour cost	65845	29.34	67302	28.84	69608	28.24
e)	Veterinary & Miscellaneous cost	3814	1.70	4015	1.72	3943	1.60
f)	Interest on variable cost at 7 %	13327	5.94	13867	5.94	14333	5.82
	Total variable cost	203707	90.91	211969	90.84	219094	88.90
3.	Fixed cost						
a)	Amortized cost of animal	7549	37.05	7954	37.20	9459	34.57
b)	Amortized cost of building	6135	30.11	6462	30.22	8426	30.80
c)	Depreciation cost	4840	23.75	5020	23.48	6987	25.54
d)	Interest on fixed capital at 10 %	1852	9.09	1944	9.09	2487	9.09
	Total fixed cost	20376	9.09	21380	9.16	27359	11.10
4.	Total cost	224083	100.00	233349	100.00	246452	100.00
5.	Returns						
a)	Milk yield (l)	12696		10580		9620	
b)	Returns from milk	317306	95.37	330555	95.21	349139	94.26
c)	Returns from Manure	10258	3.08	11584	3.34	15982	4.31
d)	Returns from sale of male calf	5144	1.55	5060	1.46	5286	1.43
	Total gross returns	332708	100.00	347199	100.00	370407	100.00
6.	Total net returns	108625		117437		123608	
	Returns per cow	24688		32621		38328	
	Returns per rupee investment	1.48		1.49		1.50	

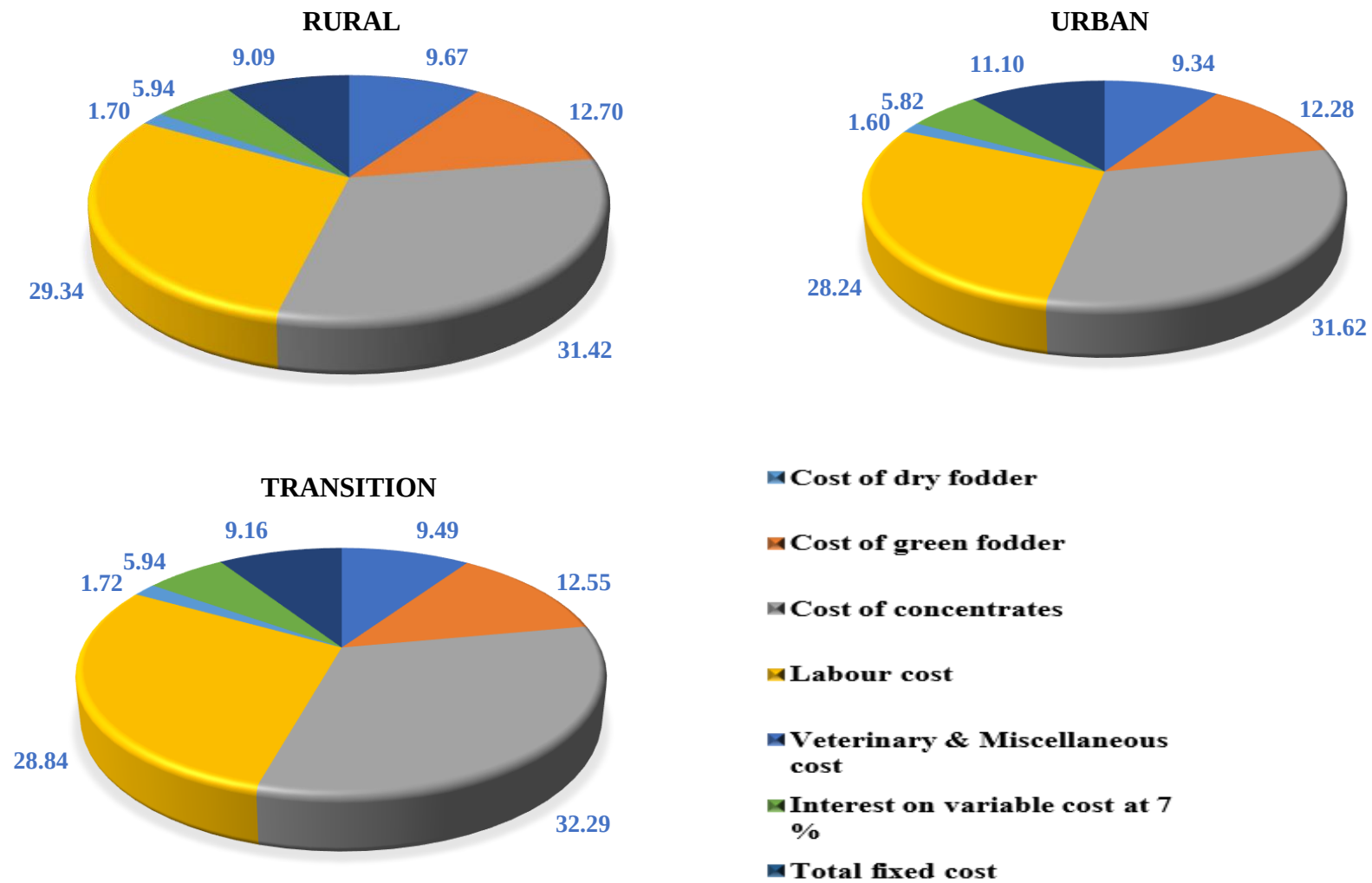


Fig. 4.2: Composition of total cost of milk production across rural-urban interface of Bengaluru north (%)

4.3.1 Economic analysis of milk production in rural-urban interface of Bengaluru North

The economics of dairy unit was assessed in the rural area considering all costs including opportunity costs in the production of dairy. In rural area of north of Bengaluru, the average herd size was four ($4.4 \approx 4$). From the table 4.10 it is evident that within the variable cost, the highest percentage was constituted by cost of concentrates. Out of the total cost, the percentage share of concentrates was the highest (31.42 %), which is followed by labour cost (29.34 %), cost of green fodder (12.70 %), cost of dry fodder (9.67 %), veterinary and miscellaneous cost (1.70 %). The share of total fixed cost in the total cost was 9.09 per cent, as the fixed costs remain the same irrespective of the level of production. The total net returns from dairy was ₹ 1,08,625 and the returns per cow was ₹ 24,688. The returns per rupee of investment was 1.48.

In transition area of north of Bengaluru, the average herd size was four ($3.6 \approx 4$). In table 4.10 we can be seen that 32.29 per cent of the total variable cost was constituted by cost of concentrates, followed by labour cost (28.84 %), cost of green fodder (12.55 %), cost of dry fodder (9.49 %) and veterinary and miscellaneous cost (1.72 %). The share of total fixed cost in the total cost was 9.16 per cent, as the fixed costs remain the same irrespective of the level of production. Out of the total gross returns from dairy, returns from the sale of milk was ₹ 3,30,555, which constituted to about 95.00 per cent of total gross returns. Returns from sale of manure and sale of male calf contributes 3.34 per cent and 1.46 per cent, respectively. Net returns from dairy was ₹ 1,17,437 and returns per cow was ₹ 32,621. The returns per rupee of investment was 1.49.

The economics of dairy unit was assessed in the urban area considering all costs including opportunity costs in the production of dairy. In urban area of Bengaluru north, the average herd size was three ($3.1 \approx 3$). Within the variable cost, the highest percentage was constituted by cost of concentrates. Out of the total cost, the percentage share of cost of concentrates was the highest (31.62 %), followed by labour cost (28.24 %), cost of green fodder (12.28 %), cost of dry fodder (9.34 %), veterinary and miscellaneous cost (1.760 %). The share of total fixed cost in the total cost was 11.10 per cent, as the fixed costs

remain the same irrespective of the level of production. The total net returns from dairy was ₹ 1,23,608 and the returns per cow was ₹ 38,328. The returns per rupee of investment was 1.50.

Due to the influence of urbanization, the dairy unit has undergone some structural changes. At the individual farm level, size of the herd has come down. But on a commercial scale, the size of the herd has increased. The average herd size in three transects of rural, transition and urban area was four, four and three, respectively. Dairy was one of the major sources of livelihood for small farmers in the study area. Cost of concentrates was the highest for dairy farmers in all the three regions followed by the cost of labour and cost of green fodder. Returns per cow was ₹ 24,688, ₹ 32,621 and ₹ 38,328 in rural, transition and urban areas, respectively. The returns per rupee of investment was 1.48, 1.49 and 1.50 in rural, transition and urban areas, respectively. Thus, results revealed that the profitability of dairy farming was more in urban area as compared to rural and transition areas.

