Analysis of Milk Products Manufacturing Cost and Handling Losses in Composite Dairy Plant.

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Abstract

The Indian dairy sector, as the world's largest milk producer, is a cornerstone of rural livelihoods and national food security. This study presents a detailed analysis of manufacturing costs and handling losses in a composite dairy plant, with a specific focus on the economic and operational dimensions of milk processing. Conducted the research, integrating quantitative data, such as cost of raw materials, utilities, labour, packaging, and equipment depreciation, with qualitative insights from on-site observations and stakeholder interviews.

The study quantifies the utilisation and loss patterns of milk solids, Fat, solids-not-fat (SNF), and total solids across multiple product lines, including fluid milk, ghee, butter, paneer, and skimmed milk powder (SMP). Seasonal variations between flush and lean periods are examined to assess their impact on cost efficiency and product yields. A comprehensive cost allocation framework distinguishes between fixed and variable costs, facilitating accurate estimation of per-unit production expenses.

Findings reveal that raw material procurement dominates the cost structure, while losses during processing significantly affect profitability and operational sustainability. The research underscores the need for enhanced process optimisation, loss minimisation strategies, and the adoption of advanced technologies to improve economic viability. The outcomes of this study hold significant implications for dairy plant managers, policy planners, and industry stakeholders aiming to enhance productivity, reduce waste, and promote sustainable practices in the dairy sector.

Keywords

Dairy industry, manufacturing cost analysis, milk solids handling loss, composite dairy plant, milk utilisation pattern, process optimisation, cost efficiency, seasonal variation, skimmed milk powder (SMP), Indian dairy sector.

CHAPTER I

INTRODUCTION

India is the world's largest producer of milk. The Indian dairy industry has grown at a rate of more than 5% per year over the previous three decades, and the country became the largest producer of milk in the 1990s. This is no minor feat when we consider that dairying in India is essentially strict, with farmers often keeping dairy cows in proportion to their free crop and also being accessible for family labour with little inputs and a minimal amount of marketed products. The prevalence of restrictive trade policies in the dairy industry, as well as the establishment of Amul-type cooperatives, have modified the country's dairy farming methods. In the early 1950s, India was commercially importing roughly 55,000 tonnes of milk powder per year to supply urban milk demand. The majority of key improvements in dairying have occurred in India just this century. The dairy business is critical to the global food market, producing a diverse range of milk products that are enjoyed by millions of people worldwide. Dairy plant management is constantly looking for ways to improve operational efficiency and profitability while minimizing handling losses. Understanding the elements that contribute to manufacturing costs and identifying places where losses occur are critical stages in accomplishing these objectives.

This study is to thoroughly examine the production costs and handling losses in a composite dairy plant, providing important insights into the many cost variables and potential areas for improvement. This research tries to give a complete knowledge of the financial elements of milk product manufacturing by studying important components of the production process such as raw materials, labour, equipment, packaging, and utilities.

The manufacturing cost study will look at how raw material prices affect overall costs. Milk, being the principal raw material, can experience considerable price swings based on location, seasonality, milk quality, and procurement techniques. The study will also analyse the price of various additions and ingredients necessary for certain milk products. Labour expenses, including skilled personnel participating in the manufacturing process, will be analysed. Furthermore, the study will look at the costs of equipment and machinery, which are important in dairy processing. The cost of purchasing, operating, and maintaining equipment Furthermore, energy usage and machinery maintenance costs will be regarded as contributing elements to production costs. The influence of packaging materials and prices will also be investigated. Water and electricity are needed for dairy plant operations. The use of these resources throughout the production process incurs extra costs that must be factored into the study. In the dairy sector, handling losses are a serious concern, resulting in product waste and financial losses. This study will look at possible sources of loss throughout the production and packaging processes. The research seeks to give significant insights into optimizing handling operations, minimizing losses, and increasing overall efficiency by identifying these areas. Furthermore, the study will underline the significance of quality control and compliance in dairy plant operations. The investigation will look into the expenses of testing, quality assurance, and conformity to regulatory norms. To conduct this research, a case study approach will be employed, focusing on a composite dairy plant as a representative model. Detailed data on production volumes, financial records, and operational

practices will be collected and analysed to provide a robust understanding of manufacturing costs and handling losses in the specific context of the plant.

