

**ECONOMIC ANALYSIS OF MANUFACTURING PRODUCTS
IN HASSAN CO-OPERATIVE MILK PLANT (KARNATAKA)**



**THESIS SUBMITTED TO THE
ICAR-NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL
(DEEMED UNIVERSITY)**

**IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF**

**MASTER OF SCIENCE
IN
AGRICULTURAL ECONOMICS
BY**

**PRAPHUL DEV D
B.Sc (Agriculture)**

**DIVISION OF DAIRY ECONOMICS, STATISTICS AND MANAGEMENT
ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
(DEEMED UNIVERSITY)
KARNAL-132001 (HARYANA), INDIA**

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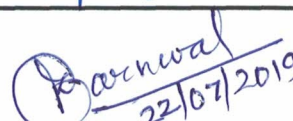
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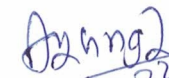
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This is to certify that the thesis entitled, “ECONOMIC ANALYSIS OF MANUFACTURING PRODUCTS IN HASSAN CO-OPERATIVE MILK PLANT (KARNATAKA)” submitted by MR. PRAPHUL DEV D towards the partial fulfillment of the award of the degree of MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS of the ICAR-NATIONAL DAIRY RESEARCH INSTITUTE (DEEMED UNIVERSITY), Karnal, Haryana, India, is a bonafide research work carried out by him under my supervision, and no part of the thesis has been submitted for any other degree or diploma.

**(A.K. Chauhan)
MAJOR ADVISOR**

Dated:



Dedicated
To
Farmers,
The Indian Defense
Force
&
The Police Department,
Govt. of Karnataka



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ABSTRACT

India's milk production has reached to 176.3 MMT during the year 2017-18; consequently, the per-capita availability of milk in India has also increased to 375 gram per day. The NSSO data on monthly per capita expenditure on milk and milk products in rural as well as in urban area has showed an increasing trend due to the increasing income of middle class families and health awareness among the people. Well-established milk co-operatives and many dairy industries are being set up throughout the country has enhanced milk handling and processing capacity of milk in India. Dairy Industry faces pressure while fulfilling the contradictory agendas of producers and consumers. It also faces a high energy cost which is a serious threat. Estimation of scarce resource utilization, manufacturing cost and break-even level of various milk products is an important step for the management to take right decisions for policy and planning purpose. Keeping in view the above facts, the present study entitled *Economic Analysis of Manufacturing Products in Hassan Cooperative Milk Plant (Karnataka)* was conducted with the following specific objectives, to estimate the resource utilization in the plant for manufacturing different milk products, to work out cost of manufacturing different milk products and their profitability and to determine the break- even level of different milk products. A co-operative dairy plant of Karnataka was selected for the study. For estimation of energy utilization, data were collected by taking actual observations and discussions held with concerned engineers and supervisors. To work out cost of manufacturing, data were collected through discussions with officials, supervisors, labourers and records maintained by the plant. The break-even quantities of various products were calculated based on price of products realized by the plant and cost of manufacturing various products. During the study period 2017-18, the total electricity consumption by plant was 2372 thousand units and highest portion of it was consumed by refrigeration section (44.5%). The total water utilization of plant was 4.6 kilo litre per day and most of the water was used in cleaning and washing of crates and cans (31%). The permanent labour utilization was found to be highest in Engineering, Security and Account sections (15.18% each) while the contractual labourers were found highest in packaging section (19.62%). The cost of steam production was worked out to be ₹1.14 and that of from Ultra Heat Treated (UHT) milk plant boiler was ₹1.84 and the steam utilization was found highest in Ghee (0.12 kg/1000ml). The cost of refrigeration was worked out to be ₹16.46 per ton and among the products manufactured more refrigeration utilization was by curd (26.24 kilo calories/unit/hour). The cost of manufacturing Toned milk was ₹28.49, Special Toned Milk (STM) ₹34.32, Standard milk ₹34.44, UHT milk ₹35.56 for 1000 ml. of each product. The cost of Curd was observed to be ₹17.54/500gm, Peda ₹27.9/100gm, Butter milk ₹3.26/200ml, Ghee ₹415.2/1000ml, Butter ₹193.89 per 500gram and SMP ₹220.45/kg. The share of UHT in total revenue was highest (34.34%) and that of Peda was lowest (0.20 per cent). The profit margin over cost was found to be highest in Butter Milk (38.04%) and in case of SMP it was lowest (2.06%). All the products manufactured in the plant were above their Break-even quantities and the margin of safety over the Break Even Point (BEP) was found highest in Curd (86.95%) and lowest in SMP (36.51%).

सारांश

वर्ष 2017-18 के दौरान भारत का दुग्ध उत्पादन 176.3 MMT तक पहुंच गया है; परिणामस्वरूप, भारत में प्रति व्यक्ति दूध की उपलब्धता भी प्रति दिन 375 ग्राम हो गई है। एनएसएसओ के आंकड़ों के अनुसार ग्रामीण और साथ ही शहरी क्षेत्र में दूध और दूध उत्पादों पर प्रति व्यक्ति मासिक खर्च बढ़ता दिखाई गया है, जिसका मुख्य कारण मध्यम वर्ग के परिवारों की बढ़ती आय और लोगों में स्वास्थ्य जागरूकता है। पूरे देश में अच्छी तरह से स्थापित दूध सहकारी समितियां और कई डेयरी उद्योग स्थापित किए जा रहे हैं, जिससे भारत में दूध की हैंडलिंग और प्रसंस्करण क्षमता में वृद्धि हुई है। उत्पादकों और उपभोक्ताओं के विरोधाभासी एजेंडों को पूरा करते समय डेयरी उद्योग दबाव का सामना कर रहा है। उसके अतिरिक्त डेयरी उद्योग को उच्च ऊर्जा लागत का भी सामना करना पड़ता है। विभिन्न दुग्ध उत्पादों के दुर्लभ संसाधन उपयोग, विनिर्माण लागत और ब्रेक-सम स्तर का अनुमान प्रबंधन के लिए नीति और नियोजन उद्देश्य के लिए सही निर्णय लेने के लिए एक महत्वपूर्ण कदम है। उपरोक्त तथ्यों को ध्यान में रखते हुए, “हसन कोऑपरेटिव मिल्क प्लांट (कर्नाटका) में विनिर्माण उत्पादों के आर्थिक विश्लेषण” वर्तमान अध्ययन के साथ निम्नलिखित विशिष्ट उद्देश्यों के साथ किया गया, ताकि विभिन्न दुग्ध उत्पादों के विनिर्माण के लिए संयंत्र में संसाधन उपयोग का अनुमान लगाया जा सके और लागत पर काम किया जा सके, भिन्न दूध उत्पादों से लाभप्रदता और विभिन्न दूध उत्पादों के विखंडन का पता लगाया जा सके। अध्ययन के लिए कर्नाटक के एक सहकारी डेयरी संयंत्र को चुना गया था। ऊर्जा के उपयोग के आकलन के लिए, वास्तविक अवलोकन और संबंधित इंजीनियरों और पर्यवेक्षकों के साथ चर्चा करके डेटा एकत्र किया गया। विनिर्माण लागत पर काम करने के लिए, अधिकारियों, पर्यवेक्षकों, मजदूरों और संयंत्र द्वारा बनाए गए रिकॉर्ड के साथ चर्चा के माध्यम से डेटा एकत्र किया गया था। विभिन्न उत्पादों की ब्रेक-ईवन मात्रा की गणना उत्पादों की कीमत और विभिन्न उत्पादों के निर्माण लागत के आधार पर की गई थी। अध्ययन अवधि 2017-18 के दौरान, संयंत्र द्वारा बिजली की खपत 2372 हजार यूनिट थी और इसका अधिकांश हिस्सा प्रशीतन अनुभाग (44.5%) द्वारा खपत किया गया था। संयंत्र का कुल जल उपयोग प्रति दिन 4.6 किलो लीटर था और इसका अधिकांश (31%) ट्रे और दुग्ध केन की सफाई और धुलाई में उपयोग किया जाता था। स्थायी श्रम उपयोग इंजीनियरिंग, सुरक्षा और खाता वर्गों (प्रत्येक में 19.62%) में उच्चतम पाया गया, जबकि अनुबंधित मजदूरों को पैकेजिंग अनुभाग (1%) में उच्चतम पाया गया। भाप उत्पादन की लागत रु.1.14 और अल्ट्रा हीट ट्रीटेड (यूएचटी) मिल्क प्लांट बॉयलर से रु. 1.84 था और भाप का उपयोग घी (0.12 किग्रा/1000 मिली) में सबसे अधिक पाया गया था। प्रशीतन की लागत दही (26.24 किलो कैलोरी / यूनिट / घंटा) में रु. 16.46 प्रति टन और यह उच्चतम प्रशीतन आवश्यकता पाई गई। टोन्ड दूध के निर्माण की लागत रु. 28.49, स्पेशल टॉन्ड मिल्क (एसटीएम) रु.33.32, मानक दूध रु. 34.44, यूएचटी दूध 1000 मिली के लिए रु. 5.56 पाया गया। दही की कीमत रु. 17.54/500 ग्राम, पेड़ा रु. 27.9/100 ग्राम, बटर मिल्क रु. 3.26/200 मिलीग्राम, घी रु. 415.20/1000 मिली ग्राम, बटर रु. 193.89 प्रति किलो और एसएमपी रु. 220.45/किग्रा थी। कुल राजस्व में यूएचटी का हिस्सा उच्चतम (34.34%) और पेड़े का निम्नतम (0.20 प्रतिशत) था। बटर मिल्क में लागत से अधिक लाभ मार्जिन (38.04%) पाया गया और एसएमपी के मामले में यह सबसे कम (2.06%) था। संयंत्र में निर्मित सभी उत्पाद अपने ब्रेक-सम मात्राओं से ऊपर थे और ब्रेक ईवन पॉइंट (बीईपी) पर सुरक्षा का मार्जिन दही में सबसे अधिक (86.95%) और एसएमपी (36.51%) में सबसे कम पाया गया।

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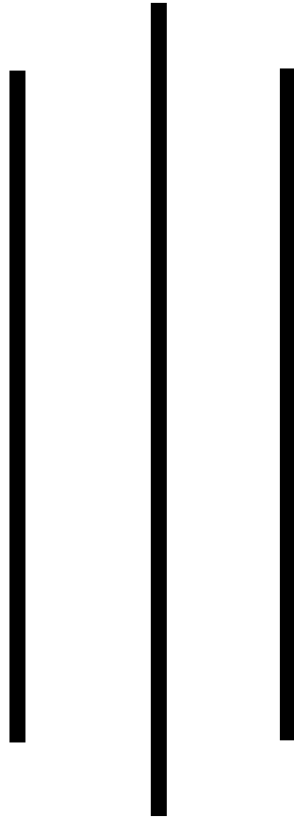
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LIST OF ABBREVIATIONS

Sl. No	Short form	Abbreviations
1	LLPD	Lakh Litres Per Day
2	LPD	Litres Per Day
3	NDDDB	National Dairy Development Board
4	TR	Tonnes of Refrigeration
5	KG	Kilo Grams
6	DCS	District Cooperative Society
7	HAMUL	Hassan Milk Union Limited
8	KMF	Karnataka Milk Producer's Federation Limited
9	DAHD&F	Department of Animal Husbandry, Dairying and Fishery.
10	UHT	Ultra Heat Treated
11	SMP	Skimmed Milk Powder
12	STM	Special Toned Milk
13	ETP	Effluent Treatment Plant

CHAPTER – 1



INTRODUCTION

1. INTRODUCTION

India ranks first in global milk production. The milk production in the country has increased from 165.40 million tonnes (MT) in 2016-17 to 176.35MT in 2017-18, achieved a growth rate of 6.62 per cent while world milk production increased from 800.2 MT in 2016 to 826 MT in 2017 (NDDDB, 2018). Dairy sector contributes about 4.6 per cent of GVA during the year 2016-17 and forms an essential part of the rural Indian economy, serving as an important source of employment and supplementary income (National Accounts Statistics-2016). This is because the milk production is dominated by resource poor farmers consisting of landless laborer's, small and marginal farmers who in aggregate own 70 per cent of the national milch animal herd. The per capita availability of milk in India during 2017-18 was 375 gram/day which is higher than the minimum nutrition requirement of 280 grams as recommended by World Health Organization (WHO). The per capita monthly consumption expenditure on milk and milk products is increasing and the amount reaches to ₹116.38 in rural and ₹187.14 in urban areas (NDDDB, 2011-12) which is mainly because of increase in the income of middle class families. Except, few exports of dairy products, almost all the dairy produce in India is domestically consumed, with fluid milk is being in large quantities. The National Dairy Development Board (NDDDB) estimates that, by the end of 2022 the demand for milk will be around 180 million tonnes and therefore, the Indian dairy industry possesses a huge potential for processing through value addition and inclusive development.

The dairy industry in India not only offers profitable business opportunities but also serves as a tool of socio-economic development of the people. Keeping this in view, the Government of India has introduced various schemes and initiatives that are aimed at the development of the dairy sector in the country. For instance, the National Dairy Plan (Phase-I, 2011-2018) aims to improve the cattle productivity and increase the production of milk by expanding and strengthening the rural milk procurement infrastructure and also by providing greater market access to the farmers. On the other hand, the private participation in the Indian dairy sector has been increased over the past few years. Both national and

international players are entering the dairy industry, attracted by the size and potential of the Indian market. The focus is being given to value-added products such as cheese, yogurt, probiotic drinks, etc. and to the innovative products keeping in mind the specific requirements of the Indian consumers. With these developments the industry has achieved the strength of a producer-owned and professionally managed cooperative system, despite the facts that a majority of dairy farmers are not educated, run small and marginal operations and selling milk as their sole source of income. The existence of restrictive trade policy of milk in the Dairy Industry and the emergence of Amul type of cooperatives in almost all the states have changed the dairy farming practices in the country. As on April 2015, about 15805000 dairy farmers of which 4779000 were women belonging to 177000 village level societies, sell their milk to one of 183 milk producers' cooperative unions operated in over 418 districts of India who in turn are supported by 22 state cooperative milk marketing federations (DAHD&F, 2018). By this, farmers have gained the favorable price for their milk and receive services like timely information regarding the process or technology to be used for milking, artificial insemination, feed and fodder etc. Their production which was essentially a self-reliant one is now being transformed into a commercial proposition.

Milk being a nutritional beverage is a highly perishable one which needs either to be consumed or to be quickly disposed for its transportation through cold chain over a long distance which makes it a difficult one. Hence, the processing of milk is an essential activity that needs to be done as soon as possible and must be stored in a specific storage conditions which enhances its quality and shelf life. The processing involves the surplus milk which is confined to some production site is collected, chilled, pasteurized and processed into products such as butter, ghee, milk powder, cheese etc. The milk processing technology apart from increasing the quality and shelf life of milk products, it has also enabled us to transport the products from production sites to consumer sites of every corners of the country. This indicates that it has transformed the marketing of milk from a localized one in to a national market, where the processed products are sold to consumers of different locations across the country and the world. This activity enables the consumers to afford milk and milk products at reasonable price and quality.

The milk production in the world and in country is increasing and demand for milk and milk products in the country has attracted many multinational companies and entrepreneurs to set up milk plants in the country. Consequently, the number of milk plants registered under Milk and Milk products Order (MMPO), increased from 789 in 2006 to 1065 during 2011 (MoA, GOI, 2013). India's total installed milk processing capacity in the co-operatives sector is 663 lakh litres per day (LLPD), while private dairies process 733 LLPD (MoA, GOI-2018). Ensuring hygienic milk handling involves adoption of a cold chain from milk collection point to till it reaches the dairy plant for processing. The organized dairy sector has managed to gradually increase its market share for items such as liquid milk, ice cream, ghee, curd, milk based beverages, cheese, paneer etc. Though the unorganized small scale operators continue to account for a major share, particularly in unpasteurized liquid milk and indigenous dairy based sweets. In case of many traditional indigenous products, a large proportion is still being produced and retailed by the unorganized sector. The government in order to promote dairy Industry and to attract more investment in this sector has reduced excise duty of 16 per cent to zero on processing machineries (Dairy Universe, India).

The way, in which various activities are carried out like milk procurement, it's processing and distribution influences the success of Dairy Industry. To endure in this tough competition, Indian Dairy Industry has to be well-organized, efficient and effective. Most often Dairy Industries face tremendous pressure while fulfilling the contradictory agendas of producers and consumers. Farmers try to increase their share in per litre of milk while consumers seek maximum satisfaction per litre of milk. In order to balance this opposite goals, dairy plants have to be innovative with suitable strategy to be cost effective. Also there is a consumption of considerable amount of energy by the dairy plants in processing of milk and milk products. By 2025, developing nations of the world will quadruple their energy consumption. With increase in demand for energy, about 80 per cent will be met by the non-renewable sources like petroleum, natural gas, coal etc. while only 20 percent is met through renewable means and nuclear power. Different plants in India have wide variations in the specific energy consumption. Because of the present energy deficiency and restrictions of the non-renewable energy means, prices of all types of fuels are increasing rapidly which simultaneously increases the cost of

processing in dairy plants. Dairy processing holds huge potential for high returns and therefore, economic and judicious energy utilization is an immediate need of the day for realizing the above objective of high returns from milk products. Due to the fluctuations in milk arrivals which is due to seasonality and perishability of milk, most of the dairy plants in India use only 80 per cent of its installed capacity. This leads to increase the processing cost per litre of milk which ultimately reduces the benefits to both consumers and producers (India Dairy.com) and hence, there should be a continuous estimation with respect to economics and energy utilization of manufacturing dairy products. Estimation of resource utilization like water, steam, electricity, refrigeration, and human resources, manufacturing cost and break-even level of various milk products is unavoidable part of management to take right decisions for product manufacturing, policy and planning purpose to ensure maximum turnout from the plant.

Keeping in view the above facts, the present study entitled “Economic Analysis of Manufacturing Products in Hassan Cooperative Milk Plant (Karnataka)” was conducted with the following specific objectives-

- To estimate the resource utilization for manufacturing different milk products in the plant.
- To work out the cost of manufacturing different milk products and their profitability.
- To determine break-even level of different milk products.