Net income per cow was higher 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 majority of farmers marketed 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 rural and transition areas, where the majority of the farmers were marketed their milk through MPCs (Milk Producer's Co-operative Societies). The above reasons made the difference in the net income per milch animal in the three regions of the study area. Thus, the hypothesis of dairy enterprise is more profitable in urban area than in rural area is accepted. The results revealed that the profitability of dairy farming is more in urban area compared to rural and transition areas. The results were similar to the study conducted by Shobha, K. A (2018).

4.3.2 Activity-wise employment generation from dairy enterprise across rural-urban interface of Bengaluru North

Table 4.11 shows the activity-wise employment generated by dairy enterprise per annum per household. The major and important activities in dairy were categorised as milking, feeding, cleaning fodder management, marketing and other activities.

In rural area, highest employment was generated by the activity of fodder management (28.27 mandays), followed by cleaning (21.86 mandays), milking (20.57 mandays), marketing and other activities (17.89 mandays) and feeding (11.41 mandays).

In transition area also, highest employment was generated by fodder management activity (31.20 mandays), followed by milking (21.63 mandays), cleaning (18.89 mandays), marketing activities (18.42 mandays) and cleaning (9.87 mandays).

In urban area, the highest employment was generated by the activity of fodder management (35.99 mandays), followed by marketing and other activities (19.46 mandays), milking (18.79 mandays), cleaning (16.72 mandays) and feeding (9.05 mandays).

Table 4.11: Activity-wise employment generation from dairy enterprise across rural-urban interface of Bengaluru North

(Man days/ Household/ Annum)

Sl. No.	Activity	Transect					
		Rural	Percentage	Transition	Percentage	Urban	Percentage
1.	Milking	42.33	20.57	55.66	21.63	50.76	18.79
2.	Feeding	23.48	11.41	25.40	9.87	24.44	9.05
3.	Cleaning	44.99	21.86	48.60	18.89	45.16	16.72
4.	Fodder management	58.19	28.27	80.27	31.20	97.21	35.99
5.	Marketing and other activities	36.81	17.89	47.39	18.42	52.56	19.46
	Total	205.81	100	257.31	100	270.14	100

In urban area marketing and other activities used higher number of mandays as compared to rural and transition areas as in urban area the dairy farmers sell milk to private parties and some sell directly to the consumer.

4.3.3 Employment generation from dairy enterprise in Bengaluru North

Dairying plays an important role in generating employment and utilising surplus family labour available in rural areas. The values from table 4.12 revealed that across the transects the annual employment generation by dairy was 339.9, 347.3 and 355.9 labour days in rural, transition and urban areas, respectively. The average of the total employment generated among different categories in rural area was 339.9 labour days which constitutes 29.27 per cent, 67.02 per cent and 3.68 per cent participation by male, female and children, respectively and for transition area total labour used was 347.3 labour days which constitutes 39.33 per cent, 60.35 per cent and 0.32 per cent participation by male, female and children, respectively. In urban area total labour used was 355.9 labour days which constituted 35.49 per cent and 64.51 per cent by male and female, respectively. Children's role in dairy activities was zero in urban area. It can also be observed from the table that the participation of women was highest in all the three transects of Bengaluru north. The number of labour days of employment generated by dairy was more in urban area as compared to rural and transition areas. Thus, the hypothesis of employment generated by dairy is higher in urban area than that in rural area is accepted. The findings are in consistent with the study by Rangnekar (2006), where he stated dairy farming has a potential of providing income and employment as it is labour intensive generates relatively higher employment.

Table 4.12: Employment generation from dairy enterprise across rural-urban interface of Bengaluru North

(Labour days/ Household/ Annum)

Particulars	Transect					
	Rural	Percentage	Transition	Percentage	Urban	Percentage
Male	99.50	29.27	136.60	39.33	126.30	35.49
Female	227.80	67.02	209.60	60.35	229.60	64.51
Child	12.50	3.68	1.10	0.32	0.00	0.00
Total	339.90	100.00	347.30	100.00	355.90	100.00

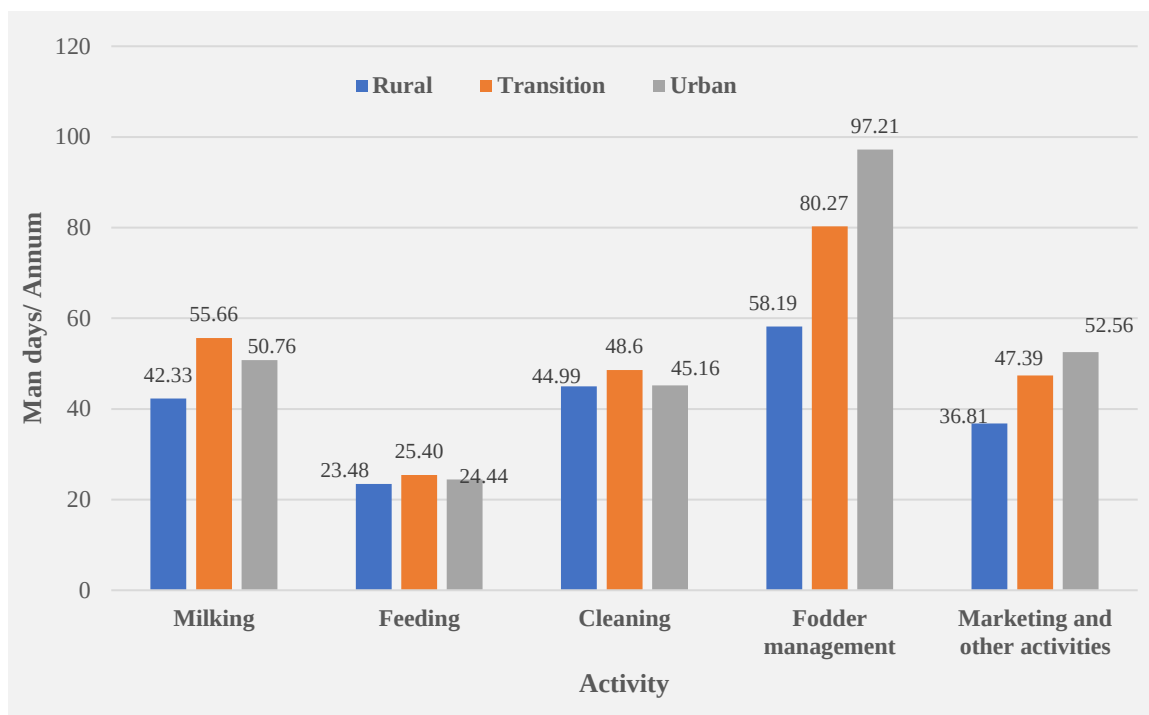


Fig. 4.3: Activity-wise employment generation from dairy enterprise across rural-urban interface of Bengaluru North

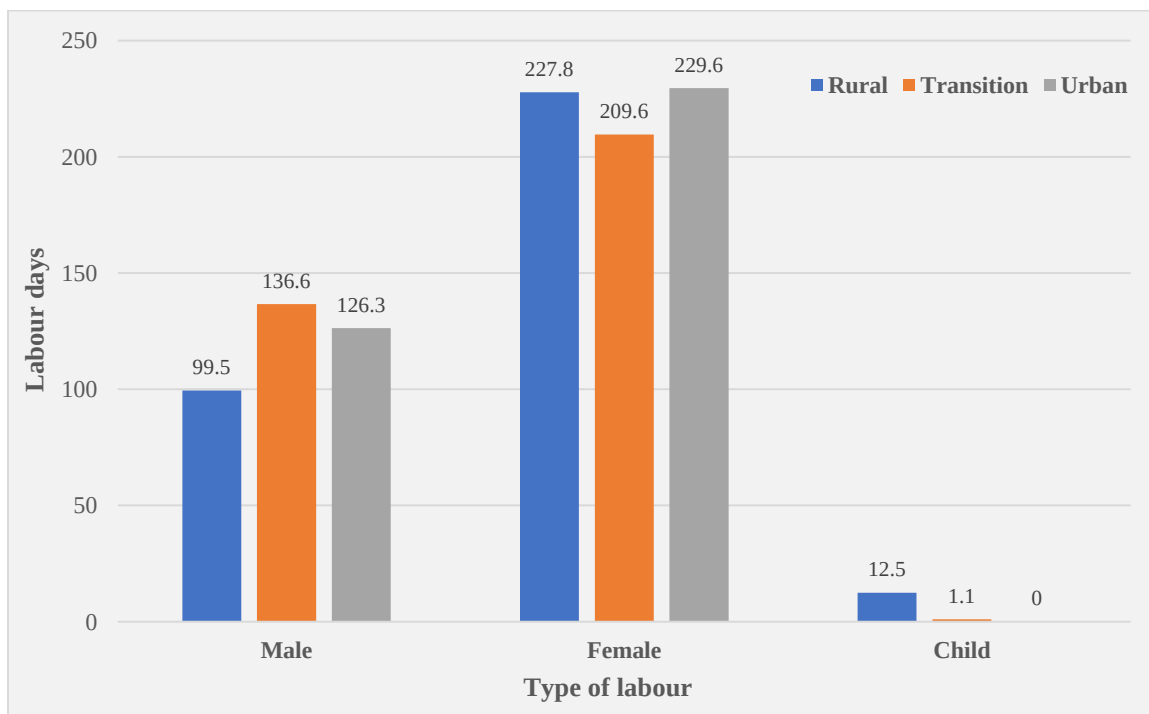


Fig. 4.4: Employment generation from dairy enterprise across rural-urban interface of Bengaluru North

4.4 Socio-economic factors influencing the selection of dairy enterprise

Socio-economic factors such as age, gender, education, availability of cattle shed, family size, size of landholding and source of income influences selection of dairy as an enterprise. The influence of these factors on the herd size of the dairy farmer was analysed in all the three gradients of Bengaluru North.