Finally, by throwing light on the financial elements of milk product manufacture, this research hopes to add to the knowledge base of dairy industry experts, plant managers, and stakeholders. The study's findings may aid decision-making processes, promote cost-cutting measures, and increase overall operational efficiency in composite dairy operations. The research intends to help the industry's efforts toward sustainable and economically viable milk product manufacture by identifying areas for development.

1.1 HISTORY OF DAIRY

India is well-known as the 'Oyster' of the global dairy sector, providing several prospects for entrepreneurs worldwide. It may be a pipe dream for any country in the world to profit from the world's largest and fastest-expanding milk and milk product industry. With deregulation, India's dairy business has grown rapidly. As the economy gives tremendous chances for MNCs and international investors to unlock the full potential of this industry. The primary goal of the Indian dairy industry is to manage national resources in order to increase milk output and upgrade milk processing via the use of modern technology. Dairy has been around for thousands of years, with evidence of dairy production and milk consumption extending back to ancient civilizations. Here is a little history of dairy. Dairy farming most likely began approximately 7,500 BCE in the Fertile Crescent region of the Middle East. Milk became available as a food source due to the domestication of animals such as cattle, sheep, and goats. Dairy farming was used by ancient civilizations such as the Sumerians, Egyptians, Greeks, and Romans, who produced milk products such as cheese, butter, and yogurt. Dairy farming became a significant aspect of agricultural techniques in medieval Europe, particularly in areas with adequate weather and grazing meadows. Monastic orders played an important role in the development of dairy farming, as monasteries frequently possessed vast herds of cows and produced milk products for sustenance and commerce. The dairy sector saw considerable changes throughout the industrial revolutions of the 18th and 19th centuries. Improvements in transportation, refrigeration, and processing techniques transformed the storage, distribution, and preservation of milk and dairy products. Technological innovations continued to change the dairy business throughout the twentieth century. The advent of homogenization, which prevents milk fat separation, as well as the creation of specialized equipment for the manufacturing of cheese, butter, and yogurt, expanded the range of dairy products accessible to customers. Advances in packaging and transportation have enabled dairy products to be distributed globally, making them available to a diverse variety of customers worldwide. The history of dairy demonstrates the persistent relevance of milk and milk products as key sources of nourishment and cultural significance in diverse communities throughout history.

1.2 SCENARIO OF THE GLOBAL DAIRY SECTOR

The global dairy sector is dynamic and influenced by various factors that shape its current scenario. In this scenario, the global dairy sector is experiencing both challenges and opportunities. The global demand for dairy products continues to rise due to population growth, urbanization, and increasing disposable incomes, particularly in emerging economies. Consumers' dietary preferences and the nutritional value of dairy products contribute to their popularity. Consumer preferences are evolving, with a greater focus on health and wellness, sustainability, and ethical considerations. Organic, grass-fed, and locally sourced dairy products are in high demand. Technological advancements are altering the dairy industry. Various parts of dairy production, processing, and distribution are utilizing automation, data analytics, and artificial intelligence. Milk production is optimized through precision agriculture and herd management technologies, while innovative processing processes increase product quality and safety. The worldwide dairy market is dominated by exporting countries such as New Zealand, the European Union, and the United States. Trade treaties and geopolitical circumstances have an impact on market access and competitiveness. Protectionist policies, tariff barriers, and regulatory disparities, on the other hand, can stymie trade and cause market distortions. The dairy industry continues to prioritize food safety and quality. To safeguard customers and maintain industry standards, strict laws and quality control mechanisms are in place. Initiatives such as traceability and product labelling increase transparency and consumer confidence. Consolidation characterizes the dairy sector, with huge multinational corporations and dairy cooperatives dominating the market. Mergers and acquisitions take place to improve market positions and broaden global reach. The global dairy industry is resilient and adaptable to shifting market circumstances. Dairy producers and processors use creative techniques to deal with pricing volatility, weather-related issues, and changing customer expectations. Collaboration between industry players, research institutions, and the government promotes information sharing and the sector's long-term development.