Scope of the study

- Studying the energy utilization by plant reveal certain aspects like whether the plant is efficient in handling resources, find out any wastage of resources, analysis of existing technology and if possible, finding an alternative technologies in utilization of energy sources, cost minimizing alternatives etc. These aspects aid in proper management of available resources which ultimately guide the management to take up cost minimizing strategies.
- Estimating the cost of manufacturing of different dairy products is vital for the management of the plant to take right decisions regarding the proper allocation of

time and resources to products. Moreover, the supply of product in the market by the plant largely depends on demand for that product and the management of the plant has to be very careful about cost components of that product in demand so as to make an optimum profit margin and to sustain in the market.

- Break-even point is a situation of a production level of the product where in the total revenue from product will be just equal to its total cost i.e., the product is neither making profit nor making losses. This study of break-even point of different products in the plant would help the management how much quantity to produce so that the total cost of manufacturing doesn't exceed total revenue. This is an indication to the management that manufacturing the product lesser than the break-even level would lead to incur loss.

Limitation of the study:

In spite of the best effort to conduct the study, certain restraints encountered which is chiefly social behavior which is not deterministic. Few limitations were due to the following reasons:

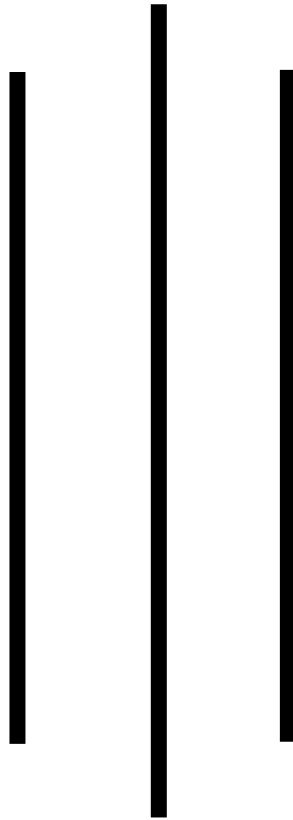
- In certain context like the data on expenditure on quality maintenance of each product was unavailable and had to be worked out by apportioning on the basis of the value of the product.
- Although all the due care was taken to record the data accurately during the study period, few findings were mainly based on estimations because equipments like water meters were not damaged in the plant.
- As the study is restricted to a specific Milk Plant of Karnataka Co-operative Milk Producer's Federation Ltd., the cost estimates varies from plant to plant subject to the handling capacity and technology being used in manufacturing different products. Hence, sweeping generalization should be drawn with some reservations.

Organization of the study

In all, the study is presented in *five* chapters. First and current chapter includes introduction, scope and limitations of the study. Chapter 2 deals with the extensive review of recent literature which was done prior to and during the course of

study. Chapter 3 is about the methodology used and profile of study area. Chapter 4 discusses the results of analysis of study and finally Chapter 5 presents the summary and broad conclusions emerged out of the results of the study, followed by a list of bibliography.

CHAPTER – 2



REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The present chapter discusses the most relevant information regarding the similar studies conducted by earlier researchers like the area of work and the methodologies adopted by them. The review of studies gives an insight about the research gap that exists in the past studies and hence, the overlapping or duplication of the research work can be avoided. This also aid in formulation of hypothesis, research design in order to carry out the research work in a systemic manner. Therefore, recent extensive review has been done pertaining to the present study and is presented in the following heads.

2.1 Resource utilization in the plant for manufacturing different milk products.

2.2 Cost of manufacturing different dairy products and their profitability.

2.3 Determination of the break- even level of different dairy products.

2.1 Resource utilization in the plant for manufacturing different milk products

Manufacturing milk-based products require water, steam, manpower, electricity, refrigeration and raw materials which are scarce in nature. The cost and utilization pattern of these resources determine the price of the final product. Following are the earlier studies conducted by the researchers in this field.

Hattangady (2005) carried out research on energy efficiency of the dairy plant and concluded that 70 per cent of total electricity cost was due to refrigeration. Apart from that the ratio of water to processing a litre of milk was found to be ranged from 0.8-1:1. The study further opined that water and energy usage can be reduced by energy and water balancing in cleaning in place (CIP) section.

Chauhan *et al.* (2007) carried out research on cost and energy utilization for manufacturing products in dairy plant and the study revealed that for the purpose of refrigeration, 50 per cent of total electricity was utilized. This was followed by pasteurization section and effluent treatment plant section consuming 21.39 per cent

and 7.25 per cent of total electricity respectively. Suggestions were made to reutilize the waste condensate water in order to save soft water as well as thermal energy.

Upton (2009) conducted his study on strategies to reduce energy consumption on dairy farms in Fermoy, Ireland. He found that electricity costs were observed 8 per cent of fixed cost. Electricity alone accounts on an average 0.60 per cent per litre of milk production cost. Milk cooling consumes 32 per cent, water heating 27 per cent, vacuum pumps 19 per cent and lighting 18 per cent of total electricity consumed.

Bureau of Energy Efficiency (2010) made a detailed project report on low loss & compact thermal storage system of 300 Turbine Heat Rate TRH in Gujarat dairy cluster. It was found that 53 per cent of the total average monthly energy consumption accounted for electricity cost. Natural gas and fuel oil consumes 25 per cent and 22 per cent of energy respectively.

Mane (2013) conducted research on 'Energy management in a dairy Industry' and revealed that refrigeration consumed 35 per cent of the total electricity consumed. Processing section and boiler section utilized 33 per cent and 9 per cent of electrical load, respectively. The study suggested to use metal halide lamp instead of mercury vapour lamps for the purpose of lighting which saves 40 per cent of lighting.

Modi et al. (2014) in their case study on a milk processing plant revealed that processing section utilized 34.49 per cent of electricity followed by refrigeration section and pre pack section which utilized 33.35 per cent and 33.35 per cent, respectively.

Ali (2015) in his research on the milk plant of Balasore district, Odisha, showed that refrigeration section utilized more than half of the electricity (53.72%) compared to other sections of milk plant. During the pasteurization of milk the amount of steam utilized was found to be 0.06 kg per litre. The study also revealed that pasteurized milk utilized highest refrigeration of about 61.35 kilo calories per litre followed by Dahi, Rabidi and Paneer which was 46.70, 45.70 and 45.49 kilocalories respectively.

Chauhan et al. (2015) studied on value chain analysis of milk and milk products in milk-shed area of Ballabgarh milk plant (Faridabad) Haryana. The study revealed that water consumption was highest for the crate washing and milk can cleaning activity (28.62%) in the plant. Refrigeration consumed the highest electricity (56.03%) and

steam was used higher for ghee (0.32 per kg) compared to other products in the plant. Pasteurized milk required the highest refrigeration (63.24 kcal per litre). The cost of water pumping, refrigeration and steam generation was found to be ₹8.64 per kilo litre of water, ₹25.78 per ton of refrigeration and ₹2.81 per kg of steam respectively.

Ripi (2016) during her study on Sirsa cooperative milk plant in Haryana, found that refrigeration section consumed 41.94 per cent of total electricity in a plant, followed by Milk powder section (24.36%). The steam utilization was 0.71 kg for manufacturing one kilogram of SMP. Pasteurization process of milk utilized highest refrigeration which is about 67.89 kilo calories per litre of milk pasteurization. Crate washing and cane cleaning consumed the more water (32.26%) followed by pasteurization section (16%).

2.2 Cost of manufacturing different dairy products and their profitability

To take the proper decisions regarding manufacturing of milk products, it is important to know the cost involved in each step of manufacturing of particular product. This provide detailed information regarding various cost components involved in manufacturing of milk product which in turn helps us to fix an appropriate price for product. Moreover the profit depends on cost involved in manufacturing of that product.

Chauhan et al. (2005) studied the component wise and process wise cost in a dairy plant in Karnal. The process-wise cost of ghee was observed ₹120.97/kg, for skimmed milk ₹7.21/litre for toned milk ₹10.85/litre and for full cream milk ₹14.69/litre. The processing cost of ice-cream (without raw material) was ₹8.35/litre. The study revealed that least profit was obtained by manufacturing of paneer and highest is for ice-cream manufacturing. They also observed that margin of retailer was more than the margin earned by dairy plant in all products. While double toned milk was not yielding any profit and suggested the management to increase the quantity of production to get economics of scale or shift to alternative product which is in good demand.

Feroze (2005) conducted a study on economics in co-operative Dairy Plant for manufacturing of various dairy products and he concluded that Ghee occupied highest share (25.87%) of total solids followed by full Cream Milk (24.12%), Skim Milk Power (17.39%) and Skimmed milk (16.84%). He also observed that Double Toned Milk, Paneer and Skimmed Milk use less than 10 per cent of Total solids individually. Various

grade of fluid milk earn 55.94 per cent of sales revenue next to that is Ghee (32.84%) followed by Paneer (5.93%) and SMP(4.78%).

Ali (2015) studied the Economics of Product Manufacturing in Cooperative Dairy Plant of Coastal Odisha and observed that the most profitable product was Sweet Dahi (40%), followed by Sweetened Flavoured Milk (28.72%), Toned milk (24.76%) and Whole Milk Curd (22.46%). But both Butter milk sip and Rabidi had a profit of 19.20 per cent. He also worked out the profitability of each products manufactured and found that Sweet Dahi was the most profitable one (40.55%) followed by Sweet Flavored Milk (28%) and Toned milk (24.67%).

Chauhan et al (2015) conducted a study on Ballabgharh milk plant in (Faridabad) Haryana, about the value chain analysis of milk and milk products and during their study, they found that highest share of revenue among the total revenue was Full Cream Milk (64.48%) followed by Toned milk(16.51%). Manufacturing cost of various products like paneer was found to be ₹235.31 per kg, Ghee ₹333.62 per kg and Dahi 16.03 per cup of 400ml. The profitability of each product over the cost were also calculated and highest margin was noticed in Standardized milk (₹0.64 per litre) followed by Full Cream Milk (₹0.61 per litre).

Ripi (2016) During her study on Sirsa co-operative milk plant of Haryana, found that total production (in terms of kilograms or units) of Ghee, Dahi, Salted Lassi, Kaju pinni, Skimmed milk powder, Double Toned milk, standardized milk and Full Cream Milk in the study period were 600109kg, 614790 cups, 123222.4 litres, 61790.49kg, 1688150 litres, 1328259 litres, 2328443 litres and 168253.50 litres respectively. The manufacturing cost was found to be ₹10.35 per unit for dahi, ₹29.08 per litre for salted Lassi, ₹333.30 per kg for ghee, ₹221.21 per unit for Kaju pinni, ₹223.70 per kg for skimmed milk powder, ₹29.39 for double Toned milk, ₹36.48 per litre for standardized milk and ₹43.12 per litre for full cream. The profitability of products was also worked out and found that Dahi was most profitable one (23.29%) followed by Double toned milk (15.72%) and Paneer (14.78%).

Vanishree (2018) in her study on Value chain analysis of liquid milk in Bengaluru milk union of Karnataka observed that the share of fixed cost was 1.12 per cent and the

share of variable cost was 98.49 per cent of total processing cost of liquid milk. Overall, the cost of processing of standardized milk was assessed to be ₹1.86/litre.

2.3 Determination of the break- even level of different dairy products.

Break-even point is a point at which a plant neither makes profit nor is under loss. Total revenue equals to total cost at break-even point (BEP). The lower part production of Break-even Point indicates the plant is incurring losses and need to produce more. The knowledge of break-even quantity of a product is helpful to judge that the specific product is produced above break-even point or not.

Raju (1980) conducted a study in dairy plant of Vijayawada district of Andhra Pradesh and found that the products such as cream, sweetened milk except industrial casein were produced over the break-even point.

Khem Chand (1991) made a study on small, medium and large sweet making shops in Ganganagar district of Rajasthan and showed that all the sweet manufacturing units were working beyond break-even point and have earned enormous profit size wise large units had earning higher profit in manufactured milk product.

Murali (2001) conducted economic analysis of processed and manufactured dairy products in a co-operative milk plant and observed that actual production of SMP, Ghee, Khoa, SM were 4775 tonnes, 1118 tonnes, 45.70 tonnes and 486.26 thousand litres respectively and their break-even point are at 3679 tonnes, 593 tonnes, 792 tonnes and 42.66 thousand kilo litres respectively.

Chauhan et al.(2002) conducted a study in a Model Dairy Plant at ICAR-NDRI, Karnal, Haryana on economics of milk processing and manufacture of dairy product and found that the quantity produced of all dairy products were above the break- even point except toned milk.

Feroze (2005) conducted a research on manufacture of dairy products in a co-operative dairy plant and found that output of all products exceeded break-even point.

Chauhan et al. (2007) In his studies on Economics of milk product manufacturing units in Haryana revealed that quantity of various milk products produced in both Eastern and Western zone was higher than Break-even quantities.

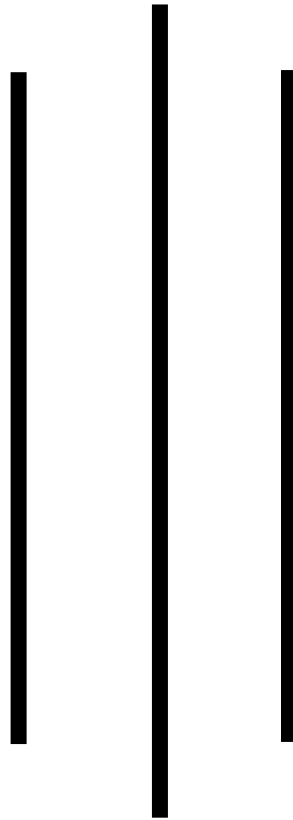
Ali (2015) in his research study entitled Economics of product manufacturing in cooperative dairy plant of coastal Odisha revealed that break-even level for toned Milk, whole milk curd, paneer, sweet dahi, rabidi, butter milk slip and sweetened flavoured milk were found to be 660.67 thousand litres, 121.78 million ton, 11.32 million ton, 33.25 million ton, 20.99 million ton, 28.62 thousand litres and 21.43 thousand litres respectively and all these products were manufactured above their break-even quantities.

Ripi (2016) made a study on Sirsa cooperative milk plant in Haryana and observed that the breakeven quantity of various milk and milk products manufactured in the plant were found to be 2.11 crore litre for standardized milk similarly 1.05 crore litre, 1.57 crore kg, 48.91 lakh cups, 16.81 lakh litre, 10.77 lakh litre, 54.136 lakh kg, 5.64 lakh kg and 1.25 lakh kg for DTM, SMP, Dahi, FCM, Salted Lassi, Ghee, Kaju Pinni and Paneer respectively.

Research gap

- In the previous studies on cost of manufacturing of dairy products lacking the products like UHT, SMP and Peda. Hence, information on cost of manufacturing of these products is not available.
- Keeping in view the demand from different income level and age groups, the new products are being launched. Therefore, with change in product mix of the plants, there is a continuous need to study the economic analysis of milk products.

CHAPTER - 3



RESEARCH METHODOLOGY

3. RESEARCH METHEDODOLOGY

The detailed methodology used for the study is explained in this chapter. This includes the criteria for the selection of state followed by the selection of dairy plant and its background and history. Then comes the sources of data and methodology involved in collecting the data. The analytical framework and the methodology for estimating the resource use and cost of production of different dairy products and determination of breakeven output levels and profitability are explained in detail.

3.1 Selection of the state

The Karnataka state has been purposively selected for the study. It is situated in the Deccan plateau which is in the southern part of India between the latitude 11.31° north and $18^{\circ}30'$ north and between 74° east and $88^{\circ}17'40''$ East longitudes. The state shares the border with Maharashtra, Andhra Pradesh, Tamil Nadu and Kerala and on the west by Arabian Sea. Karnataka produced 6562 thousand tonnes of milk during 2016-17 and stood eleventh in total milk production scenario of the country. However the per capita availability of milk in the state is quite low 313 grams/ day against the national average of 375 grams/day (NDDB, 2017-18). Karnataka Cooperative Milk Producers' Federation Limited (KMF) is the Apex Body for the dairy co-operative movement in Karnataka and is the second largest dairy co-operative amongst the dairy cooperatives in the country. In South India, it stands first in terms of procurement as well as sales of milk. Under the umbrella of KMF, there are 15864 registered Dairy Cooperative Societies^{q1} in 2018 in the state. The KMF has 14 milk unions throughout the Karnataka State (Fig 3.1) which on an average procures about 65 lakh litres of milk per day. The Flourishing Cooperative sector and its role in in dairy development provided the suitable background to conduct this study in Karnataka.

3.1.1 Selection of the dairy plant

The Karnataka Cooperative Milk Producers' Federation Limited (KMF) comprised of a group of 14 dairy plants over the state. Among this Hassan Milk Producers Union Limited (HAMUL) of Hassan district have purposively selected having the processing

capacity of 3, 00,000 litres per day (LPD), has the variety of product mix, maintenance of and easy accessible to requisite data and well maintenance of records prompted to its selection.