4.4.1 Socio-economic factors influencing the selection of dairy enterprise in Bengaluru north

Nine variables were selected to study the influence of socio-economic factors on selection of dairy enterprise, namely, age, number of male members, number of female members, education, availability of cattle shed, size of landholding under rainfed condition, size of landholding under irrigated condition and experience in farming. The Logit model results presented in table 4.13 reveals the factors influencing in the selection of dairy enterprise among the farmer respondents.

Table 4.13: Socio-economic factors influencing in selection of dairy enterprise in Bengaluru North (Logit output)

Sl. No.	Variables	B	S E	Sig.	Exp (B)
1.	Age	-1.195***	0.294	0.000	0.303
2.	No. of male	0.905	0.819	0.269	2.472
3.	No. of female	0.069**	0.30	0.022	1.072
4.	Education	2.426	1.624	0.135	0.088
5.	Cattle shed availability	0.175***	0.074	0.018	1.192
6.	Landholding (Rainfed)	0.169	0.085	0.446	1.184
7.	Landholding (Irrigated)	0.22**	0.382	0.038	0.661
8.	Income	2.61***	1.248	0.06	3.648
9.	Experience in farming	1.272	0.324	0.995	3.570
	Constant	-17.08***	7.385	0.021	0.000

Note: ***indicates significant at 1%, ** indicates significant at 5%, *indicates significant at 10%

Among these variables, age, number of female members, availability of cattle shed, irrigated land, income and experience in farming influenced selection of dairy enterprise. The odds ratio (Exp B) reflects the influence of these variables on the likelihood of farmers' preference towards dairy. Age shows negative significance as in the study area dairy was practiced as a tradition. Dairy mainly managed by women. Hence, female members of the family have contributed positively in selection of dairy enterprise. Irrigated land and availability of cattle shed have significant positive influence in selection of dairy enterprise.

4.4.2 Socio-economic factors affecting the size of dairy unit in rural-urban interface of Bengaluru north

The results of linear regression model are given in table 4.14. The dependent variable was the herd size of the dairy unit. In rural are, the coefficient of multiple determination is 0.641, for our sample problem, this means 64.1 per cent of test score variation can be explained by independent variables. The t-statistics for size of land holding are statistically significant at 10 per cent level of significance. This means that size of land holding contributes significantly to the herd size and the t-statistics for family size was statistically significant at the 0.05 level. Which indicates that one per cent increase in the size of landholding and family size increases herd size by 0.42 and 0.29 per cent, respectively.

In the transition area, among all the socio-economic variables considered influencing herd size, availability of cattle shed and age of the dairy farmer showed positive relationship with the herd size. Both these factors found significant at 1 and 5 per cent level of significance, respectively. Coefficient of multiple determination was 0.824, which means 82.4 per cent of the variation in dependent variable was explained by the independent variables.

In urban area, among all the factors, availability of cattle shed and family size were related positively with the herd size and found significance at 5 per cent and 1 per cent level of significance, respectively. Whereas, age, education and source of income negatively related with the dependent variable.

Table 4.14: Socio-economic factors affecting the size of dairy unit across rural-urban interface of Bengaluru North

Variables	Rural			Transition			Urban		
	Co-efficient	Std. Err	t value	Co-efficient	Std. Err	t value	Co-efficient	Std. Err	t value
constant	0.890	1.555	0.573	1.971	1.399	1.410	3.27	2.225	1.47
Age	0.012	0.025	0.497	0.57***	0.027	2.076	-0.033 ^{NS}	0.031	-1.083
Gender	0.755	0.765	0.986	-0.597	0.634	-0.942	0.697	0.955	0.729
Education	-0.455 ^{NS}	0.810	-0.561	0.484	0.643	0.752	-1.372 ^{NS}	1.092	-1.257
Cattle shed availability	-1.683 ^{NS}	0.712	-2.362	1.205**	0.654	2.011	0.657**	0.907	2.321
Family size	0.297**	0.187	2.084	-0.048 ^{NS}	0.094	-0.513	0.38***	0.107	3.537
Size of land holding	0.423*	0.142	2.986	-0.074 ^{NS}	0.071	-1.049	---	---	---
Source of income	1.160	0.738	1.571	-0.115 ^{NS}	0.667	-0.172	-0.199 ^{NS}	0.797	-0.259
R²	0.641					0.824		0.866	
Adjusted R²	0.562					0.788		0.849	

Note: ***indicates significant at 1%, ** indicates significant at 5%, *indicates significant at 10%

In all the three gradients, family size was positively related with the herd size, which means, as livestock being labour intensive, farmers with excess family labour availability prefers increasing herd size. In rural area, size of landholding is positively related with herd size, which indicates that agricultural land is important for growing fodder crops and for grazing of livestock animals. In transition and urban areas, availability of cattle shed is a prerequisite for addition of milch animal.

4.5 Role of women in dairy enterprise

Women contribute significantly to animal husbandry. Hence, women participation and their involvement in taking major decisions were assessed in all the three gradients, viz., rural, transition and urban areas of Bengaluru north.

Dairy activities consist of maintenance of animals which includes cleaning of cattle sheds and animals, feeding of fodder, feed and water, milking, fodder management activities such as fodder harvesting and collection, fodder chopping. Other important activities are processing and marketing. This involves processing of milk into various milk products, purchase of animals, sale of animal, sale of manure, purchase of feed and fodder. Another important category of dairy specific activity is health related activities such as vaccination, breeding (Artificial insemination), care of sick and new born animals and dehorning of calves.

4.5.1.1 Women participation in dairy activities in rural area

Table 4.15 reveals that in rural area majority of livestock maintenance activities were performed by women. In 62.5 per cent of the total households milking was done by women members of the family, followed by feeding (57.5 %) and cleaning (52.5 %).

Related to processing and marketing activities, milk processing was done majorly by farm women, i.e., in 92.5 per cent of the total sample households, followed by selling of milk and milk products (40.0 %) and 22.50 per cent each of purchase of animals, sale of animals and purchase of feed and fodder.

Table 4.15: Women participation in dairy activities in rural area

(n=40)

Sl. No.	Dairy specific activities	Men		Women		Jointly	
		Number of households	Per cent to total sample households	Number of households	Per cent to total sample households	Number of households	Per cent to total sample households
A.	Livestock maintenance activities						
1.	Cleaning	14	35.0	21	52.5	5	12.5
2.	Feeding of fodder & ration	13	32.5	23	57.5	4	10.0
3.	Milking	13	32.5	25	62.5	2	5.0
4.	Fodder harvest & collection	31	77.5	7	17.5	2	5.0
5.	Fodder chopping	23	57.5	15	37.5	2	5.0
B.	Processing and marketing activities						
1.	Milk processing	2	5.0	37	92.5	1	2.5
2.	Selling milk & milk products	11	27.5	16	40.0	13	32.5
3.	Purchase of animal	29	72.5	9	22.5	2	5.0
4.	Sale of animal	27	67.5	9	22.5	4	10.0
5.	Sale of manure	29	72.5	7	17.5	4	10.0
6.	Purchase of fodder & feed	31	77.5	9	22.5	0	0
C.	Health activities						
1.	Vaccination	34	85.0	6	15.0	0	0
2.	Breeding	28	70.0	6	15.0	6	15.0
3.	Care of sick & new born animals	19	47.5	19	47.5	2	5.0
4.	Dehorning of calves	28	70.0	3	7.5	9	22.5

Related to health activities, women members take care of sick and new born animals in 47.50 per cent of the total households. Whereas, all other activities were mainly performed by men and in some households the dairy activities were taken up jointly by both men and women members of the family.

4.5.1.2 Women participation in dairy activities in transition area

In transition area, table 4.16 revealed that under livestock maintenance activities, in 57.5 per cent of the total households in transition area, women alone take up both milking and cleaning activities, followed by feeding of fodder and feed (55 %).