Table 1.1 Milk Production Across Countries

Milk production across countries (Million tonnes)

country	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2017
India	**20.80**	**25.60**	**31.56**	**44.02**	**53.68**	**65.37**	**79.66**	**95.62**	**121.85**	**155.69**	**176.27**
Afghanistan	0.75	0.85	0.84	0.72	0.82	1.36	1.65	1.73	1.72	2.20	2.12
Argentina	4.19	5.65	5.31	5.64	6.28	8.77	10.12	9.91	10.63	12.06	10.10
Australia	7.76	6.70	5.57	6.23	6.46	8.46	10.85	10.13	9.02	9.49	8.80
Bangladesh	1.07	1.18	1.16	1.31	1.59	1.99	2.14	2.62	2.02	2.10	2.01
Brazil	7.42	10.05	12.06	12.57	15.08	17.13	20.53	25.53	30.96	34.86	33.74
Canada	8.31	7.75	7.41	7.48	7.98	7.92	8.16	7.81	8.24	8.14	8.10
Chile	1.12	1.00	1.12	1.05	1.39	1.90	2.00	2.31	2.54	2.04	2.00
China	1.96	2.37	2.93	4.76	7.04	9.46	12.37	32.02	41.16	36.28	34.87
Denmark	4.48	4.92	5.12	5.10	4.74	4.68	4.72	4.58	4.91	5.36	5.56
Finland	3.31	3.16	3.28	3.08	2.82	2.47	2.45	2.43	2.34	2.44	2.41
France	22.85	24.72	27.89	28.40	26.81	26.09	25.74	25.71	24.21	25.93	25.26
Germany	28.18	28.75	32.10	33.63	31.34	28.63	28.35	28.48	29.65	32.71	32.69
Indonesia	0.17	0.19	0.25	0.40	0.60	0.73	0.79	0.85	1.48	1.46	1.54
Ireland	3.08	3.59	4.72	5.83	5.40	5.35	5.16	5.38	5.33	6.59	7.48
Mauritania	0.24	0.18	0.23	0.22	0.27	0.28	0.32	0.37	0.69	0.78	0.77
Mexico	4.11	6.24	7.23	7.47	6.27	7.54	9.44	10.03	10.89	11.61	11.99
Nepal	0.63	0.71	0.75	0.81	0.92	1.01	1.17	1.35	1.62	1.86	2.05
Netherlands	8.24	10.22	11.79	12.53	11.23	11.29	11.16	10.85	11.81	13.55	14.54
New Zealand	5.99	6.10	6.70	7.88	7.51	9.29	12.24	14.64	17.01	21.94	21.37
Norway	1.73	1.84	1.97	1.98	1.99	1.93	1.74	1.59	1.58	1.61	1.57
Pakistan	7.45	8.19	9.01	10.86	14.72	19.01	25.57	29.44	35.49	41.59	44.29

Milk production across countries (Million tonnes)

country	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2017
Poland	14.96	16.38	16.49	16.44	15.84	11.64	11.89	11.95	12.30	13.25	13.70
Romania	3.12	3.81	4.34	4.32	3.81	5.02	4.62	5.55	4.62	4.68	4.33
Russian Federation	0.00	0.00	0.00	0.00	0.00	39.31	32.28	31.15	31.84	30.79	31.18
South Africa	2.91	2.50	2.50	2.20	2.48	2.79	2.54	2.87	3.12	3.54	3.20
Sri Lanka	0.14	0.19	0.24	0.29	0.25	0.29	0.16	0.17	0.23	0.30	0.41
Sweden	2.93	3.17	3.47	3.67	3.51	3.30	3.35	3.21	2.90	2.93	2.82
Switzerland	3.20	3.40	3.68	3.87	3.88	3.93	3.91	3.96	4.11	4.07	3.92
Thailand	0.00	0.01	0.03	0.06	0.13	0.31	0.52	0.89	0.91	1.00	0.42
United Kingdom	12.97	13.93	15.97	16.02	15.25	14.84	14.49	14.47	14.07	15.32	15.26
United States of America	53.07	52.34	58.24	64.93	67.01	70.44	76.02	80.25	87.52	94.64	97.76
Viet Nam	0.02	0.03	0.04	0.05	0.06	0.06	0.08	0.23	0.34	0.75	0.91
World	**391.95**	**424.73**	**465.82**	**512.98**	**542.53**	**540.07**	**579.31**	**648.22**	**724.45**	**801.13**	**827.88**