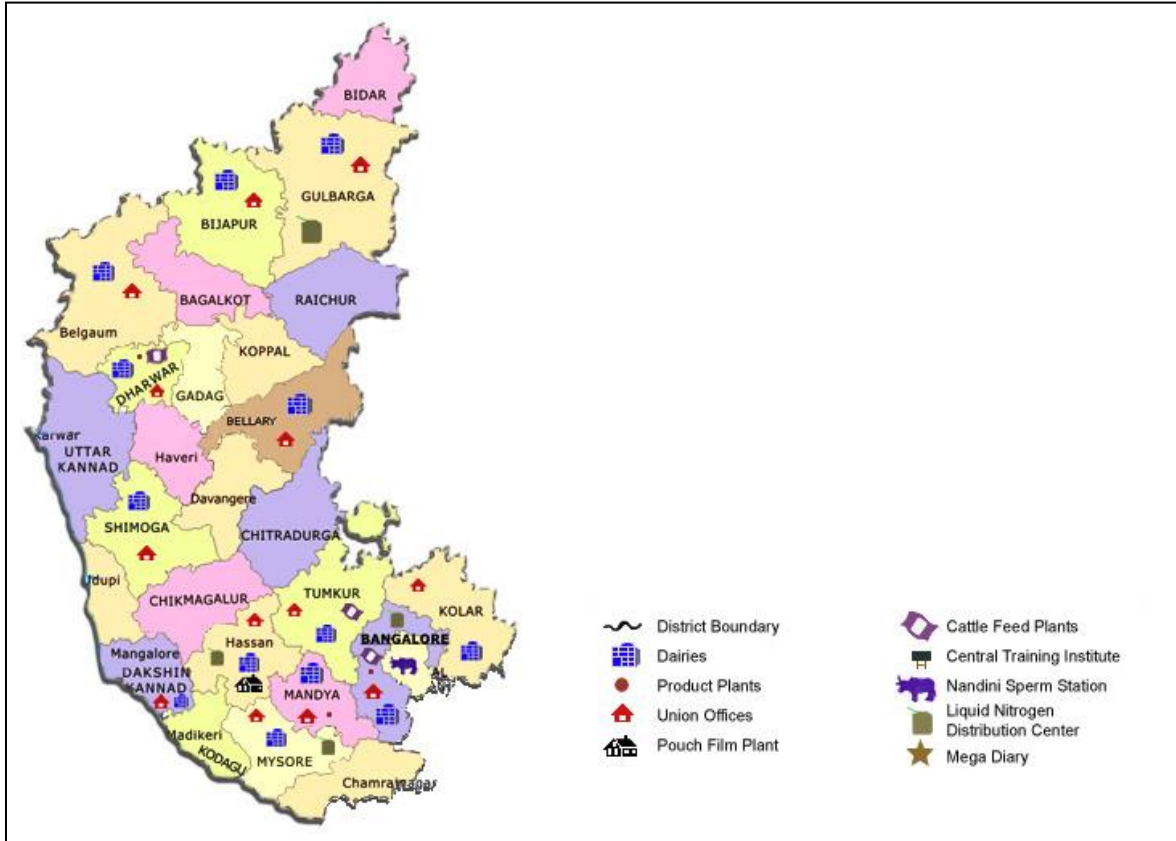


Fig 3.1: Karnataka map showing the locations of dairy units

3.2 Background and history of the plant

In June 1974 an integrated project was launched in Karnataka to recognize and restructure the dairy Industry on the co-operative principles and to lay foundation for new direction in dairy development. World Bank aided dairy development project was initiated in 1975. It initially covered 4 districts namely Mysore, Hassan, Tumakuru, and Bengaluru. The Hassan Co-operative Milk Producer Society Union Ltd. (HCMPSUL) came into existence in the year 1975. It is situated in the industrial estate beside the national highway (NH75) with a primary objective to encourage dairy development activities in the rural area. It was set up to implement the project of Karnataka Dairy

Development Co-operation (KDDC) in 1975. It was registered on 30th March 1977 after formation of milk societies. The certification of ISO 22000:2005, Quality management systems have been implemented for the plant. Milk is collected daily in two shifts from all societies of the Hassan District and it is processed and dispatched to three districts. The products manufactured at Hassan milk union are milk, peda, curd, ghee, butter milk etc. Hassan milk union procures milk from rural areas and offers various activities to dairy co-operative societies like artificial insemination, supply cattle feed, animal health care programs for the benefit of the producers.

3.1.1.1 The list of product mix of HAMUL, 2017-18

The HAMUL	
Installed Capacity: 3,00,000 LPD	
Product Mix	
Liquid Milk	Milk Products
1.Toned Milk	1. Curd
2.Special Toned Milk	2. Peda
3. Homogenized Standard Milk	3. Ghee
4. UHT Milk	4. Butter
5. Butter Milk	5. SMP

3.3 Milk shed area of the plant

Milk shed is the area, from where the milk plant receives milk regularly. Presently, the milk plant is widely spread in a 27 acre plot in the Industrial Area of B.M Road, contains the procuring and processing unit. There are presently 4 chilling centres in following places; Holenarasipura in Hassan district, Birur in Chikkmagaluru district and Shettihally near Channarayapattana and Arasikere. The operational jurisdiction of union extended to 03 districts namely, Hassan, Chikkmagaluru and Kodagu. As at the end of December, 2018, 1517 societies have been registered of which 1445 are functional with 217289 members. Out of the total, 87281 are small farmers, 64302 marginal farmers, 27821 agriculture labourers and 37885 are other big farmers, 15484 belongs to SC members, 5634 belongs to ST members and 93815 are women.

3.4 Structure of the plant

The dairy plant consists of following five major sections viz, Administrative section, Production section and Service section.

3.4.1 Administrative section

Administration functions focuses on two major areas one is implementing of policy decisions of board of the milk union as per the direction of the CEO and prevailing the act of rules. The other one is human resource activities which involves recruitment and maintenance of its human resource strength for which its own establishment section, there are welfare activities of the employees which is looked after by administration and has its own standing orders, document section which is approved by the consultant authorities.

i. ***Management and information section:***

Management Information system has an assistant manager where all the information regarding the organization is provided. This section keeps record of the overall day to day activities of the plant.

ii. ***Security section:***

The security personnel of this section are engaged in patrolling the plant to avoid the risk from trespassers, tightening the security to avoid all types of theft and any physical attack by outsiders.

3.4.2 Finance section

Finance section is where all the billing and accounts are maintained also consists of a manager, assistant manager and an accounts officer where the manager holds the responsibilities of monthly accounts schemes and other bills.

3.4.3 Procurement section

Procurement unit has 2 levels of manger, procurement manager who maintains the society's activities at field level and has a deputy manager under him to take care of all the procurement activities. The Procurement manager is also responsible for implementing and controlling clean milk production schemes and Government schemes. This section is also responsible for the provision of technical cooperation projects of

equipment, supplies and sub-contracts services, in accordance with approved specifications and purchasing procedures. The Section's work is focused on investigation of sources of supply, obtaining price quotations, negotiations with suppliers on price and delivery, preparation of contracts, arranging of transportation, monitoring of the installation of procured milk.

3.4.4 Processing section

The processing and production of milk takes place in this section. This is also known as heart of the plant because the activities of processing and manufacturing of various milk products is carried out in this section.

3.4.4.1 Activities of processing section

Reception, chilling and storage- The milk is received in the plant directly by the tanker and milk can reception where milk cans are unloaded on can conveyer and lid is opened. COB and Adulteration test is done at platform level and cross examined at reception dock lab. Milk from different MPCs are weighed by weighing machine records the weight of the milk from each society and inputs it to the computer database (RMRD) which is all monitored by an employee. The Filter where placed at bottom of weighing bowl to filter; the milk from the can is poured into dump tank (capacity of 2000lts) and then the can is washed through can washer (900cans/hour) with washing soda and hot water, dried using hot air circulation. Milk reception dock and milk collection is done in two shifts every day to keep up with the requirements. After the quality of milk by the quality control laboratory is approved, the milk is taken into the silo through raw milk chiller. The chilled milk is stored in insulated silo tank for further use in the processing of milk and manufacturing of products.

Pasteurization- Milk is pumped from Dump tank to Raw milk Silo through chillers where the milk is chilled to below 5 degree and stored at 4 -5 degrees and then it is transferred to pasteurization unit. There are 3 pasteurizers (02 Unit of 20,000LPH Milk Pasteurizer, 1 Unit of 10,000LPH Pasteurizer and of 10,000LPH Cream Pasteurizer) and in processing area which works under principle of HTST (High temperature Short Time) that is 73.4 degrees for 15 seconds which is then chilled down to 4-5 degrees,

pasteurization is done to kill both pathogens and spoilage causing organisms in the raw milk and to achieve higher shelf life of milk. The milk is pasteurized and standardized using SMP (Skim Milk Powder) and cream and stored at processed milk silos and then milk is pumped to pre-packer for packing into different variants of liquid milk.

Cream separation- The fat content in the raw milk on an average will be 4.5 per cent and if the fat content was found to be higher, then the fat is removed to produce milk with different fat variants and this is done by process of cream separation. Lower fat variant milk such as 3 per cent fat, 1.5 per cent fat, or skim milk (0.1 % fat) is in demand in most markets. This type of milk are produced either by skimming the whole milk partially or by skimming it completely and then adding the requisite amount of cream back to achieve the desired amount of final fat content.

Reconstitution process - this process involves mixing skim milk powder or whole milk powder in milk or water during the lean season in order to increase the desired SNF per cent in the milk. The milk powder is fed to RCM hopper and at the same time milk in the RCM tank is sucked and mixed with milk or water as per the requirement.

Homogenization- is a process where fat globules in cream are broken up in to small size in order make them remain suspended evenly in the milk rather than separating out and floating to the surface.

Cleaning and sanitization- Cleaning of milk processing or manufacturing equipments in a dairy plant is done by a system called Cleaning In Place (CIP). It performs acid or detergent cleaning operations after completion of every processing/ production activity.

Pouch filling- Pouch filling machine also known as Pre-Pac or poly pack machine has been designed specifically for filling of pouch. Prepack Machine works on the principle of Form-Fill-Seal and hence it is also referred to as form fill and seal (FFS) machines. The packing material used is heat sealable plastic film. The film is fed continuously in the form of a roll. The film moves continuously downward in a strip, the film is then folded longitudinally. The edges get heat sealed to make a flat vertical tube. As the continuous cylinder moves downwards, transverse heat seal are made by jaws which

have the effect of closing the bottom of the pouch so that measured volumes of liquid product can be filled into the space. The space above the liquid produces a pillow-shaped flexible pouch or sachet which can be separated from the tube as an individual pack.

3.4.4.2 Activities of product section

During the study period, major products like peda, ghee, butter, curd and butter milk were manufactured here.

Peda manufacturing- It is manufactured in fixed proportion per batch. 80 litres of milk is poured in to peda vat and is heated in a medium temperature steam. Then slowly temperature is increased allowing milk to boil. About 4 kg of sugar is added and is stirred continuously until it reaches creamy coloured semi hard texture. It is then taken from vat and poured in to crate and when cooled it is made in to many pieces of circular shape in a machine then packed and dispatched.

Ghee- butter is used as a raw material in manufacturing of ghee. The butter blocks or the fresh butter taken from continuous butter making machine is put to butter melting vat and the temperature is slowly raised to 115 degree Celsius. Then the temperature is slowly brought down and the ghee residue is allowed to settle down in settling tank. The ghee is then transferred to clarifier tank and then to filling tank. Finally ghee is then tested for quality and packed.

Butter- cream is used as a raw material for manufacturing of butter. The cream which is separated from milk by cream separator is primarily stored in a cream ageing tank and then it is taken to continuous butter making machine. This machine converts cream in to butter and is collected in a vast butter collection tub. The butter is then fed to packing machine which packs the butter in a specified quantity and finally the butter is stored in a cold room.

Curd manufacturing- The pasteurized milk is standardized to get 3 per cent fat and 10 per cent SNF and is stored in HMST tank. Then it is pasteurized at 85-90 degree Celsius, held for 15 minutes and cooled to 35-40 degree Celsius. The culture prepared from laboratory is added, mixed thoroughly, packed in a poly film and then incubated at

35-40 degree Celsius in an incubation room and finally dispatched after storing the sachets in a cold store room.

Butter milk manufacturing- The standardized curd is mixed with potable pasteurized water then a masala filtrate which is extracted from pulverizer is added and the quality and taste is checked. Then the product is filled in a poly film and stored under below 5 degree Celsius.

3.4.5 Service block

This block includes the various sections that aid in processing or manufacturing the different milk products. These sections are boiler section, electrical section, refrigeration section, mechanical section, water softening plant, quality control lab and an effluent treatment plant to treat the waste water in order to reduce the pollutant content in it and to make use of recycled water for the purpose of gardening, cleaning the outdoor sites, cleaning the drainages etc.

Boiler section- steam is an important component in milk plant which is required to heat the raw milk or other products in manufacturing process and also for various general cleaning purposes like cleaning the milk cans, crates, equipments especially by CIP section where hot water is required etc. this production and supply of steam is done by boiler section. Two boilers were installed during the study period and the fuel used in it is fire wood. The one of them will be in use continuously and the other will be used when the former needs to be serviced or repaired.

Electrical section- electricity is needed for running the machines, motors, equipments and other electrical equipment's. Karnataka electricity Board provides electricity to the plant. At the sub-station, High voltage (11 KV A) is supplied and is stepped down through a step down transformer to low voltage (440 volts) to avoid line losses.

Refrigeration Section- this section provides chilled water to processing and product section for removing the heat from the substance to lower down the temperature to the desired level than that of the surroundings which helps in long shelf life of the products. It also maintains cold temperature in the cold storage room where the milk and milk products are stored for a temporary period before dispatch.

Water supply- the source of water for the plant is from underground. The plant has its own four tube wells from which ground water is pumped. An overhead tank of 1 lakh

litre capacity is constructed to where water is pumped from underground and is supplied to various sections of the plant and also for various other uses.

Quality control lab- the quality aspects of raw milk, milk and milk products is looked after by this section. Its job is spread across milk reception to milk and milk products dispatch. Also the quality of raw water and effluents from used water is also tested by this lab. This is done to keep vigilance on the quality management of the plant.

Mechanical section- this section includes the work shop where the equipments which are required for milk processing are repaired and serviced. It makes small tools and vessels that are used in day to day activities. Overall the function of the workshop is to provide services of mechanics for repairing and regular maintenance of the equipments and machinery Installed in the premises of the plant.

Effluent treatment plant- these plants treats waste water released from plant and make it usable for irrigation and other secondary activities. Waste water goes through a series of processes. Waste water from drainage system is pumped to collection tank, from where the water enters the equalization tank and then it is pumped in to the aeration tank where the smell of polluted water is removed then the less smelly water is then drained to fan tank and then to clarifier tank. The sludge is separated out in binoge tank and the water free of sludge is pumped to filter tank. This is the last stage of water treatment and treated water is used for irrigation purpose in the Plant campus.

3.5 Data and its source

The data for the study milk plant during 2017-18 were collected from the records maintained by different sections of the milk plant. Various methods were used to collect data to fulfill different objectives. To estimate the energy utilization during manufacturing process of milk products, data were collected by taking actual observations during products manufacturing, conducting time and motion study during manufacturing of products and discussions with the concerned persons who were looking after different activities of the plant. The actual observation method was adopted to get information on consumption of water in different sections of the plant, Time and motion study was done in order to record the time and different activities done by a single person, labour used in manufacturing different products, running hours of the equipments and machines etc.

The personal discussion and interview method was made to obtain data on electricity consumption in different plant sections, offices and streetlights consumption. Discussions were made with the machine operators and in-charge of different sections. The records were looked upon to get information on the various traits like daily raw milk received with Fat and SNF content by the plant during the study period, price paid for milk, raw material used by different sections of the plant for manufacturing various products, output of different products, salary and other benefits of the staff and contract labourers, fuel used in boilers, generators and other sections, spare parts, electricity bills, telephone bills, interest paid on loans other recurring expenditures of the plant, chemicals used for testing of samples in the quality control section, running hours of different machines ,capacity of the motors, current and voltage drawn by the motors fitted with different equipments from the log book maintained by different section or units.

3.6 Analytical procedure

3.6.1 Resource utilization in the plant for manufacturing different milk products

The resource utilizations were studied are:

- i) Electricity and Power consumption
- ii) Steam Utilization
- iii) Refrigeration Utilization
- iv) Water Utilization
- v) Human Resource Utilization

i) Electricity and electric power consumption:

Electric Power was calculated as: In case of single-phase system:

$$\text{Power} = \frac{V_L * I_L * \text{Cos}\phi}{1000} = \text{KWH}$$

In case of three-phase system:

$$\text{Power} = \frac{\sqrt{3} * V_L * I_L * \text{Cos}\phi}{1000} = \text{KWH}$$

Where,

$$\begin{aligned} V_L &= \text{Line voltage} \\ I_L &= \text{Line current} \\ \text{Cos}\phi &= \text{Power factor assumed (0.8) (Theraja and Thraja} \\ &1992) \end{aligned}$$

Electricity consumed for street lights, tube, lamps, computers and other electric appliances was calculated by watt and hour method.

$$\text{Electric load} = \frac{\text{Hours} \times \text{Watts}}{1000} = \text{Kilowatt hours}$$

ii) Steam requirement was calculated by the given formula:

$$\text{Steam Requirement (kg.)} = \frac{M \times S \times T}{L}$$

Where,

$$\begin{aligned} M &= \text{Quantity of the product to be heated (kg.)} \\ S &= \text{Specific heat of product} \\ T &= \text{Temperature difference (T}_1\text{-T}_2\text{, initial and final} \\ &\quad \text{Temperature of the product in centigrade)} \\ L &= \text{Latent heat of steam} \end{aligned}$$

iii) Refrigeration utilization was studied as follows:

$$\text{Refrigeration load in Kilocalories /hour} = (M \times S \times T) / t$$

Where,

$$\begin{aligned} M &= \text{Quantity of product to be cooled (kg)} \\ S &= \text{Specific heat of the product} \end{aligned}$$

T = Temperature difference in centigrade (T_1-T_2) (Ahmed, 1997)
t = Time duration

iv) Water utilization was studied as follows:

The plant has its own tube well and overhead water tank for storing of water. So the cost of extracting ground water per kilolitre was worked out and the cost of preparing soft water was added to the cost of raw water for arriving at the cost of soft water. The soft water was mainly used for mixing in the products, steam generation and refrigeration section. The raw water was used for cleaning, washing crates and gardening.

The water consumption was worked out for the boiler section as per the capacity of the boiler to evaporate water per hour. The water used in the refrigeration section was estimated in consultation with the in charge and the operator of the refrigeration section. The water consumption in different section of the production block for cleaning operations in the plant, cleaning of trays and other specific purpose was estimated by taking the actual operations from the water flow from the hose pipes, time of water flow and quantity of water.

v) Human resource utilization:

In a dairy plant, single person was engaged in performing more than one activity particularly in production section of the plant. For example production manager looks after ghee production as well as the pouch filling operation with the assistance of other staff. So the man hours used for performing different activities were worked out by taking the actual observations by conducting the time study. Finally, man hours employed for manufacturing a particular product was multiplied with the per hour salary/wages of the concerned person. In case of contract Labour, the wages were directly allocated to that job/ product for which the Labour was hired.

3.6.2 Estimating the cost of manufacturing of different milk products and profitability.

For computing the cost items, whole expenditure was classified into fixed and variable costs as below:

$$\text{Total Cost} = \text{Total Fixed Cost} + \text{Total Variable Cost}$$

Table-3.6.2 Different cost components considered

Sl. No	Components	Sl. No	Components
1	Raw material	9	House keeping
2	Electricity	10	Depreciation on building
3	Water	11	Depreciation on equipment and machinery
4	Steam	12	Expenditure on manpower
5	Refrigeration	13	Quality control
6	Repair and Maintenance	14	Interest on plant equipment and machinery
7	Store and stationary	15	Milk and milk solid losses
8	Packing material	16	Miscellaneous expenses

3.6.2.1 Fixed costs:

Fixed costs are those costs which do not vary with the level of production.