With respect to processing and marketing activities, milk processing was done by women in all the dairy farm households (100 %), followed by selling of milk and milk products (27.5 %), in one fourth of the total household, activities such as purchase of animals, sale of animal, sale of manure and purchase of feed and fodder were done by women.

Women took care of sick and new born animals in 62.5 per cent of the households and remaining activities were either performed by men alone or performed jointly by male and female members of the family.

4.5.1.3 Women participation in dairy activities in urban area

Table 4.17 shows that in urban area, cleaning activities were mostly performed by women in 60 per cent of the households, followed by feeding (55 %), milking (50 %), fodder chopping (32.5 %) and fodder collection (22.5 %).

With respect to processing and marketing activities, milk processing was done by women alone in all dairy households (100 %), followed by purchase of animal (30 %), feed and fodder (30 %), sale of animal (25 %), sale of manure (22.5 %) and selling of milk and milk products (10 %).

Related to health activities, care of sick and new born animals were done by women in 47.5 per cent of the families and of the remaining activities, some were performed by men and some activities were done jointly by both male and female members.

Table 4.16: Women participation in dairy activities in transition area

(n=40)

Sl. No.	Dairy specific activities	Men		Women		Jointly	
		Number of households	Per cent to total sample households	Number of households	Per cent to total sample households	Number of households	Per cent to total sample households
A.	Livestock maintenance activities						
1.	Cleaning	9	22.5	23	57.5	8	20.0
2.	Feeding of fodder & ration	9	22.5	22	55.0	9	22.5
3.	Milking	14	35.0	23	57.5	3	7.5
4.	Fodder harvest & collection	24	60.0	8	20.0	8	20.0
5.	Fodder chopping	20	50.0	12	30.0	8	20.0
B.	Processing and marketing activities						
1.	Milk processing	0	0	40	100	0	0
2.	Selling milk & milk products	26	65.0	11	27.5	3	7.5
3.	Purchase of animal	27	67.5	10	25.0	3	7.5
4.	Sale of animal	23	57.5	10	25.0	7	17.5
5.	Sale of manure	30	75.0	10	25.0	0	0
6.	Purchase of fodder & feed	26	65.0	10	25.0	4	10.0
C.	Health activities						
1.	Vaccination	31	77.5	5	12.5	4	10.0
2.	Breeding	20	50.0	11	27.5	9	22.5
3.	Care of sick & new born animals	10	25.0	25	62.5	5	12.5
4.	Dehorning of calves	27	67.5	5	12.5	8	20.0

Table 4.17: Women participation in dairy activities in urban area

(n=40)

Sl. No.	Dairy specific activities	Men		Women		Jointly	
		Number of households	Per cent to total sample	Number of households	Per cent to total sample	Number of households	Per cent to total sample
A.	Livestock maintenance activities						
1.	Cleaning	13	32.5	24	60.0	3	7.5
2.	Feeding of fodder & ration	9	22.5	22	55.0	9	22.5
3.	Milking	15	37.5	20	50.0	5	12.5
4.	Fodder harvest & collection	29	72.5	9	22.5	2	5.0
5.	Fodder chopping	23	57.5	13	32.5	4	10.0
B.	Processing and marketing activities						
1.	Milk processing	0	0	40	100.0	0	0
2.	Selling milk & milk products	28	70.0	4	10.0	8	20.0
3.	Purchase of animal	25	62.5	12	30.0	3	7.5
4.	Sale of animal	26	65.0	10	25.0	4	10.0
5.	Sale of manure	28	70.0	9	22.5	3	7.5
6.	Purchase of fodder & feed	24	60.0	12	30.0	4	10.0
C.	Health activities						
1.	Vaccination	24	60.0	5	12.5	11	27.5
2.	Breeding	31	77.5	4	10.0	5	12.5
3.	Care of sick & new born animals	12	30.0	19	47.5	9	22.5
4.	Dehorning of calves	6	15.0	9	22.5	5	12.5

Dairy enterprise can easily be maintained by the women members of the family. In the study area, majority of the women involved in milk processing and in health activities, women involved in taking care of sick and new born animals. Remaining health activities were performed jointly by men and women members of the family. Dehorning of calves, vaccination and breeding activities were mainly performed by men alone. Hence, the stated hypothesis, women play a major role in dairy enterprise than men is accepted. The results are in consistent with the study conducted by Nataraju (2012).

4.5.2 Decision making pattern in dairy enterprise

Decision making is an important prerequisite in any enterprise, so also in dairy. In dairy enterprise as the farm family fully involves in livestock management. Hence, it is needed to see who takes what decisions. Major decisions related to dairy management were grouped under four categories, namely, fodder related decisions, decisions related to care of animals, decisions related to investment in dairy and marketing related decisions. It was investigated to find whether these decisions were taken solely by male or female members of the family or taken jointly.

4.5.2.1 Decision making pattern in dairy enterprise in rural area

Table 4.18 revealed that in 50 per cent of the families, decisions related to purchase of fodder and feed was taken up by men and also growing of fodder (45 %). The decisions of growing fodder (35 %) and purchase of feed and fodder (27.50 %) were taken jointly by male and female members of the family.

The decisions related to care of animals, in majority of the households, women take decisions such as health aspects (57.50 %) and breeding related decisions (47.50 %).

Men take most of the decisions related to investment in dairy. In 77.50 per cent of the households, men took decisions related to taking dairy loans, followed by construction of cattle shed (72.50 %), number of animals to rear (47.50 %) and selection of breed of animal (32.50 %). Women take decisions related to construction of cattle shed in only 12.50 per cent of the households and taking dairy loans (15 %).

Table 4.18: Decision making pattern in dairy enterprise in rural area

(n=40)

Sl. No.	Major decision variables	Men		Women		Joint	
		Number of households	Per cent to total sample	Number of households	Per cent to total sample	Number of households	Per cent to total sample
A.	Fodder related decisions						
1.	Growing of fodder	18	45	8	20	14	35
2.	Feed & fodder purchase	20	50	9	22.5	11	27.5
B.	Care of animals						
1.	Health aspects	5	12.5	23	57.5	12	30
2.	Breeding/ Artificial insemination	13	32.5	19	47.5	8	20
C.	Investment in dairy						
1.	Construction of shed	29	72.5	5	12.5	6	15
2.	Selection of breed of animal	13	32.5	8	20	19	47.5
3.	No. of animals to rear	19	47.5	9	22.5	12	30
4.	Taking dairy loans	31	77.5	6	15	3	7.5
D.	Marketing related decisions						
1.	Sale of livestock products	15	37.5	13	32.5	12	30
2.	Sale of animal	9	22.5	3	7.5	8	20

Regarding marketing aspects, women take decisions related to sale of livestock products and sale of animals, in 32.50 and 7.50 per cent of the families, respectively.

4.5.2.2 Decision making pattern in dairy enterprise in transition area

Table 4.19 revealed that the decisions of growing fodder and purchase of feed and fodder were taken by men in 45 and 32.5 per cent of the total households. The decisions of care of animals that were related to health aspects and breeding were respectively undertaken by women in 55 and 52.5 per cent of the households. In transition area, the decisions related to investment in dairy were taken mostly by men, decisions such as construction of cattle shed (70.00 %), taking dairy loans (57.50 %) and deciding the number of animals to rear (50.00 %). The marketing related decisions, such as sale of animals (55.00 %) and sale of livestock products (42.50 %) were taken by men.

4.5.2.3 Decision making pattern in dairy enterprise in urban area

As revealed by table 4.20, decision related to purchase of feed and fodder was taken by men in 67.5 per cent of the total households. Decisions related to health aspects were taken by women in 55 per cent of the households and related to breeding by women in 50 per cent of the total households. Investment in dairy related decisions such as construction of cattle shed and number of animals to rear were taken by men in 77.5 and 55.5 per cent of total dairy farm families. Decisions related to marketing such as sale of animals and sale of livestock products were taken by men in 80 and 60 per cent of the families.

In all the three gradients, it was evident that most of the decisions related to livestock management were taken by male members and female members involved in taking decisions related to health aspects, breeding and in sale of livestock products. In decisions such as, selection of breed of animal, the number of animals to rear were taken jointly by male and female members of the family. Decisions such as taking dairy loans, construction of cattle sheds, purchase of feed and fodder and sale of animals, which involves financial matters were taken mostly by male members of the family due to lack of knowledge on accounting and financial matters with the female members of the family.