Source:FAOSTAT, 24 Dec 2019

1.3 SCENARIO OF INDIAN DAIRY SECTOR

The Indian dairy industry is expanding rapidly and undergoing major transformation. Milk output in the Indian dairy sector is steadily increasing. The sector benefits from the participation of smallholder farmers, who collectively contribute to the country's milk output. Historically, liquid milk has been the most popular commodity, but there is a rising demand for processed dairy products such as cheese, butter, ghee, yogurt, and ice cream. Changes in consumer choices, urbanization, and the impact of Western food habits are driving this trend.

In the Indian dairy business, technology utilization is increasing. Dairy producers are harnessing advances in breeding techniques, artificial insemination, and current herd management procedures to improve milk output and animal health. A crucial responsibility in the Indian dairy business is to ensure quality and safety requirements. Government agencies, such as the Food Safety and Standards Authority of India (FSSAI), oversee and monitor the industry to ensure product quality and customer safety. To ensure transparency and customer confidence, stringent quality control procedures are in place, including obligatory testing and product labelling standards. The Indian dairy sector has seen some market liberalization, allowing foreign dairy corporations to enter. International dairy commerce has risen, with India becoming a major supplier of dairy products such as skimmed milk powder and ghee. Tariff barriers and sanitary and phytosanitary restrictions, on the other hand, offer obstacles to international commerce. The Indian dairy industry provides several job possibilities, particularly in rural areas. This scenario depicts the current situation of the Indian dairy industry, emphasizing its expansion, cooperative model, value addition, technology adoption, government assistance, quality focus, international commerce, and benefits to rural development. The Indian dairy sector is

evolving as a result of shifting customer tastes, technological improvements, and regulatory interventions, setting it up for future growth and development. The government has been actively involved in giving the necessary push for advances to occur by adopting various schemes and programs. The industry acknowledges the importance of private sector promoters contributing to the industry's growth and achievement of its objectives. A proactive public-private partnership is required for the dairy sector to be as lucrative as agriculture and other manufacturing sectors.

1.4 STRUCTURE OF INDIAN DAIRY INDUSTRY

The Indian dairy business is structured with a mix of small-scale farmers, dairy cooperatives, large-scale dairy product producers, and a major presence of organized retail chains. The cooperative concept has been critical in empowering farmers and ensuring their involvement in the dairy value chain. Government agencies, regulatory authorities, and research groups all contribute to the development, safety, and quality assurance of the industry. This framework fosters a thriving and diversified dairy ecosystem that meets the needs of India's massive population. The Indian dairy sector is divided into two segments: organised and unorganised. Traditional milkmen, merchants, and self-consumption at home comprise the unorganised segment, while cooperatives and private dairies comprise the organised segment. India is the largest producer of milk in the world, but its dairy sector is still dominated by unorganised players. According to industry estimates, about 48 per cent of the milk produced in the country is either consumed at the producer level or sold to non-producers in rural areas. The remaining 52 per cent of the milk is marketable surplus, sold mainly to consumers in urban areas.