Following costs were categorized as the fixed costs of the plant.

Watch and ward expenses -Watch and wards are the expense of the plant for its security, which was given on annual contract. The total expenditure of the security contract was apportioned among different products on the basis of their value.

Street light expenses -Street light expenses are those expenses on tube lights on the roads and around the plants for security reasons and are apportioned on the basis of value of the products.

Depreciation on building and machinery- Depreciation is a loss in the value of an asset due to its wear and tear. Depreciation on the building/ equipment was worked out by straight-line method. The life of the building depends upon the quality of construction, care and maintenance of the building. The depreciation rate of 2.5 per cent was

charged on the building as per the discussion with engineers of the plant ensuring that expected life of building is 40 years. In case of working out the depreciation on machinery/ equipments like moving machines, compressors, motors, still equipments, double jacketed equipments (silo tanks) and boilers, the useful life of different types of equipments and machinery is determined 15 to 25 years in consultation with the engineers of the plant.

Interest on investment- The interest on fixed capital was taken into account as such the actual amount paid toward interest by the plant during the financial year. The interest rate was taken to be 7.7 per cent.

3.6.2.2 Variable costs:

Variable costs are those costs which vary with the level of production. Higher the production, higher will be the extent of variable costs. The following costs were grouped into variable costs of the plant.

Store maintenance- The expenditure incurred on repair and maintenance of equipment, machinery and building was allocated as per the records maintained in the store and included in the separate store maintenance head.

Labour charges- It comprises the salaries, allowances and other benefits and facilities entitled to the employees. Time studies were conducted to arrive at Labour-time spent in manufacturing the individual products and accordingly labour cost was apportioned.

Quality control expenditure- The expenditure incurred in the quality control section of the plant was classified into fixed and variable costs. Expenditure on fixed costs such as depreciation on building and equipments was apportioned among different products on the basis of the value of the products. The expenditure on variable costs like chemicals was apportioned in different products on the basis of the material used in the sample tested for different products.

Refrigeration charges- The role of the refrigeration section is to provide chilling water and maintain the required temperature in the cold stores of the plant. The cost of one

kilocalorie of refrigeration was worked out and it was multiplied with the kilo calories required in extracting the heat from a particular product.

Electricity charges- The electricity energy can be estimated accurately if the separate energy meters are installed in each section of the plant. If the energy meters in different sections of the plant were not installed, then in order to measure the power and electricity consumption, watt hour method was used to estimate the electrical energy consumed by street lights, tube light, ceiling fans, exhaust fans, wall fans, lamps, computers, air conditioners, impellers of the cold stores and other electric points around the buildings of the plant. The power consumption for running the machines for performing different operations in the production and auxiliary units was calculated on the basis of the actual current drawn, line voltage and power factor method by using the formulas presented in the analytical frame work.

Steam charges- Steam is the root source of heat for general use in the dairy plant because of its economy, flexibility, and other attributes, which adopt it for conveying large quantities of heat from a heat source to the product to be processed. To arrive at the cost of total steam/ steam used in different products, first of all the cost of production of one kg of steam produced was calculated and then it was multiplied with the quantity of steam used in different operations and for manufacturing different products. The quantity of steam used in different products and for boiling the water was worked out by using the formula given in the analytical framework.

Water charges- As the milk plant has its own tube well and cemented overhead water tank for ensuring the regular supply of water for performing different operations of the plant. So the cost of extracting ground water per kilolitres was worked out. The cost of preparing soft water was also separately calculated and added in the cost of raw water for arriving at the cost of soft water. The soft water is mainly used for mixing in the products, steam generation and refrigeration section. The raw water is used for cleaning and washing crates etc.

Raw material cost-The raw material cost includes all the expenditure on milk and other material inputs, like sugar, salt. Citric acid, flavors etc. used for manufacturing particular

product. Milk losses were also included in the raw material. The cost of raw milk used in manufacturing different products was calculated on the basis of fat price paid by the plant during the financial year under study. As the plant received mixed milk (cow and buffalo milk) and the data on price paid by the plant on the basis of fat contents was collected from the records of the plant. The fluctuations in price of raw milk were observed during the period of study. So the weighted average of the price of raw milk was taken into account. The cost of raw milk was computed for different products on the basis of FAT and SNF contents in different products.

Miscellaneous expenses- Miscellaneous expenses include the small expense on dusters, soap cakes, detergents, cleaning and sanitation material, glasses, towels used in different sections.

3.6.2.3 The Joint costs

There are some joint costs in the plant like electricity, steam, labour, administration and refrigeration. The apportioning of joint cost was done and allocated according to the value of a product. Higher the value of a product, higher will be the amount of costs allocated to that product (Ali, 2014; Chauhan et al, 2015 and Ripi, 2016 also apportioned the costs in the similar way in their studies).

3.6.2.4 Profitability of product

Price at dock is the price of the product realized by the plant. This price is taken in to consideration while working out the profit margin of various products manufactured. The cost of manufacturing of various products is subtracted from the price of product realized by the plant and the difference is divided by cost in order to obtain profit margin.

- Gross profit is obtained by subtracting raw material cost and cost involved in processing of the product except fixed cost from the revenue of the product.

Gross Profit = Total Revenue - variable cost involved in
manufacturing of the product
Gross Profit Margin = (Gross Profit / Total Revenue) * 100

- Operating profit is obtained by deducting the operating expenses from the revenue of the product.

Operating Profit = Total Revenue - {variable cost+
(Administrative+ Marketing+
General) cost}
Operating Profit Margin = (Operating Profit/ Total Revenue)* 100

- Pre-tax profit is also called as Net income before tax and it is obtained by deducting all the costs involved in manufacturing the product excluding tax component from the revenue of the product.

Pre-tax Profit = Total Revenue - {variable cost+ Fixed Cost}
Pre-tax Profit Margin = (Pre-tax Profit/ Total Revenue)* 100

- The net profit is the Net income after tax. To obtain the Net profit, first the tax percentage is applied to total revenue of the product to get the amount of tax for the product. It is then added to cost and the resultant is subtracted from revenue of the product.

Net Profit = Total Revenue - {Total cost+ (Total Revenue*Tax %)}
Net Profit Margin = (Net Profit/ Total Revenue)* 100

3.6.3 Break-even level of different milk products:

Break- even level is that level of output where the plant is neither making profit nor making loss.

Break-even output was worked out with the following method:

- $TR=TC$ (1)
- $P \times Q = TFC + (AVC \times Q)$ (2)
- $P \times Q - (AVC \times Q) = TFC$ (3)
- $(P-AVC) \times Q = TFC$ (4)
- $Q = \frac{TFC}{P - AVC}$ (5)

Where,

- TR = Total revenue,
- TC = Total cost
- P = Price of the product
- Q = Break- even output
- TFC = Total fixed cost and
- AVC = Average variable cost

3.6.3.1 Margin of Safety

It is the percentage of quantity of product, which is above the Break-even quantity or Break-even point (BEP).

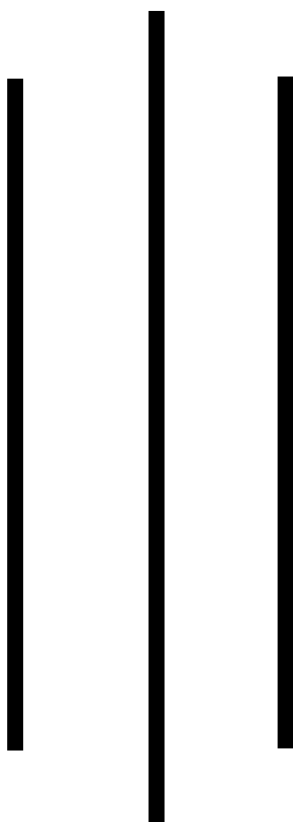
$$\text{Margin of safety} = \{(A_Q - B) / A_Q\} * 100$$

Where,

A_Q = Actual Quantity of the Product Produced

B = Break-even Quantity of the Product

CHAPTER - 4



RESULTS AND DISCUSSION

4. RESULTS & DISCUSSION

This chapter presents the results which are obtained from the analysis of data that were collected as per the objectives during the study period. The results are presented under the following headlines:

- 4.1 Resource utilization in the plant for manufacturing different milk products.
- 4.2 Cost of manufacturing different milk products in the plant and their profitability
- 4.3 Break-even level of various milk products manufactured in the plant.

4.1 Resource utilization in the plant for manufacturing different milk products.

Studying the pattern and the extent to which the resources are being utilized in the milk plant is important to ensure its proper allocation and improving its efficiency. It helps in finding the loop holes in managing the resources and to make efforts to reduce the losses of scarce resources. Analyzing the resource utilization is a required prior condition in order to work out the cost of manufacturing different milk products in the plant and therefore the data pertaining to this objective is analyzed and is presented below.

4.1.1 Electricity utilization

The data on electricity consumption by the plant was collected from different sections and were organized in Table- 4.1.1. The total electricity consumption in the plant during the financial year i.e. from April 2017 to March 2018 was 2372 thousand units. The data were obtained from electrical section of the plant where the records on different sections regarding electricity consumption units were maintained. Electricity and power consumption was estimated where energy meters were not installed.

With different sections consuming electricity, the major portion of electricity was consumed by refrigeration section (44.5%) which is followed by Skimmed Milk Powder

(SMP) section (18.8%). The processing, product and packaging sections together consumed 20.7 per cent of total electricity. In processing section toned milk, special toned milk, standard milk, curd and butter milk were manufactured and were packed in packaging section. The electricity cost of these sections were apportioned among products produced according their value.

Table- 4.1.1 Electricity consumption by various sections in a plant (2017-18)

Sl. No	Section	Annual Electricity consumption ('000 units)	Annual Electricity Consumption (%)
1	Refrigeration	2068	44.55
2	Processing/ pasteurization	444	09.50
3	Packaging (milk, buttermilk, curd)	481	10.37
4	SMP	876	18.88
5	Boiler	244	05.26
6	Effluent Treatment Plant (ETP)	236	05.00
7	Tube well	112	02.42
8	Product (butter, ghee, peda)	42	00.92
9	Miscellaneous*	136	02.95
	Total	4642	100
	UHT Milk Plant	2372	

Miscellaneous are the electricity consumption by fan, , street light, tube lights, A.C and exhaust fan, conference hall, canteen, toilets, security, quality control and store room.*

4.1.2 Steam requirement

Steam is generated through a boiler having a capacity of 4 ton per hour, which is being installed in a boiler section of the plant. The generated steam is used for multi purposes like pasteurizing milk, heating the milk product during its manufacturing process, cleaning of cans, cleaning in place etc. There was no provision to calculate steam condensate since the condensate was attached directly to underground drainage system. The steam required by various products was calculated by recording the initial

temperature of milk, final temperature of product and temperature of semi-finished material during manufacturing process and also through consulting respective operators. The steam which was used for miscellaneous operations like can washing, cleaning in place etc. was calculated and was apportioned among products based on their revenue generated in plant.

The amount of steam produced during the study period 2017-18 was 13140000 kg. The steam utilization by different products during their manufacturing process is summarized in the Table- 4.1.2. The steam requirement for Ghee is estimated to be 0.12kg per 1000ml, 0.08 kg for 1000ml UHT milk and 0.08 kg for 1kg SMP, 0.02 kg for Pasteurizing 1000ml milk and 0.03 kg for Peda.

Table- 4.1.2 Steam utilization by various products in the milk plant (2017-18)

Sl. No	Particulars	Steam requirement (kg/unit)
1	Pasteurized Milk (1000ml)	0.02
2	Curd (1000gm)	0.05
3	Ghee (1000ml)	0.12
4	Peda (1kg)	0.03
5	UHT Milk (1000ml)	0.08
6	SMP (1kg)	0.08

4.1.3 Refrigeration utilization

Some products required chilled water during their processing. The chilled water brings down the temperature of the products making them suitable for further processing, packing etc. The refrigeration utilization for miscellaneous uses like cold store room is apportioned among the various products based on their value.

The refrigeration utilization by various products is tabulated in Table-4.1.3 which reveals that about 11.88 Kcal of refrigeration per hour was utilized during pasteurizing

1000 ml of milk, 26.4 Kcal/1000ml/hour by curd and 10.71 Kcal/1000ml/hour by UHT milk.

Table-4.1.3 Refrigeration utilization by various products in the milk plant (2017-18)

Sl. No	Particulars	Refrigeration requirement (Kcal/unit/hour)
1	Pasteurized Milk (1000ml)	11.88
2	Curd (1000ml)	26.24
3	UHT milk (1000 ml)	10.71

4.1.4 Water utilization

Water is one of the most important resources required by the plant to process milk and manufacture milk products. It is used in pasteurization of milk, products manufacture and miscellaneous operations like Cleaning in Place (CIP), crate washing, cleaning floors, refrigeration, drinking purposes, labs, toilets etc. The plant has its own tube wells as sources of water. The water is lifted up and stored over the overhead tank from where it is supplied to different sections and purposes. The water utilization by different sections and for various purposes like cleaning crates, washing cans and other specific activities was estimated by taking actual observations from hose pipes by through water flow rate. Consultations were also made with operators and engineers regarding water requirement for refrigeration, CIP and boiler sections.

The water utilization in different sections was estimated and is summarized in Table-4.1.4. The major portion of water in the plant was utilized for cleaning of crates (31.58%) followed by pasteurization section (18.43%), Curd and butter milk section (8.68%). The water used for miscellaneous operations include drinking purposes, quality control, cleaning floors etc. The total water used in the plant during the study period 2017-18 was 4,60,000 litres per day (LPD) including the UHT Milk plant. The water use ratio of the plant was worked out to be 1:1.57 which means that in order to process a litre of milk about 1.57 litres of water was utilized. In a similar study conducted by Ali during 2013-14 found that the water use ratio was 1:1.54 and Chauhan

et al. during 2015-16 found that the water use ratio was 1:1.52. The efficient use of water is a must to reduce water cost in a litre of milk.

Table-4.1.4 Water utilization by different section of the milk plant (2017-18)

Sl. No	Major sections	Water requirement (kilolitres/day)	Water Utilization (%)
1	Pasteurization Section	70000	18.43
2	Cleaning in Place	30000	07.90
3	Crate washing	120000	31.58
4	Boiler section	25000	06.57
5	Curd and butter milk	33000	08.68
6	Refrigeration	25000	06.58
7	Miscellaneous	28000	07.36
8	Product section	23000	06.06
10	SMP	26000	06.84
11	Total	380000	100
	UHT Milk Plant	800000	
	Water utilization ratio	1:1.57	

4.1.5 Human resource utilization

Dairy industry provides an employment opportunity to many which aid in finding a way for their livelihood. Though in recent years there has been an attempt in modernizing dairy industry through making it fully automated. The industry still requires human resources like skilled and semi-skilled labourers, engineers, security personals, dairy technicians and lab technicians for making standard quality products, administration staff to look after the different types of activities of the plant.

Table-4.1.5.1 Permanent staff utilization by different sections of the plant (2017-18)

Sl. No	Different Sections	Number of Permanent employees	Percentage Share
1	Electrical & Mechanical	12	15.18
2	Security	12	15.18
3	Accounts	12	15.18
4	Reception dock	7	8.86
5	Administrative	7	8.86
6	Packing	4	5.06
7	Refrigeration	4	5.06
8	Quality control	4	5.06
9	Product section (Ghee, Butter, peda)	4	5.06
10	Processing/ pasteurization	3	3.79
11	MIS	3	3.79
12	SMP	3	3.79
13	Curd & Buttermilk section	2	2.53
14	CIP	1	1.26
15	ETP	1	1.26
	Total	79	100
	UHT Milk Plant	12	

Human resource employed in the plant is grouped in to two categories namely permanent and contractual man power. Table 4.1.5.1 depicts the permanent man power employed in different sections of the plant. The highest number of employees were observed in Electrical & Mechanical, Security and Accounts sections which is 15.18 per cent in each followed by Reception block and Administrative section (8.86% each), Packing, Refrigeration, Quality control and Product sections each sharing 5.06 per cent, Pasteurization, SMP and Management Information Systems (MIS) sections each share

3.79 per cent, curd and butter milk (2.53%), CIP and ETP sections each shares 1.26 per cent.

Table-4.1.5.2 Contractual labour utilization by different sections of the plant (2017-18)

Sl. No	Sections	Number of Contractual labourers	Percentage share
1	Packing	21	19.62
2	Boiler	13	12.14
3	Reception dock	11	10.28
4	Electrical & Mechanical	10	9.34
5	SMP	10	9.34
6	Product section (Ghee, Butter, peda)	8	7.47
7	Security	8	7.47
8	Quality control	6	5.60
9	Accounts	6	5.60
10	Processing/ pasteurization	5	4.67
11	Refrigeration	3	2.80
12	Curd & Butter Milk	3	2.80
13	CIP	2	1.86
14	ETP	1	0.93
	Total	107	100
	UHT Milk Plant	163	

Contractual labourers employed in different sections of the plant are depicted in the table-4.1.5.2. This table shows that the highest contractual labourers are employed in Packing section (19.62%) followed by Boiler section (12.14%), Reception Dock (10.28%), Electrical and Mechanical section and SMP section each sharing 9.34 per cent, Production section and Security section each sharing 7.47 per cent, Quality control and Accounts sections each shares 5.06 per cent, Processing/ Pasteurization

section (4.67%), Refrigeration and Curd & Butter milk sections (2.80%), CIP (1.96%) and finally ETP (0.93%).

4.1.6 Cost of Resource Utilization in Plant

4.1.6.1 Cost of steam production

Steam is the main source of heat energy in the plant which is used for pasteurizing the milk, manufacturing products and also for miscellaneous activities like can washing, crate cleaning, CIP etc. It is generated through boilers which have been installed in the plant. There are two boilers in the plant each having a capacity of four ton per hour and the fuel used in it is fire wood. One boiler remains in use continuously and the other will be on standby mode and is operated as and when required or when the other is under maintenance. Along with these two boilers there is a separate boiler for UHT milk plant which is of one ton per hour capacity. Since, much more steam is required by UHT milk processing and for other miscellaneous activities in the UHT milk plant, a separate boiler is installed.