Table 4.19: Decision making pattern in dairy enterprise in transition area

(n=40)

Sl. No.	Major decision variables	Men		Women		Joint	
		Number of households	Per cent to total sample	Number of households	Per cent to total sample	Number of households	Per cent to total sample
A.	Fodder related decisions						
1.	Growing of fodder	18	45	11	27.5	11	27.5
2.	Feed & fodder purchase	13	32.5	11	27.5	16	40
B.	Care of animals						
1.	Health aspects	8	20	22	55	10	25
2.	Breeding/ Artificial insemination	10	25	21	52.5	9	22.5
C.	Investment in dairy						
1.	Construction of shed	28	70	5	12.5	7	17.5
2.	Selection of breed of animal	12	30	4	10	24	60
3.	No. of animals to rear	20	50	5	12.5	15	37.5
4.	Taking dairy loans	23	57.5	11	27.5	6	15
D.	Marketing related decisions						
1.	Sale of livestock products	17	42.5	11	27.5	12	30
2.	Sale of animal	22	55	8	20	10	25

Table 4.20: Decision making pattern in dairy enterprise in urban area**(n=40)**

Sl. No.	Major decision variables	Men		Women		Joint	
		Number of households	Per cent to total sample	Number of households	Per cent to total sample	Number of households	Per cent to total sample
A.	Fodder related decisions						
1.	Growing of fodder	-	-	-	-	-	-
2.	Feed & fodder purchase	27	67.5	2	5	11	27.5
B.	Care of animals						
1.	Health aspects	10	25	22	55	8	20
2.	Breeding/ Artificial insemination	13	32.5	20	50	7	17.5
C.	Investment in dairy						
1.	Construction of shed	31	77.5	4	10	5	12.5
2.	Selection of breed of animal	8	20	4	10	28	70
3.	No. of animals to rear	23	57.5	9	22.5	17	42.5
4.	Taking dairy loans	34	85	4	10	2	5
D.	Marketing related decisions						
1.	Sale of livestock products	24	60	9	22.5	7	17.5
2.	Sale of animal	32	80	3	7.5	5	12.5

Hence, the stated hypothesis women take major decisions relating to production aspects rather than financial aspects is accepted. These results are similar to the study by Sangeetha (2010). The results are in line with the study conducted by Anika (2014) who found that roles are gender oriented in dairy management.

4.6 Synergic effect of dairy farming on farm productivity

To know the synergic effect of dairy enterprise on farm productivity, net income from agriculture with and without dairy enterprise was analysed. For which the cost of cultivation for major crops in the study area, such as, ragi, maize, tomato and potato were calculated.

4.6.1 Cost and returns for major crops grown in Bengaluru North

4.6.1.1 Cost of cultivation of ragi in Bengaluru North

Ragi is an important food grain crop cultivated in Karnataka. In the study area it was grown under rainfed condition. The cost and returns of ragi were calculated for farmers with and without dairy enterprise. As indicated in the table 4.21, cost of cultivation of ragi of farmers without dairy enterprise was found higher than those with dairy enterprise. It was ₹ 27,104 per acre and ₹ 26,195 per acre in non-dairy and dairy farmers, respectively. Inclusion of dairy reduced the fertilizer cost (₹ 1,533/ ac) and increased the returns (₹ 5,759/ ac). The net returns were higher in the case of dairy farmers (₹ 5,530/ ac) as compared with non-dairy farmers (₹ -1, 138/ ac). Non-dairy farmers incurred loss when compared with dairy farmers and the returns per rupee of expenditure was higher in the case of dairy farmers (1.21) as compared with non-dairy farmers (0.96).

4.6.1.2 Cost of cultivation of maize in Bengaluru north

Table 4.22 revealed that the cost of cultivation of maize of non-dairy farmers was higher as compared with that of the dairy farmers, i.e., ₹ 21,803/ ac and ₹ 21,424/ ac, respectively. Inclusion of dairy reduced the fertilizer cost (₹ 1,526/ ac) and increased the returns (₹ 5,157/ ac). Net returns were higher in the case of dairy farmers (₹ 7,988/ ac) as compared to non-dairy farmers (₹ 2,831/ ac). Returns per rupee of investment was higher (1.37) in the case of dairy farmers as compared to non-dairy farmers (1.13).

Table 4.21: Cost of cultivation of ragi in Bengaluru north

(per acre)

Sl. No.	Particulars	Dairy farmers			Non-dairy farmers		
		Quantity	Value (Rs.)	percent to total cost	Quantity	Value (Rs.)	percent to total cost
I	Variable cost (Rs.)						
	Human labour (man days)	27.23	7718	29.47	29.86	8558	31.58
	Bullock labour (BP days)	2.16	1695	6.47	1.58	1231	4.54
	Machine labour (hrs)	4.61	3336	12.74	5.23	3841	14.17
	Seed (kgs)	9.34	140	0.53	9.82	146	0.54
	FYM (tractor load)	1.14	3794	14.48	0.68	2294	8.46
	Fertilizer cost		2453	9.37		3986	14.71
	Miscellaneous		382	1.46		316	1.17
	Interest on working capital @ 7 per cent		1366	5.22		1426	5.26
	Total variable cost		20885	79.73		21799	80.43
II	Fixed cost (Rs.)						
	Depreciation		312	1.19		308	1.14
	Land revenue		15	0.06		15	0.06
	Rental value of land		4500	17.18		4500	16.60
	Interest on fixed capital @ 10 per cent		483	1.84		482	1.78
	Total fixed cost		5310	20.27		5305	19.57
III	Total cost (I + II)		26195	100.00		27104	100.00
IV	Returns (Rs.)						
	Main product (q)	7.9	24111		6.28	19795	
	By product (tractor loads)	1.28	7614		1.04	6171	
	Gross returns		31725			25966	
	Net returns		5530			-1138	
	Cost of production (Rs. per q)		3316			4316	
V	Returns per rupee of investment		1.21			0.96	

Table 4.22: Cost of cultivation of maize in Bengaluru north

(per acre)

Sl. No.	Particulars	Dairy farmers			Non-dairy farmers		
		Quantity	Value (Rs.)	percent to total cost	Quantity	Value (Rs.)	percent to total cost
I	Variable cost						
	Human labour (man days)	15.17	4287	20.01	17.24	4902	22.48
	Bullock labour (BP days)	2.12	1660	7.75	1.06	821	3.77
	Machine labour (hrs)	2.84	2039	9.52	3.12	2256	10.35
	Seed (kgs)	7.66	604	2.82	7.82	611	2.80
	FYM (tractor load)	1.04	3022	14.10	0.64	1864	8.55
	Fertilizer cost		2632	12.29		4158	19.07
	Miscellaneous		269	1.25		247	1.13
	Interest on working capital @ 7 per cent		1612	7.53		1651	7.57
	Total variable cost		16125	75.26		16511	75.73
II	Fixed cost						
	Depreciation		303	1.41		296	1.36
	Land revenue		15	0.07		15	0.07
	Rental value of land		4500	21.00		4500	20.64
	Interest on fixed capital @ 10 per cent		482	2.25		481	2.21
	Total fixed cost		5300	24.74		5292	24.27
III	Total cost (I + II)		21424	100.00		21803	100.00
IV	Returns						
	Main product (q)	13.78	24115		11.74	20545	
	By product (tractor loads)	2.02	5297		1.89	4088	
	Gross returns		29412			24633	
	Net returns		7988			2831	
	Cost of production (Rs. per q)		1555			1857	
V	Returns per rupee of investment		1.37			1.13	

4.6.1.3 Cost of cultivation of tomato in Bengaluru north

Tomato is one of the important vegetable crops grown in the study area. Table 4.23 showed that, in the case of non-dairy farmers both variable (₹ 1,84,085/ ac) and fixed costs (₹ 42,658/ ac) were higher than that of dairy-farmers (variable cost ₹ 1,67,754/ ac and fixed cost ₹ 40791/ ac). Inclusion of dairy reduced the fertilizer cost (₹ 5,429/ ac) and increased the returns (₹ 32,556/ ac). The net returns from tomato were also higher in the case of dairy farmers (₹ 1,38,266) as compared to non-dairy farmers (₹ 1,05,710). The returns per rupee of investment was higher in dairy farmers (1.58) than that of non-dairy farmers (1.41).

4.6.1.4 Cost of cultivation of potato in Bengaluru North

Total cost of cultivation of potato was higher in the case of non-dairy farmers (₹1,13,540/ ac) as compared to dairy farmers (₹ 1,10,887/ ac). Net returns were also higher in the case of dairy-farmers (₹ 50,931/ ac) than the non-dairy farmers (₹ 31,061/ ac). Return per rupee of investment was higher in the case of dairy farmers (1.46) as compared to non-dairy farmers (1.27).

4.6.2 Synergic effect of inclusion of dairy milch animals in crop cultivation in Bengaluru north

Cost and returns of major crops calculated per unit area is given in table 4.25. The table also gives the average costs, gross returns and net returns for all the crops per sample household.