The total amount of steam produced during the study period 2017-18 was 13140000 kg by processing plant boiler whereas 1460000 kg of steam was generated by UHT milk plant boiler. The Table 4.1.6.1 shows the cost of steam production and it can be seen that about ₹1.14 has been calculated in producing a kilogram of steam from the processing plant boiler. Various cost components are involved in producing a steam in which the fuel cost alone has accounted 61.16 per cent of total cost followed by Labour cost (18.11%), Electricity cost (10.72%), Depreciation and Interest (4.19%), Soft water cost (3.5%) and Repair and maintenance cost (2.33%). The Table-4.1.6.2 shows the cost of steam production by UHT milk plant boiler. Among various cost components involved, fuel cost shares 55.8 per cent of total cost of steam production followed by Labour cost (16.8%), Depreciation and Interest (16.7%), Electricity (6.66%), Soft water (2.08%) and Repair and Maintenance (1.86%).

Table 4.1.6.1.1 Cost of steam production processing plant boiler (2017-18)

Components	Expenditure / annum (‘000₹)	₹/kg	Cost (%)
Variable cost			
Electricity	1612	0.12	10.72
Labour	2723	0.20	18.11
Soft water	525	0.04	3.5
Repair and maintenance	350	0.02	2.33
Fuel (wood)	9198	0.7	61.16
Subtotal (A)	13899	1.05	95.80
Fixed cost			
Depreciation	195	0.01	1.29
Interest	435	0.03	2.89
Subtotal (B)	630	0.04	4.19
Total (A+B)	15040	1.14	100
Total steam production in 2017-18	13140000 kg		

4.1.6.2 Cost of water pumping

Water being an important resource is utilized by all the sections of the plant. As discussed previously, the water use ratio in the plant during the study period 2017-18 was 1:1.57. The total quantity of water utilized by the plant during 2017-18 was 1679 kilo litres. The cost of water pumping was ₹6.5 per kilo litre of water which is depicted from the Table-4.1.7. Among various cost components involved, 67.76 per cent of total cost of water pumping was shared by Electricity alone which is followed by Potassium iodate (14.56%) used for softening water, Labour cost (7.78%), Repair and Maintenance cost (6.86%) and Depreciation and Interest (2.93%).

Table 4.1.6.1.2 Cost of steam production of UHT milk Plant boiler (2017-18)

Components	Expenditure /annum (‘000₹)	₹/kg	Expenditure (%)
Variable cost			
Electricity	179	0.12	6.66
Labour	453	0.31	16.8
Water	56	0.03	2.08
Repair and maintenance	50	0.03	1.86
Fuel (wood)	1500	1.02	55.8
Subtotal (A)	2239	1.53	83.3
Fixed cost			
Depreciation	117	0.08	4.35
Interest	332	0.22	12.3
Subtotal (A)	449	0.30	16.7
Total (A+B)	2689	1.84	100
Total steam production in 2017-18	1460000 kg		

4.1.6.3 Cost of refrigeration

The refrigeration capacity of the plant is 165 tonnes of refrigeration per hour. The total Tonnes of Refrigeration (TR) produced in a plant during the study period 2017-18 was 1204500 TR. The Table 4.1.8 depicts that the cost of Refrigeration is ₹13.46 per kilo litre of water wherein about 79.10 per cent of total cost is utilized by electricity which is followed by Labour cost (15.20%), Depreciation and Interest (3.99%), Repair and Maintenance (1.61%) and Water cost (0.09%).

Table-4.1.6.2 Cost of pumping the water in a Plant (2017-18)

Components	Expenditure ('000₹)	₹/kilolitre	Expenditure (%)
Variable cost			
Electricity	740	4.4	67.76
Labour	85	0.50	7.78
Potassium iodate	159	0.94	14.56
Repair and maintenance	75	0.44	6.86
Subtotal (A)	1060	6.31	97.06
Fixed cost			
Depreciation	15	0.09	1.37
Interest	16	0.09	1.46
Subtotal (B)	32	0.19	2.93
Total cost (A+B)	1092	6.5	100
Cost per litre of water		0.0065	

4.2 Cost of manufacturing different dairy products and profitability of products

The cost of manufacturing various products is calculated and the cost is categorized in to variable cost and fixed cost, total cost and per unit cost are also depicted in tables of this section. Profits can be calculated only if cost estimates are available.

4.2.1 Toned milk

The toned milk variant contains 3 per cent Fat and 8.5 per cent Solid Not Fat (SNF) and is one of the most consumed milk variant. Its total production during the study period 2017-18 was 2931489 litres and the cost of manufacturing was worked out to be ₹28.49 per litre. The variable cost shares 94.98 per cent of total cost of manufacturing whereas the fixed cost share is about 5.02 per cent of total cost. The important costs considered for representing the total cost of manufacturing were raw material cost which shares 88 per cent of total cost, processing cost (10%) and

packaging cost (2%). The Table 4.2.1 depicts the cost components of toned milk and Fig. 4.2.1 gives the percentage share of major costs grouped in to raw material, processing and packaging costs.

Table-4.1.6.3 Cost of refrigeration in the milk plant (2017-18)

Components	Expenditure/annum (‘000₹)	Expenditure (%)	Cost of Refrigeration per kilolitre of Water
Variable cost			
Electricity	15698	79.10	13.03
Labour	3006	15.20	2.49
Water	18	0.09	0.01
Repair and maintenance	320	1.61	0.26
Ammonia	61	0.31	0.05
Subtotal (A)	19042	96.01	15.80
Fixed cost			
Depreciation	311	1.57	0.25
Interest	479	2.42	0.39
Subtotal (B)	791	3.99	0.65
Total cost (A+B)	19834	100	16.46
Tonnes of Refrigeration in 2017-18	1204500 TR		

4.2.2 Special toned milk (STM)

The Special Toned milk has 4 per cent fat and 9 per cent SNF. The total production of STM during the study period was 6011022 litres. The cost of manufacturing STM was found to be Rs. 34.32 per litre and the share of variable cost was 95.31 per cent whereas the fixed cost share was 4.69 per cent. The share of raw material, processing and packaging was 88 per cent, 9 per cent and 3 per cent respectively. Table-4.2.2 shows the cost components of manufacturing STM and Fig.

4.2.2 depicts percentage share of its major costs i.e. raw material, processing and packaging costs.

Table-4.2.1 Cost components of toned milk (2017-18)

Sl. No	Cost Components	Expenditure/annum ('000₹)	₹/1000ml	Expenditure (%)
A	Variable cost			
1	Raw material	73698	25.13	88.20
2	Electricity	442	0.15	0.52
3	Labour	639	0.21	0.76
4	Water	32	0.01	0.03
5	Steam	669	0.22	0.80
6	Refrigeration	740	0.25	0.88
7	Packaging material	1806	0.61	2.16
8	Quality control	188	0.06	0.22
9	Miscellaneous	1137	0.38	1.36
	Subtotal 1	79356	27.06	94.98
B	Fixed cost			
11	Administration & Overhead expenses	3682	1.25	4.40
12	Depreciation & interest	515	0.17	0.61
	Subtotal 2	4197	1.43	5.02
	Total (A+B)	83554	28.49	100
	Total Annual Production	2931489 litres		

4.2.3 Standard milk

The Standard Milk variant has 4.5 per cent of Fat and 8.5 per cent of SNF. Its total production during the year 2017-18 was 18456873 litres and the cost of manufacturing was found to be ₹34.44 per litre. The share of variable cost and the fixed cost was 95.31 per cent and 4.69 per cent of the total cost respectively. The share of raw material cost, processing and packaging costs were 88 per cent, 9 per cent and 3

per cent. Table-4.2.3 shows the cost components of Standard milk and Fig. 4.2.3 depicts percentage share of its major costs divided in to three groups.

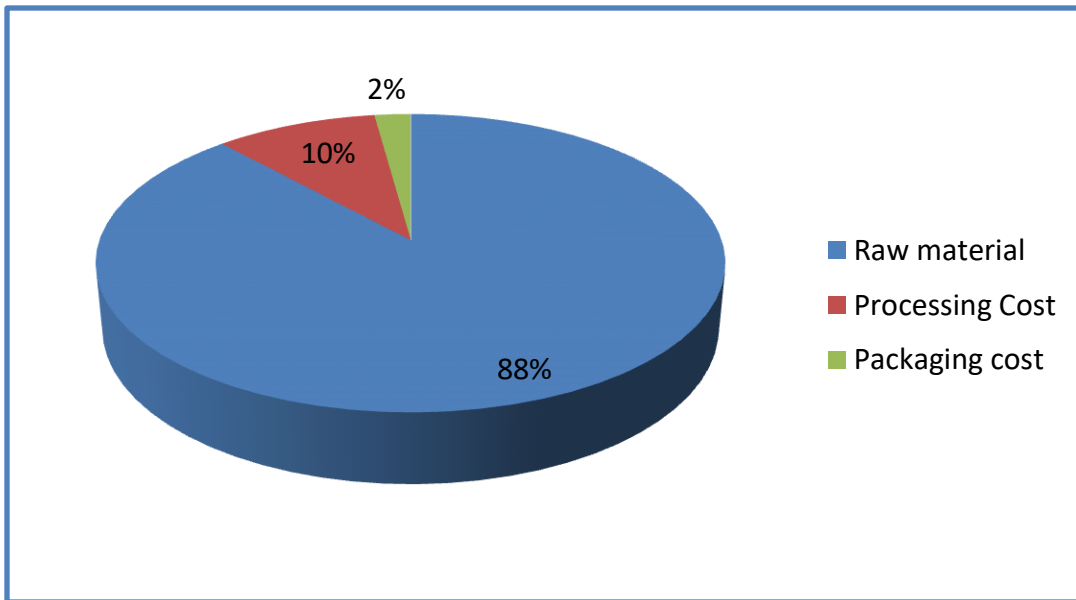


Fig. 4.2.1 Share of Major Cost Components of toned Milk

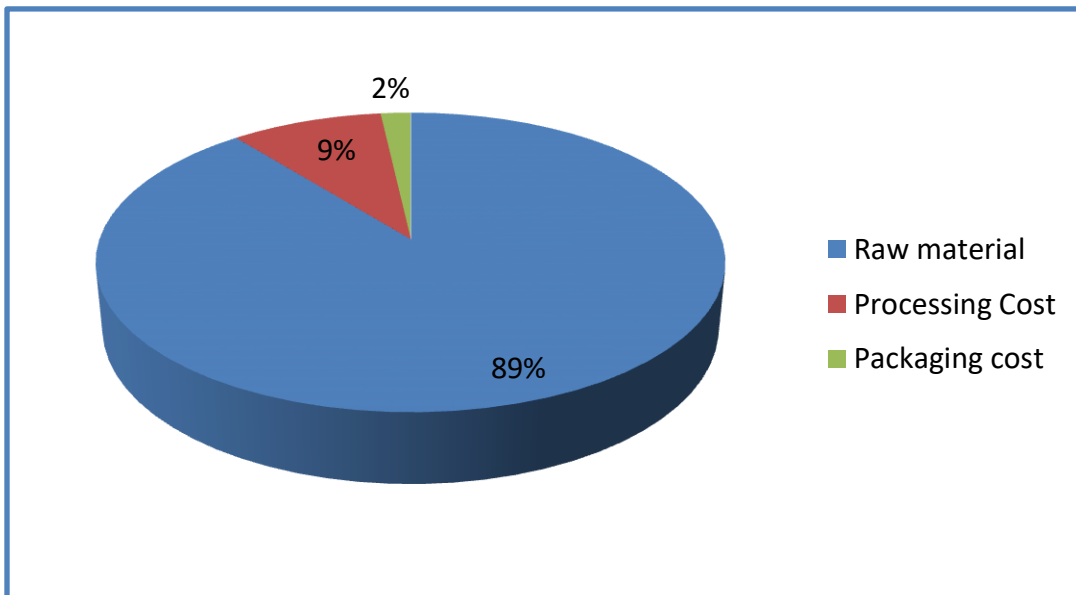


Fig. 4.2.2 Share of major cost components of STM

Table-4.2.2 Cost Components of Special toned milk (2017-18)

Sl. No	Cost Components	Expenditure/ Annum ('000₹)	₹/1000ml	Expenditure (%)
A	Variable cost			
1	Raw material	184029	30.6	89.16
2	Electricity	1115	0.18	0.54
3	Labour	1452	0.24	0.70
4	Water	69	0.01	0.03
5	Steam	1842	0.30	0.89
6	Refrigeration	1638	0.27	0.79
7	Packaging material	3705	0.61	1.79
8	Quality control	428	0.07	0.20
9	Miscellaneous	2582	0.42	1.25
10	Subtotal 1	196864	32.73	95.39
B	Fixed cost			
11	Administration & Overhead expenses	8358	1.39	4.05
12	Depreciation & interest	1169	0.19	0.56
	Subtotal 2	9527	1.58	4.61
	Total (A+B)	206392	34.32	100
	Total Annual Production	6011022 litres		

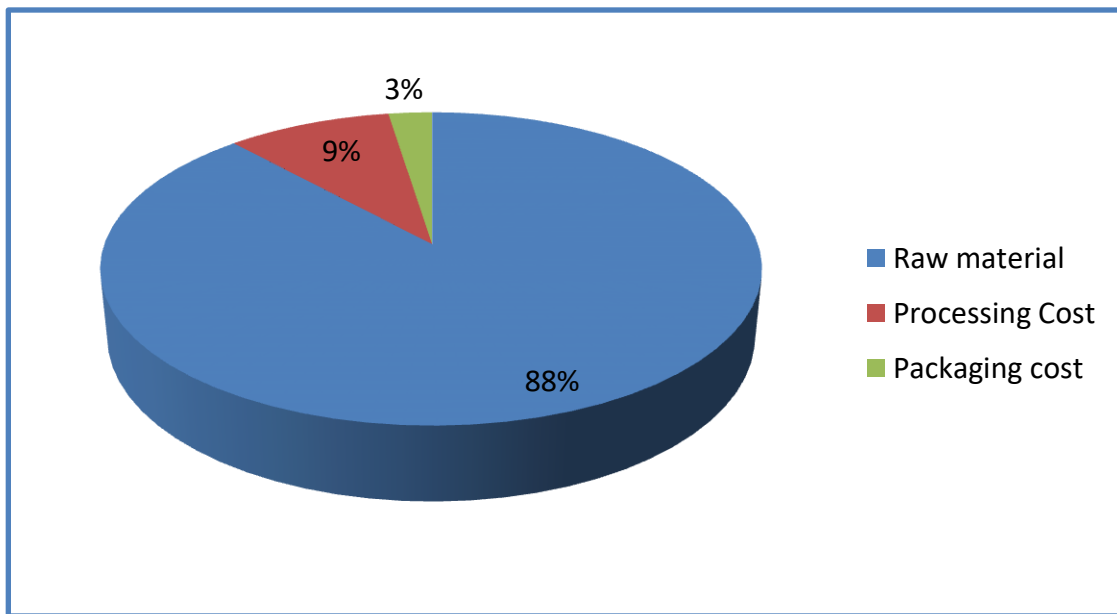


Fig. 4.2.3 Share of major cost components of standard milk

Table- 4.2.3 Cost components of standard milk (2017-18)

Sl. No	Cost Components	Expenditure/annum ('000₹)	₹/1000ml	Cost %
A	Variable cost			
1	Raw material	560914	30.38	88.20
2	Electricity	3283	0.17	0.51
3	Labour	4544	0.24	0.71
4	Water	216	0.01	0.03
5	Steam	6966	0.37	1.09
6	Refrigeration	5102	0.27	0.80
7	Packaging material	15679	0.84	2.46
8	Quality control	1340	0.07	0.21
9	Miscellaneous	8078	0.43	1.27
	Subtotal 1	606125	32.82	95.31
B	Fixed cost			
10	Administration & Overhead expenses	26147	1.41	4.11
11	Depreciation & interest	3658	0.19	0.57
	Subtotal 2	29806	1.61	4.69
	Total (A+B)	635932	34.44	100
	Total Annual Production	18456873 litres		

4.2.4 Curd

The total production of curd during the study period was 6189729 kg. The cost of manufacturing curd was worked out to be ₹17.54 per 500 grams. Table-4.2.4 gives the cost components of manufacturing the Curd and it was found that, the share of variable cost was 96.5 percent and that of fixed cost was 4.35 per cent of total cost. The share of major costs involved i.e. cost of raw material, processing and packaging was observed to be 86 per cent, 10 per cent and 4 per cent, respectively and this is pictured in the Fig. 4.2.4.