Average cost incurred on crop enterprise per acre was the highest in the case of non-dairy farmers (₹ 1,04,422), whereas the average returns obtained from crop enterprise was higher in the case of dairy-farmers (₹ 1,49,667). Net gain by inclusion of dairy was the highest in the case of tomato cultivation (₹ 32,556), followed by potato (₹ 19,870), ragi (₹ 6,658) and maize (₹ 5,158). Additional net benefit realised per household by dairy farmers over non-dairy farmers was ₹ 68,078 and per acre it was ₹ 16,061. This can also be considered as synergistic effect of dairy on farm productivity.

Table 4.23: Cost of cultivation of tomato in Bengaluru North

(per acre)

Sl. No	Particulars	Dairy farmers			Non-dairy farmers		
		Quantity	Value (Rs.)	percent to total cost	Quantity	Value (Rs.)	percent to total cost
I	Variable cost						
	Human labour (man days)	269.58	76173	32.08	283.74	80174	31.41
	Bullock labour (BP days)	2.6	2077	0.87	1.74	1383	0.54
	Machine labour (hrs)	3.95	2836	1.19	4.86	3049	1.19
	Seedlings (number)	7014.82	3928	1.65	7058.52	3953	1.55
	FYM (tractor loads)	4.62	14892	6.27	2.46	7929	3.11
	Fertilizer cost		16803	7.08		22232	8.71
	Plant Protection Chemicals		14068	5.92		20431	8.00
	Irrigation cost		2187	0.92		2269	0.89
	Staking material		21139	8.90		28346	11.11
	Miscellaneous		2677	1.13		2276	0.89
	Interest on working capital @ 7 per cent		10975	4.62		12043	4.72
	Total variable cost		167754	70.65		184085	72.12
II	Fixed cost						
	Depreciation		1782	0.75		1847	0.72
	Land revenue		25	0.01		25	0.01
	Rental value of land		18500	7.79		18500	7.25
	Managerial cost (10 % of variable cost)		16775	7.06		18408	7.21
	Interest on fixed capital @ 10 per cent		3708	1.56		3878	1.52
III	Total fixed cost		40791	17.18		42658	16.71
IV	Cost of cultivation		208545	87.82		226743	88.84
V	Marketing cost		28913	12.18		28497	11.16
VI	Total cost		237458	100.00		255240	100.00
VII	Returns						
	Main product (q)	312.46	375724		301.56	360949	
	Gross returns		375724			360949	
	Net returns		138266			105710	
VI	Returns per rupee of investment		1.58			1.41	

Table 4.24: Cost of cultivation of potato in Bengaluru North**(per acre)**

Sl. No.	Particulars	Dairy farmers			Non-dairy farmers		
		Quantity	Value (Rs.)	percent to total cost	Quantity	Value (Rs.)	percent to total cost
I	Variable cost						
	Human labour (man days)	59.41	17034	15.36	66.68	19184	16.90
	Bullock labour (BP days)	2.97	2363	2.13	2.19	1730	1.52
	Machine labour (hrs)	2.64	1969	1.78	3.14	2274	2.00
	Seedlings (number)	11.66	13697	12.35	11.78	13884	12.23
	FYM (tractor loads)	4.05	14331	12.92	2.81	9943	8.76
	Fertilizer cost		10387	9.37		19684	17.34
	Plant Protection Chemicals		6862	6.19		9998	8.81
	Irrigation cost		1748	1.58		1399	1.23
	Miscellaneous		900	0.81		800	0.70
	Interest on working capital @ 7 per cent		4850	4.37		5523	4.86
	Total variable cost		74141	66.86		84419	74.35
II	Fixed cost						
	Depreciation		1599	1.44		1506	1.33
	Land revenue		25	0.02		25	0.02
	Rental value of land		16500	14.88		16500	14.53
	Managerial cost (10 % of variable cost)		7414	6.69		8442	7.44
	Interest on fixed capital @ 10 per cent		2554	2.30		2647	2.33
III	Total fixed cost		28091	25.33		29120	25.65
IV	Marketing cost		8655	7.81		7683	6.77
V	Total cost		110887	100.00		113540	100.00
VI	Returns (Rs.)						
	Main product (q)	111.84	161818		99.84	144601	
	Gross returns		161818			144601	
	Net returns		50931			31061	
VII	Returns per rupee of investment		1.46			1.27	

Table 4.25: Cost and returns from major crops in Bengaluru North (in Rs.)

Sl. No.	Crop	Dairy farmers			Non-dairy farmers			Net gain by dairy farmer
		Cost incurred	Gross return	Net return	Cost incurred	Gross return	Net return	
1.	Ragi	26195	31715	5520	27104	25966	-1138	6658
2.	Maize	21424	29412	7988	21803	24633	2830	5158
3.	Tomato	237458	375724	138266	255240	360949	105710	32556
4.	Potato	110887	161818	50931	113540	144601	31061	19870
	Total	395964	598669	202705	417687	556149	138463	64242
	Average per acre	98991	149667	50676	104422	139037	34616	16061
	Average per household	366267	553769	187502	360255	479679	119424	68078

Hence, the stated hypothesis farm productivity of dairy farmers is more compared to non-dairy farmers is accepted. The results were in consistent with the study conducted by Kavyashree (2016). The results are similar to the study conducted by Obi *et al.* (2007) who observed dairy provides essential means of production that make farming economically viable and ecologically sustainable.

V SUMMARY AND CONCLUSION

The summary of the research along with major findings of the research are presented in this chapter. Based on the results of the present study, policy recommendations are also proposed for administrators and planners.

5.1 Introduction

The dairy industry actively contributes to the economies of several regions, communities and countries. An increasing worldwide demand is noticeable at present and the dairy industry is globalizing thereby increasing the intensity and scope of the global dairy trade. Dairy farming is a way of life for many local communities across the globe. Dairy farmers are an integral part of local economy and dairy farmers provide employment for others in the community. Furthermore, every dairy farm has a much bigger economic multiplier effect, providing employment for local veterinary officers, mechanics, feed and other suppliers. Milk and dairy products play a vital role in a healthy and a balanced diet. Milk is a rich source of calcium that is easily absorbed by the body. Calcium, along with other nutrients that are present in dairy products, namely, protein, phosphorus and magnesium are essential to build strong bone.

Dairy industry occupies an important place in the Indian economy. It has embraced the production of liquid milk, its preparation for sale and also manufacturing of dairy products. India is blessed with the largest cattle population in the world as well as India is the largest producer and also the consumer of milk in the world.

Dairy is a highly specialized field today which involves production, collection, storage, processing/ value addition and distribution of milk and dairy products. Most of the milk produced (over 80 %) is distributed as liquid milk for home consumption or manufacturing of traditional products like ghee, paneer and sweets. Nearly 70 million families throughout the country are involved in dairy farming. Among which 60 per cent of the milch animals are owned by small, marginal and landless farmers (Bhasin, 2004).

In Karnataka about 65 per cent of the population mainly depend on farming for their livelihood. At the same time farmers also practice dairying as supplementary and complementary enterprise which gives persistent income especially during crop failures. Karnataka stands ninth in cattle and buffalo population in the country contributing 4.3 per cent to the total cattle population. In milk crossbred cow population exhibited tremendous increment in urban and peri-urban regions of Mandya, Hassan, Tumakuru and Bengaluru. Since, the demand for milk is high in these areas crossbred cows are preferred because they are high milk yielders.

Women play a vital role in animal husbandry occupation as managers, decision makers and skilled workers. Increasing demand for milk and milk products in recent years intensifies dairy farming as profitable enterprise for rural women. The participation of women in dairy farm practices varies by region, culture and socio-economic status. In dairy enterprise, the contribution of women in terms of time and effort is not less than men.

Since the demand for milk and milk products increasing with urbanization, it might contribute to sustainable income growth of farmers. The dairy business has occupied a new place by venturing itself on large commercial basis leading to the high growth of milk production in rural, urban and interface areas.

Urban dairy farming consists of small holders and highly specialized, business-oriented firms. Urban dairy farmers have better knowledge regarding improved dairy management practices like milking, better feeding and health management. But farmers in these areas have lack of access to grazing land but they have better marketing opportunity. Mainly stall feeding is practised here.

In rural areas dairying is being practiced as an integral component of agriculture. In recent years farmers are showing keen interest in dairying since it gives handsome returns throughout the year unlikely agriculture which is seasonal and mainly depend on monsoon. Though dairy farming comprises of crossbred cow in addition to buffalo and indigenous cow the milk productivity is less, since the latter two types are genetically poor

yielders than former. Further, farmers have less knowledge regarding management of crossbred cows. Hence, the productivity level is lower.

In transition area, dairy farming is practised in areas where the density of human population was very high and area under crop production is shrinking due to urbanization. The milk production was dominated by crossbred cows mainly Holstein friesian. This system includes commercial dairy enterprise to the small dairy farmer (less than two cows) with greater business orientation.

Bengaluru district produces 311 thousand tonnes of milk annually with the cattle population of 4,06,306, dominated by crossbred cattle. With better infrastructure facilities, better marketing facilities and veterinary institutions, dairying is practised on the commercial scale. Per capita availability of milk is higher in Bengaluru rural (471 grams per day) than Bengaluru urban (38 grams per day). Since areas around Bengaluru are urbanizing rapidly the area under fodder crops is decreasing over the years. This is a major constraint in scaling up dairy business.

Rapid urbanization of rural areas surrounding North Bengaluru conglomerate is affecting the structure of agriculture including dairy. There is a significant variation in dairy production practices across rural and urban areas and consequently the economics of dairy production. Keeping in view the above-mentioned scenario, the present study was undertaken in the rural-urban interface of North Bengaluru with the following specific objectives

The objectives of the study are

1. To assess the role of stakeholders in dairy supply chain.
2. To examine the economic benefits and employment generated by dairy enterprise.
3. To analyse the socio-economic factors influencing in selection of dairy enterprise.
4. To analyse the role of women in dairy enterprise.
5. To assess the synergistic effect of dairy farming on farm productivity and other issues.

5.1 Study area

Bengaluru has been divided into Northern Bengaluru and Southern Bengaluru. Further, these are classified as rural, urban and interface areas by taking Vidhana Soudha as a reference point which is located at the centre of Bengaluru. The area within 15 km from the reference point is classified as the urban area and from the area, 15-25 km is regarded as transition area (or interface) while the area beyond this distance is regarded as the rural area. Northern Bengaluru was purposefully selected for the study. Three villages randomly each from rural, transition and urban were selected constituting a total of nine villages. Villages selected under urban region were Chikka Bommasandra, Allalasandra and Atturu. From transition region, Sugatta, Addiganahalli and Tarahunase were selected and from rural area Devrahalli, Sulakunte and Kodihalli were selected.

5.2 Sampling design

The purposive multistage random sampling method was used for the selection of livestock farm households. The sample frame consists of 150 farmers, of which 40 dairy farmers each from rural, transition and urban areas and 30 non-dairy farmers of northern Bengaluru were selected randomly from above listed villages irrespective of herd size.

5.3 Nature and source of data

In order to address each objective of the study, primary data was collected from the selected livestock and non-livestock farmers. For this a schedule was developed and pretested in the study area. Data was collected through personal interview method. The information collected from the farmers pertained to information on land holdings, asset position, cropping pattern, livestock holdings and related data. Further, the information on milk production and selling price, cost and returns, labour utilization under various dairy operations, role of women in specific dairy activities, cost and returns of major crops grown were also collected. The information collected was pertained to 2017-18 agriculture year.

5.4 Analytical techniques employed

For the purpose of achieving the objectives of the study, the data collected were subjected to statistical analysis. The simple statistical tools like averages and percentages

were employed in the economic analysis. Garrett ranking was used to know the reasons for taking up dairy enterprise. To analyse the various socio-economic factors influencing dairy enterprise, regression analysis was used.

5.5 Salient findings of the study

The results of the present investigation are summarized as under:

- The results revealed that 85 per cent of the dairy activity in the locale of the study was managed by male members of the family as against 15 per cent of the female members.
- Most of the sample dairy farmers had nuclear families in Bengaluru North.
- Majority (83.64 %) of the farmers were literates in Bengaluru North, and most of the illiterate and less educated farmers were belonged to rural and transition area of Bengaluru North.
- Dairy was the source of livelihood for majority of the farmers in Bengaluru North.
- Majority of the urban respondents owned comfortable household assets as compared to respondents from rural and transition area.
- In Bengaluru North, majority of the dairy farmers had marginal landholding and majority of the non-dairy farmers were small farmers.
- Ragi was the major field crop grown by both dairy and non-dairy farmers, Grapes was the major fruit crop; and tomato and potato were the major vegetable crops grown in Bengaluru north.
- In urban area, 87.10 per cent of the total number of livestock animals were crossbred cows as against 68.02 and 43.90 per cent in transition and rural areas, respectively. Few farmers own sheep, goat and bullock in the rural and transition areas of the study region.
- In Bengaluru North farmers took up dairy as an enterprise as it supplements family income.
- In rural area, availability of nearby marketing facilities and fodder were the major reasons; and in transition and urban areas, year-round income and surplus family labour

availability were the important reasons that influenced farmers in taking up dairy enterprise.

- The formal supply chain is dominated by few large processors and cooperatives which bulk and market milk on behalf of farmers.
- The informal supply chain involved farmers, transporters and traders selling raw milk and occasionally pasteurised milk was sold directly to consumers and to hotels.
- Total variable cost contributed to 90.91, 90.84 and 88.90 per cent of the total cost in rural, transition and urban areas, respectively.
- Cost of labour was the major cost followed by the cost of concentrates in milk production in all the three gradients of the study region.
- Returns per cow and returns per rupee of investment was higher in the case of urban area because majority of the farmers were 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 realised was higher in urban areas compared to rural and transition areas.
- In all the three gradients of Bengaluru North, the highest employment was generated by fodder management activity.
- In urban area, marketing and other activities require higher number of mandays of work compared to rural and transition areas because the dairy farmers in urban area sell milk to private parties and some sell directly to the consumer.
- Across the transects, the annual employment generation by dairy was 339.9, 347.3 and 355.9 labour days for rural, transition and urban areas, respectively.
- Employment generated by dairy was higher in urban area as compared with rural and transition areas.
- Dairy mainly managed by women and they have contributed positively in selection of dairy enterprise. Irrigated land and availability of cattle shed have significant positive influence in selection of dairy enterprise.
- In all the three gradients, family size was positively related with the herd size.

- In rural area, size of landholding is positively related with herd size, which means agricultural land is important for growing fodder crops and for grazing of livestock animals.
- In transition and urban areas, availability of cattle shed is a prerequisite for taking up dairy as an enterprise.
- In all three gradients, majority of women members of the family were performing livestock maintenance activities.
- Women are majorly involved in milk processing, taking care of sick and new born animals and many other works were performed jointly by male and female members of the family. Thus, women play major role than men in dairy.
- In all the three gradients, most of the decisions related to taking dairy loans, construction of cattle sheds, purchase of feed and fodder and sale of animals were attended by the male members of the family and female members involved in taking decisions related to health aspects, breeding and in sale of livestock products.
- Net benefits of inclusion of dairy was the highest in the case of tomato cultivation (₹ 32,556), followed by potato (₹ 19,870), ragi (₹ 6,658) and maize (₹ 5,158). Additional net benefit realized by dairy farmers per household was ₹ 68,078 and it was ₹ 16,061/ac.

Policy implications

Based on the results of the present study and general observations of the researcher during data collection, following suggestions were made for planning, execution and improvement of dairy development of the study area.

- On an average dairy enterprise generates almost 245 man days of employment per year. Hence, the farmers are advised to take up cultivation of crops with dairy to avail synergic effect of dairy enterprise.
- The role of women was higher in the livestock maintenance activities, milk processing and care of sick and new born animals. Thus, dairy co-operatives, extension agencies

and training institutes should give attention to farm women in improving their skills in specific dairy activities.

- Though women involvement was higher than that of men in dairy activities but most of the livestock management decisions were taken by male members, hence there is a need to empower women by establishing women dairy co-operatives.
- Dairy has a positive synergic effect on farm productivity not only through its increase in returns but also results in reduced cost of inorganic fertilizer and in turn improves soil structure. Therefore, dairy enterprise has to be encouraged with suitable incentives to strengthen organic farming.

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APPENDICES

**DEPARTMENT OF AGRICULTURAL ECONOMICS
COLLEGE OF AGRICULTURE
UAS, GKVK, BENGALURU-65**

Research Topic: “Supply Chain Management of Dairy Enterprise in Rural-Urban interface of Bengaluru North”

Interview Schedule

Name of the investigator: SOWJANYA, T. S

Date of Interview:

General information:

Farmer's name:

Age:

Education:

Occupation:

Village:

Taluk:

District:

Family information:

Name	Gender	Age	Education	Relationship with head	Occupation	Annual Income

1) Socio economic variables

a. **Institutional Participation:** Are you a member of the following organizations?