Table- 4.2.4 Cost components of Curd (2017-18)

Sl. No	Cost Components	Expenditure/annum ('000₹)	₹/500gm	Expenditure (%)
A	Variable cost			
1	Raw material	185616	14.99	85.43
2	Electricity	3283	0.26	1.51
3	Labour	2438	0.19	1.12
4	Water	67	0.005	0.03
5	Steam	1697	0.13	0.78
6	Refrigeration	2223	0.18	1.02
7	Packaging material	9236	0.74	4.25
8	Quality control	462	0.03	0.21
9	Miscellaneous	2786	0.22	1.28
	Subtotal 1	207811	16.78	95.65
B	Fixed cost			
10	Administration & Overhead expenses	9018	0.72	4.15
11	Depreciation & interest	453	0.03	0.20
	Subtotal 2	9471	0.76	4.35
	Total (A+B)	217283	17.54	100
	Total Annual Production	6189729 kg		

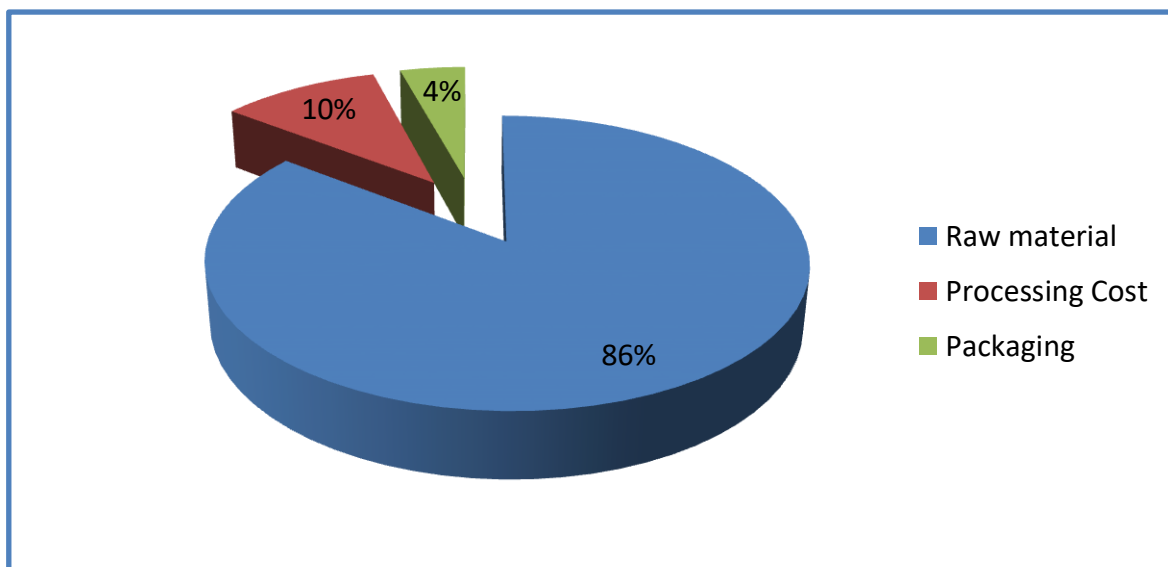


Fig. 4.2.4 Share of major cost components of curd

4.2.5 Butter milk

The total Butter Milk production during the study period 2017-18 was 772768 litres. The cost of manufacturing the 200 ml Butter Milk was worked out to be ₹3.26. The share of variable cost and fixed cost was found to be 92.41 per cent and 7.59 per cent of total cost respectively which can be seen from Table-4.2.5. The share of raw material, processing and packaging was 84 per cent, 14 per cent and 2 per cent of total cost respectively and can be understood by Fig. 4.2.5.

Table- 4.2.5 Cost components of butter milk (2017-18)

Sl. No	Cost Components	Expenditure/annum ('000₹)	Expenditure (%)	₹/200ml
A	Variable cost			
1	Raw material	10583	83.96	2.74
2	Electricity	193	1.53	0.05
3	Labour	172	1.37	0.04
4	Water	67	0.53	0.02
5	Refrigeration	94	0.75	0.02
6	Packaging material	309	2.45	0.08
7	Quality control	32	0.26	0.01
8	Miscellaneous	196	1.56	0.05
9	Subtotal 1	11648	92.41	3.01
B	Fixed cost			
10	Admin & Overhead expenses	636	5.05	0.16
11	Depreciation & interest	319	2.54	0.08
	Subtotal 2	956	7.59	0.25
	Total (A+B)	12605	100.00	3.26
	Total Annual Production	772768 litres		

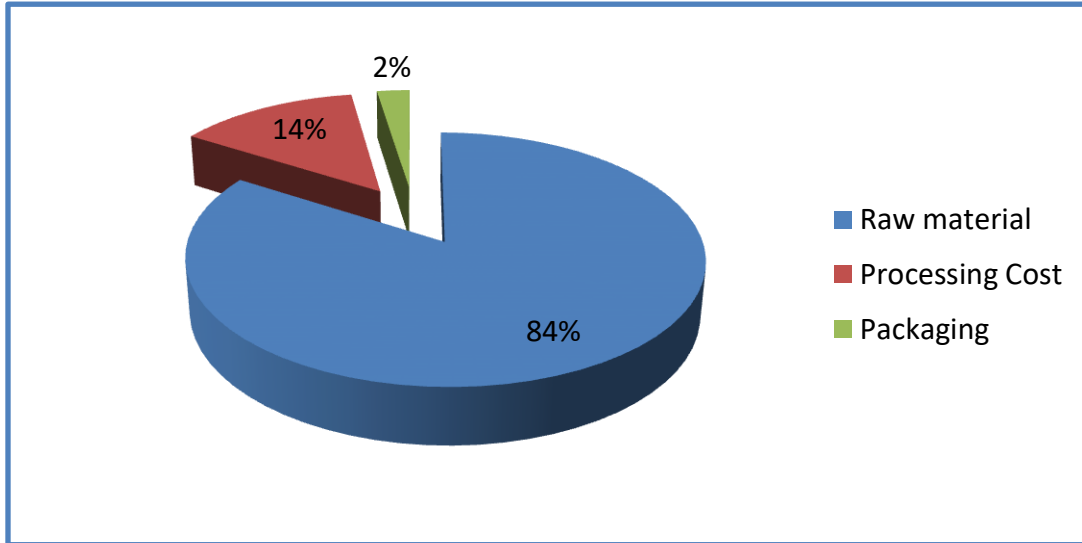


Fig. 4.2.5 Share of major cost components of butter milk

4.2.6 Peda

The quantity of Peda produced during the study period 2017-18 was 16546 kg and the cost of manufacturing was found to be ₹27.99 per 100 gram. Table-4.2.6 shows the various cost components of Peda manufacturing. It can be seen from the table that the share of variable and fixed costs was 94.6 per cent and 5.4 per cent of total cost respectively. It is evident from the Fig. 4.2.6, share of raw material, processing and packaging was found to be 76 per cent, 21 per cent and 3 per cent of total cost, respectively.

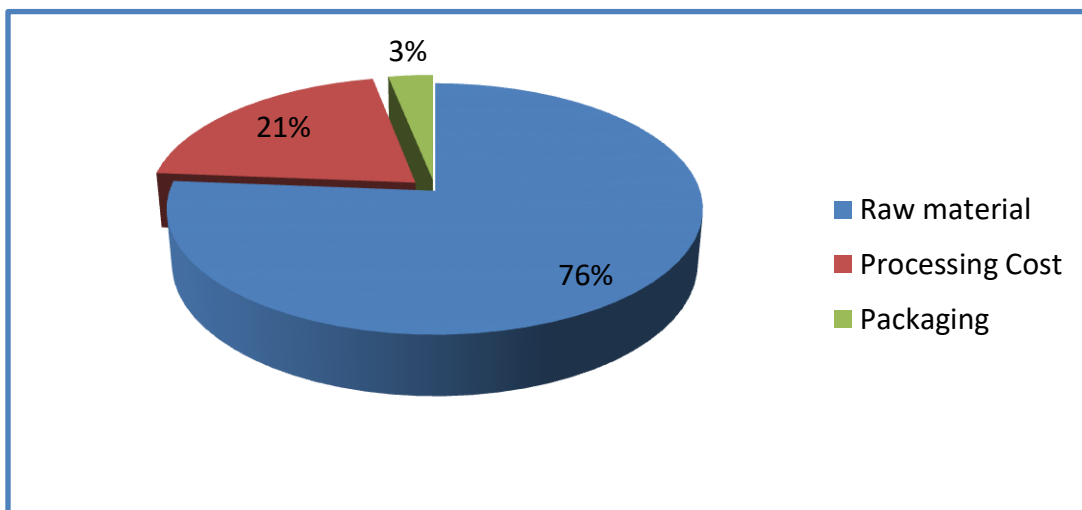


Fig. 4.2.6 Share of major cost components of peda

Table- 4.2.6 Cost components of Peda (2017-18)

Sl. No	Cost Components	Expenditure/annum ('000₹)	₹/100g	Expenditure (%)
A	Variable cost			
1	Raw material	3532	21.35	76.29
2	Electricity	21	0.13	0.46
3	Labour	546	3.30	11.8
4	Steam	55	0.34	1.20
5	Packaging material	144	0.88	3.12
6	Quality control	11	0.07	0.24
7	Miscellaneous	68	0.41	1.47
	Subtotal 1	4380	26.48	94.6
B	Fixed cost			
8	Administration & Overhead expenses	221	1.34	4.77
9	Depreciation & Interest	28	0.17	0.62
	Subtotal 2	250	1.51	5.4
	Total (A+B)	4630	27.99	100
	Total Annual Production	16546 kg		

4.2.7 Butter

The total quantity of Butter produced during the study period 2017-18 was 18044 kg. The cost of manufacturing was worked out to be ₹193.59 per 500 grams. The Table-4.2.7 shows the various cost components of Butter and it can be seen that the variable cost share was 92.05 per cent and that of fixed cost was 7.95 per cent of total cost while the Fig. 4.2.7 shows the cost share of raw material (87%), processing (12%) and packaging (1%).

Table- 4.2.7 Cost components of butter (2017-18)

Sl. No	Cost Components	Expenditure/annum ('000₹)	₹/500gm	Expenditure (%)
A	Variable cost			
1	Raw material	6119	169.57	87.46
2	Electricity	129	2.30	1.18
3	Labour	83	2.30	1.18
4	Water	32	0.91	0.46
5	Refrigeration	41	1.15	0.59
6	Packaging material	39	1.10	0.56
7	Quality control	6	0.17	0.08
8	Miscellaneous	36	1.01	0.51
	Subtotal 1	6488	178.50	92.04
B	Fixed cost			
9	Admin & Overhead expenses	117	3.26	1.68
10	Depreciation & interest	437	12.13	6.25
	Subtotal 2	555	15.39	7.93
	Total	7043	193.89	100
	Total Annual Production	18044 kg		

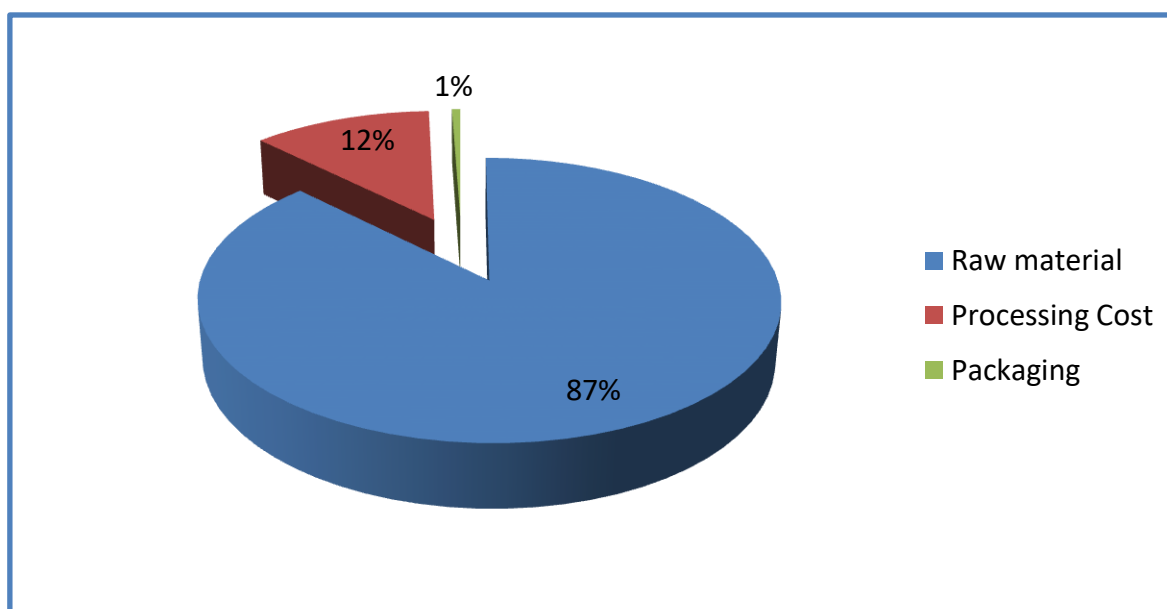


Fig. 4.2.7 Share of major cost components of butter

4.2.8 Ghee

The amount of Ghee manufactured during the study period was 125927 litres and its manufacturing cost was worked out to be ₹412.5 per litre. Table-4.2.8 shows the cost components of Ghee manufacturing. It can be seen from the table that variable cost shares 97.89 per cent while the fixed cost shares 2.11 per cent of total cost. The major costs like raw material, processing and packaging which shares 94 per cent, 5.9 per cent and 0.31 per cent of total cost respectively can be seen in Fig.4.2.8.

Table- 4.2.8 Cost components of ghee (2017-18)

Sl. No	Cost Components	Expenditure/annum ('000 ₹)	₹/litre	Expenditure (%)
A	Variable cost			
1	Raw material	49150	390.3	94
2	Electricity	71	0.56	0.13
3	Labour	1446	11.48	2.76
4	Water	21	0.17	0.04
5	Steam	121	0.96	0.23
6	Packaging material	166	1.32	0.31
7	Quality control	104	0.83	0.20
8	Miscellaneous	104	0.83	0.2
9	Subtotal 1	51186	406.5	97.89
B	Fixed cost			
10	Administration & overhead expenses	540	4.28	1.03
11	Depreciation and interest	561	4.46	1.07
	Subtotal 2	1101	8.75	2.11
	Total (A+B)	52288	415.2	100
	Total Annual Production	125927 litres		

4.2.9 UHT Milk

The Ultra Heat Treated Milk (UHT) is known for its longer shelf life i.e. it can be stored for about six months without deteriorating its quality. The total quantity of UHT

Milk manufactured during the study period was 23882000 litres. The manufacturing cost per litre was worked out to be ₹35.56. The break-up of cost of manufacturing UHT Milk in to various cost components is shown in the Table-4.2.9. The table reveals that the share of variable cost was about 90.78 per cent and that of fixed cost was about 9.22 per cent of total cost. The major cost components like raw material, processing and packaging shared 76 per cent, 17 per cent and 7 per cent of total cost, respectively which is depicted in Fig. 4.2.9.

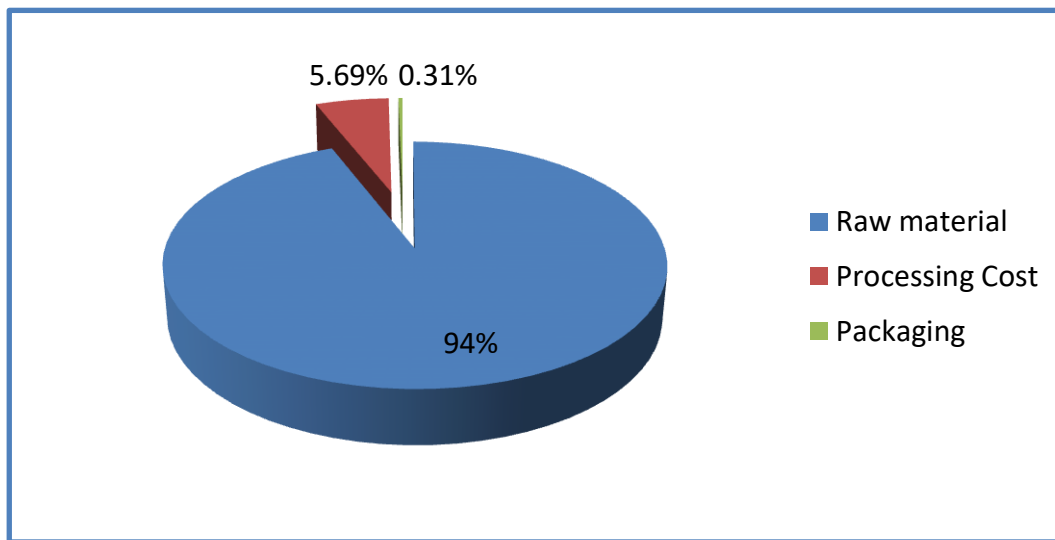


Fig. 4.2.8 Share of major cost components of ghee

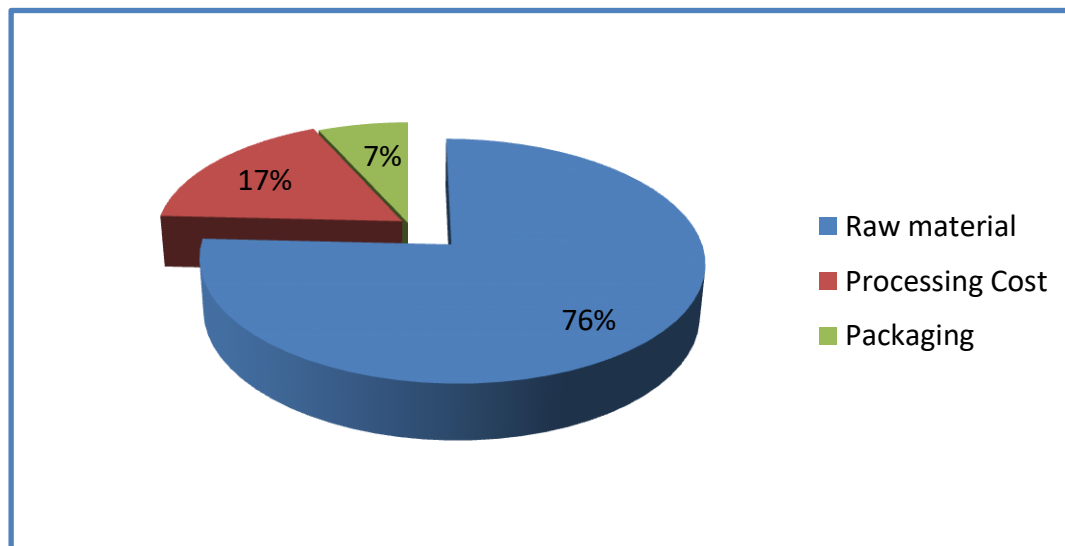


Fig. 4.2.9 Share of major cost components of UHT milk

Table- 4.2.9 Cost components of UHT milk (2017-18)

Sl. No	Cost Components	Expenditure/annum ('000₹)	₹/litre	Expenditure (%)
A	Variable cost			
1	Raw material	643453	26.94	75.76
2	Electricity	15660	0.66	1.84
3	Labour	31145	1.30	3.66
4	Water	337	0.01	0.04
5	Steam	2689	0.11	0.31
6	Refrigeration	6917	0.29	0.81
7	Packaging material	57316	2.40	6.74
8	Quality control	1913	0.08	0.22
9	Miscellaneous	11531	0.48	1.35
	Subtotal 1	770966	32.28	90.78
B	Fixed cost			
10	Admin & Overhead expenses	37325	1.56	4.39
11	Depreciation & interest	41062	1.72	4.83
	Subtotal 2	78387	3.28	9.22
	Total (A+B)	849353	35.56	100
	Total Annual Production	23882000 litres		

4.2.10 Skimmed milk powder (SMP)

The amount of SMP manufactured in the plant during the study period was 2168435 kg. The cost of manufacturing SMP is ₹220.45 per kilo gram. Table-4.2.10 reveals the various cost components of SMP and it can be observed that the share of variable cost was 96.41 per cent and that of fixed cost was 3.59 per cent of total cost. From Fig. 4.2.10, the share of cost of raw materials (92%), processing cost (7%) and packaging cost (1%) can be known.