Sl. No.	Name of the organisation	Member	Participation		
			R*	O*	N*
1	Village panchayath				
2	Co operative society				
3	Milk cooperatives				
4	Mahila Mandal				
5	Zilla panchayat				
6	Any other (Specify)				

R*- Regularly O*- occasionally N*- Never

b. Extension participation: (for previous one year)

Sl. No	Name of the activities	Extension participation		
		R*	O*	N*
1	Method Demonstration			
2	Result demonstration 3			
3	Educational tour			
4	Film show			
5	Training			

R*- Regularly O*- occasionally N*- Never

c. Mass media participation

Do you listen to radio programmes/Watch T.V.? Yes / No

If yes, how often you listen/ Watch _____

Sl. No.	Programme	Frequency of listening		
		R	O	N
1	General Programmes (including News etc.)			
2	Agricultural Programmes			
3	Women's programmes			

R*- Regularly O*- occasionally N*- Never

d. Land holding details:

Type of land	Owned		Leased in		Leased out	
	Area (Acres)	Market Value of land (Rs.)	Area (Acres)	Rent paid per season /year (Rs)	Area (Acres)	Rent received per season/year (Rs.)
1.Dry land						
2. Irrigated land						
a. Open well						
b. Tube well						
c. Tank						

d. Canal						
Fallow land						

e. Cropping Pattern

Sl. No.	Season	Period	Crops	Variety	Area (acre)	Yield	soil type
1	Kharif	Dry	1.				
			2.				
			3.				
		Irrigated	1.				
			2.				
			3.				
2	Rabi	Dry	1.				
			2.				
			3.				
		Irrigated	1.				
			2.				
			3.				
3	Summer	Dry	1.				
			2.				
			3.				
		Irrigated	1.				
			2.				
			3.				

f. Irrigation structure details:

Source	Year of drilling / construction	Investment on well including pump set	Maintenance cost per year	Yield of well (inches)	Pump on hrs per day	HP of the pump	Area irrigated
Bore well							
Open well							
Canal							

Tank							
Others							

7. Dairy experience : _____ Years

8. Have you undergone any training programs?

If yes, specify the program name _____

9. Have you received any cattle for free from government?

If yes, specify the department _____

2) Size and Composition of Herds

Types of Herd	Milk	Draught	Dual	Whether increasing/decreasing	Reasons
Desi cow					
Cross bred Cow					
Desi Buffalo					
Cross bred Buffalo					
Sheep					
Goat					
Total					

3) Reasons for Practicing Dairy Farming

Particulars	Rank
Source of income	
Supplement family income	
Easy availability of bank loan	
Off season	
Easy maintains	
Less labour requirement	
Tradition	
Easy marketing	

4) Productivity of animals

Sl. No.	Particulars	Calf/ unit/year	Number retained	Number sold	Age of sale	Place of sale	Price expected
1	Desi cow						
2	Desi buffalo						
3	Crossbred cow						
4	Crossbred buffalo						

5) Lactation length per animal

- i. Cow - No. of days in milk _____
 - No. of days dry _____
- ii. Buffalo - No. of days in milk _____
 - No. of days dry _____

6) Animals purchased

Sl. No.	particulars	Year of purchase	Source of purchase	Place of purchase	Distance	Purchase Value (Rs)
a).	Cow					
	i)local					
	ii)crossbreed					
b).	Buffalo					
c).	Bullock					
d).	Sheep					
e).	Goat					

7) Investment on livestock enterprise establishment

Sl. No.	Particulars	1	2	3	4
a).	Land value				
b).	Shed establishment				
c).	Electricity charges				
d).	Equipments (milking machine etc.)				
e).	Milking cans				

f).	Utensils				
g).	Fencing				
h).	Bore well				
i).	Store for feed and fodder				

8. a) Variable cost for Cow/Month

Number:

Sl. No.	Particulars	Quantity (Kg)	Rate/Kg	Total Cost (Rs)
1.	Green fodder			
2.	Dry fodder			
3.	Groundnut cake			
4.	Rice bran			
5.	Concentrates			
6.	Mineral mixture			
7.	Labour (In mandays)			
8.	Veterinary expenses			
9.	Others (Specify)			

b) Variable cost for Buffalo/Month

Number:

Sl. No.	Particulars	Quantity (Kg)	Rate/Kg	Total Cost (Rs)
1.	Green fodder			
2.	Dry fodder			
3.	Concentrates			
4.	Labour (In mandays)			
5.	Veterinary expenses			
6.	Others (Specify)			

c) Variable cost for Bullock/Month

Number:

Sl. No.	Particulars	Quantity (Kg)	Rate/Kg	Total Cost (Rs)
1.	Green fodder			
2.	Dry fodder			
3.	Concentrates			
4.	Labour (In mandays)			

5.	Veterinary expenses			
6.	Others (Specify)			

9) Other expenses per year

Sl. No.	Particulars	1.	2.	3.	4.
1.	Cattle shed repaire				
2.	Animal insurance				
3.	Water charges				
4.	Transportation cost				
5.	Marketing cost				
6.	Miscellaneous				

10) Feed and Fodder management:

1) Feed management

a) Purchased feed

Particulars	Quantity (kg)	Price	Total cost
1.Cow a)local			
b)cross breed			
2.Buffalo			
3.Bullock			
4.Sheep			
5.Goat			
6.Poultry			
7.Piggery			

11) Fodder management

a) Total quantity of fodder used:

b) Own production:

Name of fodder	Quantity produced	labor	Cost involved
1.Dry fodder			
2.Green fodder			

c) Purchased feed

Type of feed	Quantity purchased	Distance	Cost involved
1.Dry fodder			
2.Green fodder			

12) Gross income from Livestock

Sl. No.	Particulars	Quantity/ No.	Price per unit (Rs.)	Total Amount (Rs.)
1.	Milk yield (l)			
2.	Manure(Cartloads)			
3.	Gunny bags(No.)			
4.	Sale of male calves (No.)			
5.	Hiring out the bullocks(days)			
6.	Sale of animals(No.)			
	TOTAL			

13) Human labour employment and distribution of total number of days of work per milch animal per year (in days)

Sl. No	Size of milch animal units	For milking	For feeding	For cleaning the shed	For fodder management	Other works	Total
1.	1-2						
2.	2-5						
3.	>5						
4.	Average						

14) Member participation in dairy activities

I. Regular activities	Men	Women	Jointly
1. Washing the animals			
2. Cleaning the shed			
3. Putting fodder and ration			
4. Milking			

5. Selling the milk			
6. Keeping water			
7. Putting the waste in the bin			
8. Fodder harvesting and collection			
9. Fodder transportation			
10. Fodder chaffing			
11. Preparation of concentrate			
12. Processing of milk			
13. Making dung cakes			
II. Health activities			
1. Vaccination			
2. Breeding			
3. Care of new borns			
4. Care of sick animals			
5. Taking the calves for dehorning			
III. Marketing Activities			
1. Selling the milk/milk products			
2. Purchase the animals			
3. Selling the animals			
4. Selling the manure			
5. Purchase of fodder			
6. Purchase of feed			
IV. Other House Activity			
1. Grocery Purchase			
2. Children Education			
3. Cloth Purchasing			
4. Gold Purchasing			
5. Vehicle Purchasing			
6. Construction of House			
7. Financial Activity			

15) Decision making pattern in dairy enterprise

I. Regular activities	Wife only		Husband only		Jointly	
1. Taking loans						
2. Selection of breed of animals						
3. Selling the produce						
4. Spending the income						
5. Care of animals						
6. Investment on dairy						
7. Deciding the number of animals to rear						
8. Construction of sheds						
9. Purchase of feed/fodder						
10. Health aspects						
11. Breeding (AI/NB)						
12. Growing of fodder						
13. Fixing the time of milking						

16) Cost of cultivation**Crop:****Area:****Season:****Duration:**

Wage rate (Rs)	
Men labour/ day	
Women labour/ day	
Bullock pair/ day	
Machine labour/ hour	

A. Labour use pattern:

Sl. No.	No. of times	Family		Hired		Bullock pair days	Machine hours
		Men days	Women days	Men days	Women days		
1.	Land preparation						
2.	Nursery						
3.	Seed treatment						
4.	Sowing transplanting						
5.	Manure application						
6.	Inter cultivation						
7.	Weeding						
8.	Fertilizer application						
9.	Plant protection						
10.	Irrigation						
11.	Harvesting						
12.	Threshing						
13.	Cleaning Bagging						
14.	Marketing						
15.	Others						

B. Resource use pattern

Sl. No	Input	Quantity	Rate (Rs)
1.	Seeds		
2.	FYM		
3.	Fertilizers a) b) c)		
4.	PP chemicals		
5.	Weedicides		
6.	Seed treatment		
7.	Water irrigation		
8.	Electricity		

C. Yield and returns

Sl. No	Particulars	Unit	Yield	Price (Rs)
1.	Product			
2.	By-product			