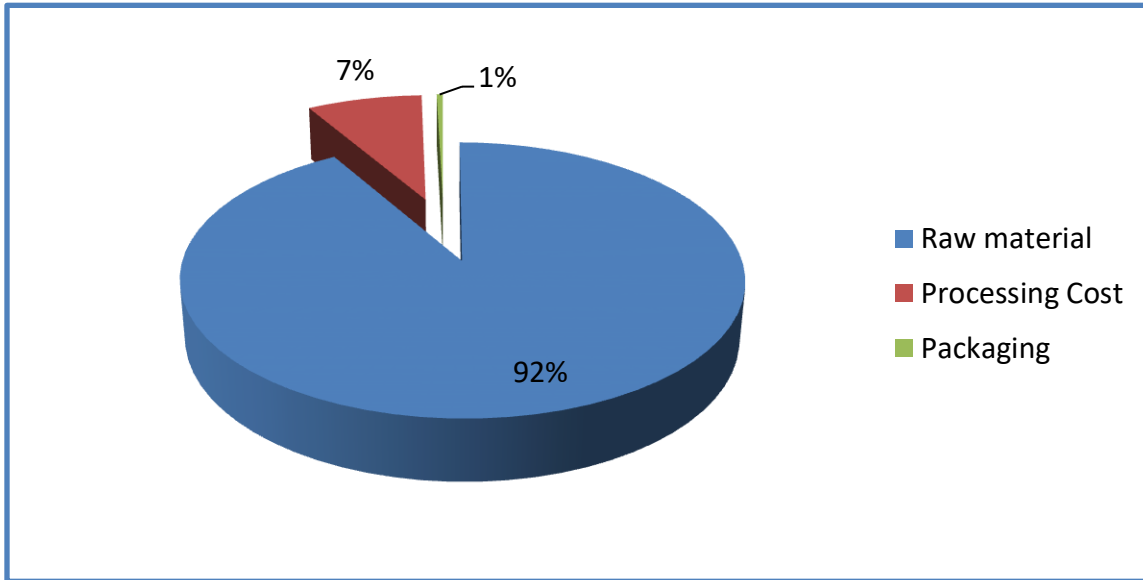


Fig. 4.2.10 Share of major cost components of SMP

Table- 4.2.10 Cost components of SMP (2017-18)

Sl. No	Cost Components	Expenditure/annum ('000₹)	₹/kg	Expenditure (%)
A	Variable cost			
1	Raw material	440686	203.23	92.19
2	Electricity	5785	2.67	1.21
3	Labour	2830	1.31	0.59
4	Water	209	0.10	0.04
5	Steam	2868	1.32	0.6
7	Packaging material	2060	0.95	0.43
8	Quality control	915	0.42	0.19
9	Miscellaneous	5520	2.55	1.15
	Subtotal 1	460876	212.54	96.41
B	Fixed cost			
10	Admin & Overhead expenses	8456	3.90	1.76
11	Depreciation & Interest	8699	4.01	1.82
	Subtotal 2	17156	7.91	3.59
	Total (A+B)	478032	220.45	100
	Total Annual Production	2168435 kg		

4.2.11 Cost of manufacturing and processing cost percentage of various milk products of the plant (2017-18)

Analyzing the processing cost of each product gives an idea about the extent of cost involved in transforming a raw material in to a finished milk product. It depicts the rough picture of cost required by unit quantity of raw material to convert to finished product. Also this helps in price fixation of the product. Table-4.2.11 gives the processing cost involved in various products of the plant.

4.2.12 Revenue generated by various products of the milk plant (2017-18)

The revenue generated by various milk products of the plant during the year 2017-18 are tabulated in Table- 4.2.12. It can be seen from the table that the highest share of revenue is by UHT Milk which is around 34.34 per cent of total revenue of the plant which is followed by standard milk (24.76%), SMP (16.92%), curd (8.54%), STM (7.91%), TM (3.48%), ghee (1.95%) and the remaining butter, butter milk and peda altogether contribute a small portion of revenue (1.06%).

Table- 4.2.11 Cost of manufacturing and processing cost percentage of various milk products of the plant (2017-18)

Sl. No	Products	Unit Quantity	Price (₹)	Processing cost (%)
1	Toned milk	1000ml	28.49	10
2	Special toned milk	1000ml	34.32	9
3	Standard Milk	1000ml	34.44	9
4	Curd	500 gram	17.54	10
5	Butter milk	200ml	3.26	14
6	Ghee	1000ml	415.2	5.9
7	Peda	100 gram	27.9	21
8	Butter	500 gram	193.89	12
9	UHT Milk	1000 ml	35.56	17
10	SMP	1 kg	220.45	7

Table- 4.2.12 Revenue generated by various milk products of the plant (2017-18)

Sl. No	Products	Units	Quantity	Revenue ('000₹)	Revenue Share of products (%)
1	Butter milk	litre	772768	17387	0.60
2	Curd	kg	6189729	246278	8.54
3	Ghee	litre	125927	56235	1.95
4	UHT milk	litre	23882000	1019232	35.34
5	Standard milk	Litre	18456873	714013	24.76
6	Toned milk	litre	2931489	100553	3.48
7	STM	litre	6011022	228241	7.91
8	Butter	kg	18044	7650	0.26
9	Peda	kg	16546	6039	0.20
10	SMP	kg	2168435	487897	16.92
	Total revenue of the plant		2883530		100

4.2.13 Profit margin over cost of various milk products of the plant (2017-18)

The information on profit margin of various products of the plant is vital for the management to decide on the product mix. It is the margin of profit earned over the cost i.e. it is calculated by subtracting the cost of manufacturing of product from the price realized by the plant for that product and dividing the profit earned per unit by the cost per unit. Table 4.2.13 shows the profit margin of various milk products produced in the plant during 2017-18. The highest profit margin among various products was observed in Butter milk (38.04%) and the lowest one was in SMP (2.06%).

4.2.14 Gross profit margin of various products

The gross profit margin reveals how inexpensively the plant can manufacture goods which it sells to its consumers. Plant's gross margin gives a good idea of the underlying profitability of a plant's primary operations. The management strives to keep the gross margin as high as possible by keeping the raw material and manufacturing

costs low, because a plant with lower product costs has better control over the prices that it can charge its customers. Plant's gross margin is calculated after finding out the gross profit. Gross profit is the amount that a plant makes from its core business after paying the *cost of goods* manufactured (the cost of raw materials and manufacturing), but before accounting for salaries, marketing, interest, and taxes. While working out the gross profit, variable cost (such as raw material, water, steam, electricity, refrigeration, packaging, quality control and miscellaneous) is subtracted from the revenue generated by that product. Table-4.2.14 shows the gross profit margin of various products produced in the milk plant during the study period 2017-18.

Table- 4.2.13 Profit margin over cost of various products of the milk plant (2017-18)

Product (1)	Unit Quantity (2)	Price realized by the plant (₹) (3)	Cost of Manufacture (₹) (4)	Profit margin (₹) (5)=(3-4)	Profit Margin (%) (6)={5/4*100}
Toned milk	1000ml	34.30	28.49	5.81	20.39
STM	1000ml	37.97	34.32	3.65	10.64
Standard Milk	1000ml	38.68	34.44	4.24	12.31
Curd	500gram	19.89	17.54	2.35	13.42
Butter milk	200ml	4.50	3.26	1.24	38.04
Ghee	1000ml	446.56	415.23	31.33	7.55
Peda	100 gram	36.50	27.99	8.51	30.42
Butter	500 gram	212.00	193.89	18.11	9.34
UHT Milk	1000ml	46.00	35.60	10.40	29.21
SMP	1kg	225	220.45	4.55	2.06

Table- 4.2.14 Gross profit margin of various products of the milk plant (2017-18)

Sl. No	Products (1)	Revenue (‘000₹) (2)	Variable Cost (‘000₹) (3)	Gross profit (‘000₹) (4)={2-3}	Gross profit margin (%) (5)={4/2*100}
1	Butter milk	17387	11648	5738	33.00
2	Curd	246278	207811	38466	15.62
3	Ghee	56235	51186	5048	8.97
4	UHT milk	1019232	770966	248266	24.36
5	Standard milk	714013	606125	107888	15.11
6	Toned milk	100553	79356	21196	21.08
7	STM	228241	196864	31376	13.75
8	Butter	7650	6441	1208	15.80
9	Peda	6039	4380	1658	27.46
10	SMP	487897	460876	27021	5.54

4.2.15 Operating profit of various products

The operating profit (or operating income) is calculated by adding to the variable cost the rest of the expenses involved directly during manufacturing and subtracting from the revenues. These other expenses are marketing, general, and administrative expenses (SG&A) and include the costs of administration, salaries, advertising and marketing. Operating income is also known as earnings before interest, taxes, depreciation and amortization. If a plant’s SG&A expenses exceed the amount it charges for the manufactured products or if rising expenses reduce its operating profit margin below that of competitors, low manufacturing costs are ineffective. Therefore, the plant sometimes move to protect the operating profit margin by downsizing or laying off contractual staff, curtailing the facilities and by eliminating less profitable product lines.

Table- 4.2.15 Operating profit of various products of the milk plant (2017-18)

SL. No	Products (1)	Revenue ('000₹) (2)	Operating Cost ('000₹) (3)	Operating profit (₹) (4)={2-3}	Operating profit margin (%) (5)={4/2*100}
1	Toned milk	100553	75674	17514	17.42
2	STM	228241	205223	39734	17.41
3	Standard Milk	714013	632273	134035	18.77
4	Curd	246278	198793	29447	11.96
5	Butter milk	17387	11012	5101	29.34
6	Ghee	56235	50646	4508	8.01
7	Peda	6039	4159	1437	23.80
8	Butter	7650	6324	1091	14.26
9	UHT Milk	1019232	733641	210941	20.70
10	SMP	487897	469333	18564	3.81

4.2.16 Pre-tax profit of various products

The Pre-tax profit in simple terms is the profit obtained after subtracting all the expenses considered while calculating the manufacturing product from the total revenue of that particular product. The subtracted costs are raw material, processing, administration and overhead expenses, depreciation and interest. This profit excludes the effect of tax being levied on price of the product. To remove the variations in profit margins due to the tax circumstances that management can't control, the management often emphasis on a company's pre-tax profit margin. Table- 4.2.16 shows the Pre-tax profit margin of various products of the plant.

Table- 4.2.16 Pre-tax profit of various products of the milk plant (2017-18)

SL. No	Products (1)	Revenue ('000₹) (2)	Pre-tax Cost ('000₹) (3)	Pre-tax profit (₹) (4)={2-3}	Pre-tax profit margin (%) (5)={4/2*100}
1	Toned milk	100553	83554	16999	16.91
2	STM	228241	206392	21848	09.57
3	Standard Milk	714013	635932	78081	10.94
4	Curd	246278	217283	28994	11.77
5	Butter milk	17387	12605	4781	27.50
6	Ghee	56235	52288	3946	07.01
7	Peda	6039	4630	1408	23.32
8	Butter	7650	6997	653	08.54
9	UHT Milk	1019232	849353	169878	16.67
10	SMP	487897	478032	9864	2.02

4.2.16 Net profit of various products

Finally, the net profit margin shows, how much a Plant makes profit after it pays all its expenses and taxes. It is the bottom line of a Plant's profitability. It takes in to account the effect of tax on the cost of product and so the profit. Table-4.2.16 shows the Net Profit margin of various products of the plant.

4.3 Break- even level of different milk products

The Break-even level is that quantity of product manufactured, where the total revenue from the product equals total cost involved in producing that quantity. It is a situation wherein the plant neither makes profit nor incurs losses by producing the break-even level quantity of the product. At the Break-even point, the plant just covers both fixed costs as well as variable costs. Therefore in order to gain profit from the particular product, primarily the plant must produce that product above its Break-even

level. Table 4.3 shows the Break-even quantities worked out of different products manufactured in the plant.

Margin of safety is the quantity of the product manufactured above its Break-even level of quantity. It is obtained by subtracting the Break-even quantity of the product from its actual output. The margin of safety provides information regarding the cushioning effect of different products when it was found that its demand and price varies in some period and the plant make sure that the quantity of output will be above BEP. From the above table, it can be seen that the margin of safety was more in case of Curd (86.95%) which is followed by Butter milk (86.20%) and Toned Milk (85.31%) whereas the lowest margin of safety was in SMP (36.51%).

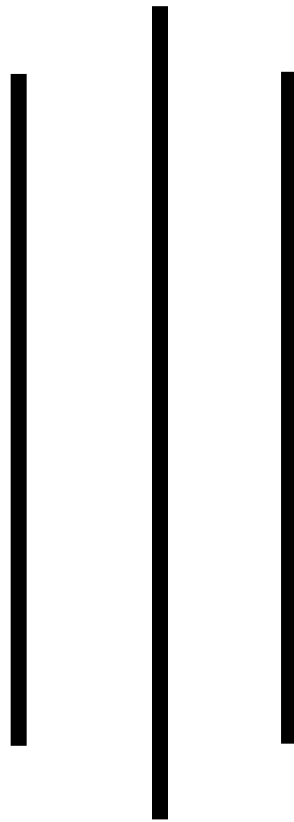
Table- 4.2.16 Net profit of various products of the milk plant (2017-18)

SL. No	Products (1)	Revenue ('000₹) (2)	Cost after Tax ('000₹) (3)	Net Profit (₹) (4)={2-3}	Net Profit Margin (%) (5)={4/2*100}
1	Toned milk	100553	88581	11971	11.91
2	STM	228241	217804	10436	4.57
3	Standard Milk	714013	671633	42380	5.94
4	Curd	246278	229597	16680	6.77
5	Butter milk	17387	13474	3912	22.50
6	Ghee	56235	55100	1135	2.01
7	Peda	6039	4932	1106	18.32
8	Butter	7650	7379	271	3.54
9	UHT Milk	1019232	900315	118916	11.67
10	SMP	487897	505643		

Table- 4.3 Break-even quantities of various products of the milk plant (2017-18)

Products	Unit Quantity	Price Realized by the Plant per unit	TFC ('000₹)	AVC (₹)	BEP (Quantity '000 unit)	Actual Output (Quantity '000 unit)	Margin of Safety (Quantity '000 unit)	Margin of Safety (%)
Toned milk	litre	34.30	4198	27.10	583.33	2931.49	2348.16	85.31
STM	litre	37.97	9528	32.79	1838.15	6011.02	4172.87	81.73
Standard Milk	litre	38.68	29807	32.88	5136.41	18456.87	13320.46	79.10
Curd	kg	39.78	9472	33.61	1535.59	6189.73	4654.14	86.95
Butter milk	litre	22.50	957	15.11	129.36	772.77	643.40	86.20
Ghee	litre	446.56	1102	406.48	27.49	125.93	98.44	78.17
Peda	kg	365.00	250	264.76	2.49	16.55	14.05	84.92
Butter	kg	424.00	555	357.59	8.36	18.05	9.69	54.13
UHT good life	litre	46.00	78388	32.34	5738.95	23882.00	18143.05	80.34
SMP	kg	225.00	17157	212.54	1376.79	2168.44	791.64	36.51

CHAPTER - 5



SUMMARY AND CONCLUSIONS

5. Summary and Conclusions

The milk production in the country during 2017-18 has reached to 176.3 Million Metric Ton (MMT) occupying 18.5 per cent of worlds total milk production. The per capita availability of milk in the country during the same period was 375 grams per day against the world average of 299 gram per day. India's decadal milk production growth pegged at 4.8 per cent CAGR is twice that of global milk production, which is growing at 1.8 per cent CAGR (Financial express, 2018). The co-operatives and private dairies in India have access to only 20 per cent of the milk produced whereas approximately 34 per cent of the milk is sold in the unorganized market while 46 per cent is consumed locally. The National Dairy Development Board (NDDB) estimates that, by the end of 2022 the demand for milk will be around 180 million tonnes and therefore, the Indian dairy industry possesses a huge potential for processing through value addition and inclusive development.

The dairy industry in India not only offers profitable business opportunities but also serves as a tool of socio-economic development of the people. On the other hand, the private participation in the Indian dairy sector has been increased over the past few years. As on April 2015, about 15805000 dairy farmers of which 4779000 were women belonging to 177000 village level societies, sell their milk to one of 183 milk producers' cooperative unions operated in over 418 districts of India who in turn are supported by 22 state cooperative milk marketing federations (DAHD&F, 2018). Their production which was essentially a self-reliant one is now being transformed into a commercial proposition. Whereas the number of milk plants registered under Milk and Milk products Order (MMPO), increased from 789 in 2006 to 1065 during 2011 (MoA, GOI, 2013). India's total installed milk processing capacity in the co-operatives sector is 663 lakh litres per day (LLPD), while private dairies process 733 LLPD (MoA, GOI-2018). The government in order to promote dairy Industry and to attract more investment in this sector has reduced excise duty of 16 per cent to zero on processing machineries (Dairy Universe, India).

The way, in which various activities are carried out like milk procurement, its processing and distribution influences the success of Dairy Industry. To endure in this tough competition, Indian Dairy Industry has to be well-organized, efficient and effective. Most often Dairy Industries face tremendous pressure while fulfilling the contradictory agendas of producers and consumers. Also there is a consumption of considerable amount of energy by the dairy plants in processing of milk and milk products. Different plants in India have wide variations in the specific energy consumption. Dairy processing holds huge potential for high returns and therefore, economic and judicious energy utilization is an immediate need of the day for realizing the above objective of high returns from milk products. Due to the fluctuation in milk arrivals which is due to seasonality and perishability of milk, most of the dairy plants in India use only 80 percent of its installed capacity. This leads to increase the processing cost per litre of milk which ultimately reduces the benefits to both consumers and producers (India Dairy.com) and hence, there should be a continuous estimation with respect to economics and energy utilization of manufacturing dairy products. Estimation of resource utilization like water, steam, electricity, refrigeration, and human resources, manufacturing cost and break-even level of various milk products is unavoidable part of management to take right decisions for product manufacturing, policy and planning purpose to ensure maximum turnout from the plant.

Keeping in view the above facts, the present study entitled “Economics of Manufacturing Products in Hassan Cooperative Milk Plant (Karnataka)” was conducted with the following specific objectives-

- To estimate the resource utilization for manufacturing different milk products in the plant.
- To work out cost of manufacturing different milk products and profitability
- To work out the break-even level of different Milk products

In order to fulfill the above objectives, Karnataka state was purposively chosen for the study. The Karnataka Cooperative Milk Producers' Federation Limited (KMF) comprised of a group of 14 dairy plants over the state. Among this Hassan Milk Producers Union Limited (HAMUL) of Hassan district have purposively selected having the processing

capacity of 3, 00,000 litres per day (LPD), has the variety of product mix, maintenance of and easy accessible to requisite data and well maintenance of records prompted to its selection. The data for the study of milk plant during 2017-18 was collected from the records maintained by different sections of the milk plant. The actual observation method was adopted to get information on consumption of water in different sections of the plant, Time and motion study was done in order to record the time and different activities done by a single person, labour used in manufacturing different products, running hours of the equipments and machines etc. The personal discussion and interview method was adopted to obtain data on electricity consumption in different plant sections, offices and streetlights consumption. Discussions were also made with the machine operators and in-charge of different sections. The analysis of data was done by employing a standard methodology discussed in Chapter-3 to achieve different objectives of the study.

Salient findings of the study

The analysis of resource utilization showed that,

- Nearly half of the total electricity of plant was consumed by refrigeration section (44.5%) followed by SMP section (18.8%), packaging section (10.37%) and processing section (9.5%). More than 80 per cent of total electricity of the plant is consumed by these sections.
- The steam requirement for Ghee was estimated to be 0.12kg per 1000ml, 0.08 kg for 1000ml UHT milk and 0.08 kg for 1kg SMP, 0.02 kg for Pasteurizing 1000ml milk and 0.05 kg for Peda manufacturing.
- The highest refrigeration utilization was observed for manufacturing curd (26.4 Kcal/1000gm/hour) followed by pasteurized milk (11.88 Kcal/1000ml/ hour) and UHT milk (10.71 Kcal/1000ml/ hour)
- The plant utilized about 460000 litres of water daily and the water use ratio was found to be 1:1.57. The major portion of water was used for crate washing and can cleaning (31.58%) followed by pasteurization section (18.43%), curd and butter milk section (8.68%) whereas the water consumption was found to be less in product section (6%)

- The highest permanent man power was found in electrical & mechanical, security and accounts sections which is 15.18 per cent in each followed by reception block and administrative section (8.86% each), packing, refrigeration, quality control and product sections each sharing 5.06 per cent, pasteurization, SMP and management and information systems (MIS) sections each share 3.79 per cent, curd and butter milk (2.53%), CIP and ETP sections each shares 1.26 per cent.
- The highest contractual labourers were employed in packing section (19%) which is followed by boiler section (12.14%), reception dock (10.28%), electrical and mechanical section and SMP section each sharing 9.34 per cent, production section and security section each sharing 7.47 per cent, quality control and accounts sections each shares 5.06 per cent, processing/ pasteurization section (4.67%), refrigeration and curd & butter milk sections (2.80%), CIP (1.96%) and finally ETP (0.93%).
- There were two boilers used in the plant. The one was used in processing plant having 4 ton per hour capacity and other was used for UHT plant bearing 1 ton per hour capacity. The cost of production of a kilogram of steam from former was worked out to be ₹1.14 whereas the cost of production of a kilogram of steam from latter was calculated to be ₹1.84.
- The cost of pumping a kilo litre of water was worked out to be ₹6.50. The share of variable and fixed cost in the total cost of water pumping was found to be 97 per cent and 3 per cent respectively.
- The cost of refrigerating kilo litre of water was worked out to be ₹16.46. The share of variable cost was 96 per cent and that of fixed cost was 4 per cent of total cost.
- The cost of manufacturing of toned milk was estimated to be ₹28.49, special toned milk ₹34.32, standard milk ₹34.44, UHT milk ₹35.56 for 1000ml of each product. The cost of curd manufacturing was ₹17.54 per 500gm, peda ₹27.9 for 100gm, butter milk ₹3.26 per 200ml, ghee ₹415.2 per 1000ml, butter ₹193.89 per kg and SMP ₹220.45 per kg.

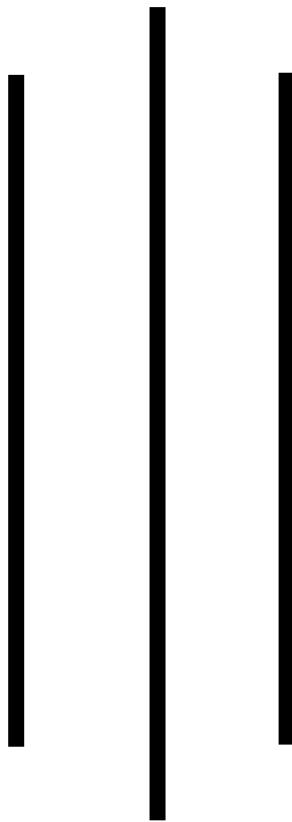
- The share of processing cost out of total cost of various products was observed for toned milk (10%), STM (9%), standard Milk (9%), curd (10%), butter milk (14%), ghee (5.9%), peda (21%), butter (12%), UHT Milk (17%) and SMP (7%).
- Among various products, the major share of revenue was earned by UHT Milk which is around 34.34 per cent of total revenue of the plant which is followed by Standard Milk (24.76%), SMP (16.92%), Curd (8.54%), STM (7.91%), TM (3.48%), Ghee (1.95%) and the remaining from Butter, Butter milk and Peda altogether contribute a small portion of revenue (1.06%).
- The highest profit margin over the cost among various products was observed in Butter milk (38.04 %) and the lowest one was in SMP (2.06%).
- Four types of profits were worked for each product and it was found that all products earned positive Gross profit, Operating profit, Pre-tax profit and Net profit. But in case of SMP, first three profits showed positive value but the Net profit was found to be negative i.e. after adding tax component to cost of SMP.
- All the products produced in the plant were above their Break-even quantities. The highest margin of safety over Break-even quantity was found in curd (86.95%) followed by Butter Milk (86.20%) and Toned milk (85.21%) while the less margin of safety was found in SMP (36.51%)

The conclusions made above have some policy implications

- The water use ratio as discussed earlier is 1:1.57. By judicious use of water in various sections may narrow down the ratio to 1:1 which the KMF has claimed and therefore, reducing the cost of water pumping ultimately will reduce the cost of manufacturing of products as well as saving of water.
- There was no recycling of condensation of steam in plant. If the condensed steam is recycled and used for secondary activities, then there will be a less utilization of water.
- The packaging cost of UHT milk was 7 per cent of total cost of manufacturing the product. With proper calibration of filling cum packing machines, the packaging losses can be reduced thereby reducing the cost of packaging.
- The profit margin among various products was found to be highest in butter milk but due to its seasonality of demand the income earned is low compared to other

products. Therefore, the management can think of long shelf life of butter milk like the UHT milk one and can be marketed in regions of high demand for that product.

- There was a loss in case of SMP when tax is imposed on it. Therefore, the plant may work on research and development of SMP to innovate new products from it.



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Glimpses of Data Collection



An over view of HAMUL milk plant



SMP filling and packing unit



Fire wood boiler



Fireman filling wood logs in to the boiler



Peda making



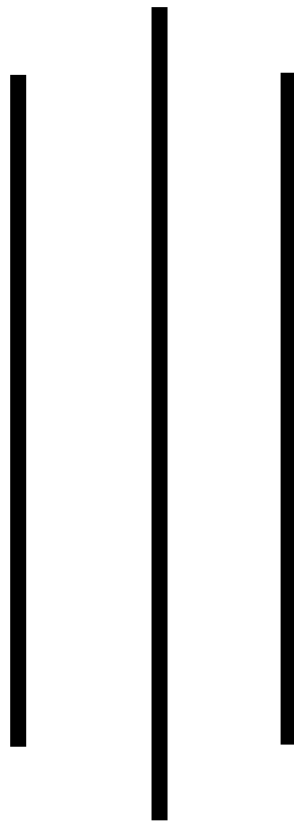
Butter being fed in to butter melting vat (ghee manufacturing)



UHT milk- filling cum packaging machine



Pasteurized milk, curd and butter milk pouch filling and packing section



APPENDIX

APPENDIX

Appendix 1. Specific Heat of the Products

Sl. No.	Products	Specific Heat
1	Ghee	2.72
2	Dahi	0.93
3	Pasteurized Milk	0.93
4	SMP	0.97

Appendix 2. FAT % and SNF % in each product

Sl. No.	Products	FAT %	SNF %
1	Toned Milk	3	8.5
2	Ghee	99.5	<0.5
3	Dahi	4	10
4	SMP	0.5	99.5
5	Standard Milk	4.5	8.5
6	Special Toned Milk	4	9
7	UHT Milk	4.5	8.5
8	Butter	42	<0.5

Appendix 3. Raw Material to Product Conversion Ratio

Sl.No	Raw materials	Quantity (Raw Material)	Output	Quantity (Output)	Raw material to product Ratio
1	Milk	1 litre	Pasteurized Milk	1 litre	1:1
2	Milk	1 litre	Curd	1 kg	1:1
3	Curd	1 kg	Butter Milk	2.5 litre	1:2.5
4	Milk	82.4 kg	Peda	17	1:0.20
5	Milk	9.15 kg	Cream	1kg	1:0.10
6	Cream	2 kg	Butter	1 kg	1:0.50
7	Butter	1.23 kg	Ghee	1	1:0.81
8	Pasteurized Milk	1 litre	UHT Milk	1 litre	1:1
9	Milk	103 kg	SMP	8.5 kg	1:0.08

**DAIRY ECONOMICS, STATISTICS & MANAGEMENT DIVISION
NATIONAL DAIRY RESEARCH INSTITUTE (Deemed University)
KARNAL (HARYANA)**

**SCHEDULE FOR RESEARCH PROJECT ON
ECONOMIC ANALYSIS OF MANUFACTURING PRODCUTS IN HASSAN COOPERATIVE
MILK PLANT (KARNATAKA)**

Schedule 1.0

A.GENERAL INFORMATION

1. Name & Address of the Plant

.....
.....

2. Name & Address of the Federation/

Union to which Affiliated

3. MMPO No. & Date of Regn. No. Date

.....

4. Date of Commissioning of Plant

5. AREA SPREAD OF THE PLANT

Particulars	2017-18
Radius of Operation (kms)	
No. of villages covered	
No. of MPCS	
No. of Milk Producers who directly supply milk to the Dairy Plant	

B.TECHNICAL INFORMATION

1. CAPACITY DETAILS

	Particulars	2017-18
A.	Installed capacity of Pasteurization Plant (000' litres/hr)	
B.	Average working hours per day	
C.	Product Manufacturing capacity (kgs/day)	
	(a) Toned milk	
	(b) Special toned milk	
	(c) Homogenized standard milk	
	(d) UHT milk	
	(e) Butter milk	

	(f) Curd	
	(g) Ghee	
	(h) Peda	
	(i) Butter	
	(j) SMP	

2. PROCESSING OF MILK (2017-18)

Sl. No	Particulars	Milk intake (litres)	Qty. produced (litres or kg)
1	Toned milk		
2	Special toned milk		
3	Homogenized standard milk		
4	Butter milk		
5	UHT milk		
6	Curd		
7	Ghee		
8	Butter		
9	Peda		
10	SMP		

3. SALES PARTICULARS

Total sales by dairy (Ex. Factor exclusive of applicable Duties and Taxes) (Rs. in Lakhs)			
	Particulars	Litres	Value (Rs)
	Total liquid milk		
a)	Toned milk (lakh litres)		
b)	Special Toned milk (lakh litres)		
c)	Butter milk (lakh litres)		
d)	UHT milk (lakh litres)		
e)	Homogenized standard milk		
	Milk products	Kg	value
a)	Curd (Kgs)		
b)	Butter (Kgs)		
c)	Ghee (Kgs)		
d)	Peda (Kgs)		
e)	SMP (Kgs)		

Schedule 2.0

Section Details

1. Refrigeration section

a. Size of the section:

b. Investment on machinery/ equipments.....

Types of machinery

Machines	Line voltage	Line current

Running hours of the machines

Month	Running hours

Running hours of the machines

Month	Running hours

c. variable components

Sl.no	Particulars	Units
1	Raw materials	
2.	Labour	
3	Maintenance	

5. Boiler section

a. Size of the section:

b. Investment on machinery/ equipments.....

Types of machinery

Machines	Line voltage	Line current

Running hours of the machines

Month	Running hours

c. variable components

Sl.no	Particulars	Units
1	Raw materials	
2.	Labour	
3	Maintenance	

6. Reception dock

a. Size of the section:

b. Investment on machinery/ equipments.....

Types of machinery

Machines	Line voltage	Line current

Running hours of the machines

Month	Running hours

c. variable components

Sl.no	Particulars	Units
1	Raw materials	
2.	Labour	
3	Maintenance	

7. Butter section

a. Size of the section:

b. Investment on machinery.....

Types of machinery

Machines	Line voltage	Line current

Running hours of the machines

Month	Running hours

c. variable components

Sl.no	Particulars	Units
1	Raw materials	
2.	Labour	
3	Maintenance	

8. Ghee section

a. Size of the section:

b. Investment on machinery/ equipments.....

Types of machinery

Machines	Line voltage	Line current

Running hours of the machines

Month	Running hours

c. variable components

Sl.no	Particulars	Units
1	Raw materials	
2.	Labour	
3	Maintenance	

9. Pasteurization section

a. Size of the section:

b. Investment on machinery/equipments.....

Types of machinery

2.	Labour	
3	Maintenance	

11. UHT section

a. Size of the section:

b. Investment on machinery.....

Types of machinery

Machines	Line voltage	Line current

Running hours of the machines

Month	Running hours

c. variable components

Sl.no	Particulars	Units
1	Raw materials	

2.	Labour	
3	Maintenance	

12. SMP section

a. Size of the section:

b. Investment on machinery.....

Types of machinery

Machines	Line voltage	Line current

Running hours of the machines

Month	Running hours

c. variable components

c. variable components

Sl.no	Particulars	Units
1	Raw material	
2.	Labour	
3	Maintenance	

14. Administrative, MIS and Account section section

a. Size of the section:

b. Investment on machinery.....

c. variable components

Sl.no	Particulars	Units
1	Raw materials	
2.	Labour	

3	Maintenance	

15. Security section

a. Size of the section:

b. Investment on machinery.....

c. variable components

Sl.no	Particulars	Units
1	Raw materials	
2.	Labour	
3	Maintenance	

Electricity Consumption

Section	No of items	Voltage per item	Current per item	Phase type
Refrigeration section				
Powder plant (SMP)				
Effluent Treatment Plant (ETP)				
Boiler				
Ghee section				
Product section				
Tube well				
Milk Reception				
Lights				
Miscellaneous*		230v		
Total				

Section	No of items	Voltage per item	Current per item	Phase type
Refrigeration section				
Powder plant (SMP)				
Effluent Treatment Plant (ETP)				
Boiler				
Ghee section				
Product section				
Tube well				
Milk Reception				
Lights				
Miscellaneous*		230v		
Total				

Steam Utilization

Products	Quantity in kg	Specific heat	T1	T2	Latent heat
SMP					
Ghee					
Curd					
Peda					
Pasteurization					
Butter					

Products	Quantity in kg	Specific heat	T1	T2	Latent heat
SMP					
Ghee					
Curd					
Peda					
Pasteurization					
Butter					

Products	Quantity in kg	Specific heat	T1	T2	Latent heat
SMP					
Ghee					
Curd					
Peda					
Pasteurization					
Butter					

Products	Quantity in kg	Specific heat	T1	T2	Latent heat
SMP					
Ghee					
Curd					
Peda					
Pasteurization					
Butter					

Human Resource Utilization

Sl. No.	Name of Section	Permanent	Contractual
1.	Reception		
2.	Processing		
3.	CIP		
4.	Refrigeration		
5.	Quality control		
6.	Product		
7.	Electrical		
8.	Mechanical		
9.	ETP		
10.	MIS		
11.	Administrative and Accounts		
12.	Security		
13.	UHT		
14.	SMP		

Sl. No.	Name of Section	Permanent	Contractual
1.	Reception		
2.	Processing		
3.	CIP		
4.	Refrigeration		
5.	Quality control		
6.	Product		
7.	Electrical		
8.	Mechanical		
9.	ETP		
10.	MIS		
11.	Administrative and Accounts		
12.	Security		
13.	UHT		
14.	SMP		

Water Utilization

Sl. No.	Particular	Water requirement (kilo liter/day)
1	Crate washing and can cleaning	
2	Pasteurization	
3	Overall floor cleaning	
4	Refrigeration	
5	Boiler section	
6	CIP section	
7	Production manufacturing section	
8	Miscellaneous	

Sl. No.	Particular	Water requirement (kilo liter/day)
1	Crate washing and can cleaning	
2	Pasteurization	
3	Overall floor cleaning	
4	Refrigeration	
5	Boiler section	
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Sl. No.	Particular	Water requirement (kilo liter/day)
1	Crate washing and can cleaning	
2	Pasteurization	
3	Overall floor cleaning	
4	Refrigeration	
5	Boiler section	
6	CIP section	
7	Production manufacturing section	
8	Miscellaneous	

Schedule 3.1

Cost of steam production in plant

Components	Total cost ('000 Rs/annum)
Variable cost	
Fuel	
Electricity	
Labour	
Softening of water	
Maintenance	
Water	
Fixed cost	
Depreciation and interest	
Total steam production:	

Cost of water pumping in plant

Components	Total cost ('000 Rs/annum)
Variable cost	
Electricity	
Chlorine	
Labour	
Repair and maintenance	
Fixed cost	
Depreciation and interest	

Cost of refrigeration

Components	Total cost ('000 Rs/annum)
Variable cost	
Electricity	
Labour	
Ammonia	
Water	
Repair and maintenance	
Fixed cost	
Depreciation and interest	