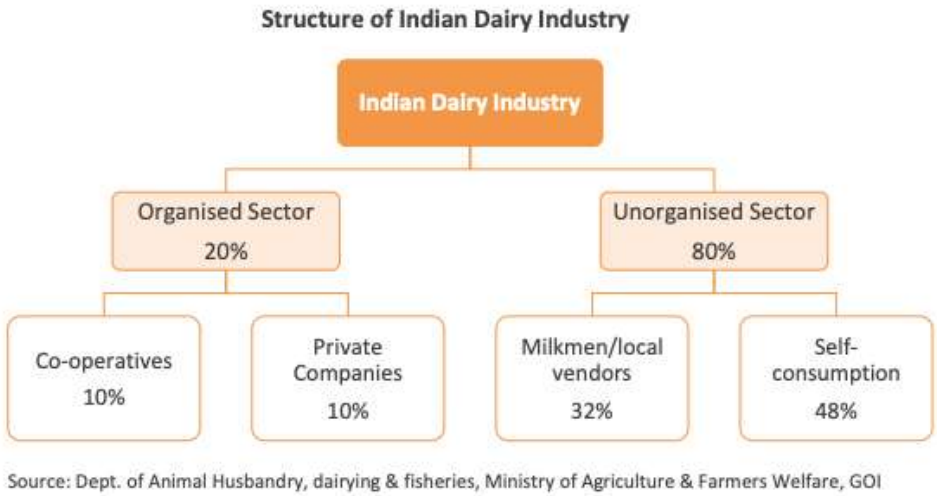

Fig.1.1 Structure of Indian Dairy Industry

1.4.1 State Wise Milk Production

Table 1.2. Shows the milk production across different states in India. In year 2021-2022 Rajasthan recorded the highest production and Uttar Pradesh 2nd largest. Top five major milk-producing states are Rajasthan (15.05 per cent), Uttar Pradesh (14.93 per cent), Madhya Pradesh (8.06 per cent), Gujarat (7.56 per cent) and Andhra Pradesh (6.97 per cent). As per the data, Animal Husbandry statistics 2022.

Table 1.2 State-wise Milk Production

State-wise estimates of Milk Production ('000 tonnes)

State	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
All India	84,400	86,159	88,082	92,484	97,066	1,02,580	1,07,934	1,12,183	1,10,425	1,21,848	1,27,904	1,32,431	1,37,685	1,46,314	1,55,491	1,65,404	1,76,347	1,87,749	1,98,440	2,09,960	2,21,064
Andhra Pradesh	5,814	6,584	6,959	7,257	7,624	7,938	8,925	9,570	10,429	11,203	12,088	12,762	13,007	9,656	10,817	12,178	13,725	15,044	15,263	14,714	15,403
Arunachal Pradesh	42	46	46	48	48	49	32	24	26	28	22	23	43	46	50	53	54	55	61	44	46
Assam	682	705	727	739	747	750	752	753	756	790	796	800	815	829	843	861	872	882	920	954	982
Bihar	2,664	2,869	3,180	4,743	5,060	5,451	5,783	5,934	6,124	6,517	6,643	6,845	7,197	7,775	8,288	8,711	9,242	9,818	10,480	11,502	12,119
Chhattisgarh	795	804	812	831	839	849	866	908	956	1,029	1,119	1,164	1,209	1,232	1,277	1,374	1,469	1,567	1,676	1,747	1,848
Goa	45	46	48	57	56	57	58	59	59	60	60	61	68	67	54	51	55	57	61	60	63
Gujarat	5,862	6,089	6,421	6,745	6,960	7,533	7,911	8,386	8,844	9,321	9,817	10,315	11,112	11,691	12,262	12,784	13,569	14,493	15,292	15,853	16,722
Haryana	4,978	5,124	5,221	5,222	5,299	5,366	5,442	5,745	6,006	6,267	6,661	7,040	7,442	7,901	8,381	8,975	9,809	10,726	11,735	11,284	11,630
Himachal Pradesh	756	773	786	870	869	933	1,007	1,026	971	1,102	1,120	1,139	1,151	1,172	1,283	1,329	1,392	1,460	1,531	1,576	1,615
J & K	1,360	1,389	1,414	1,422	1,400	1,400	1,519	1,565	1,592	1,609	1,614	1,631	1,615	1,951	2,273	2,376	2,460	2,540	2,506	2,595	2,727
Jharkhand	940	952	954	1,330	1,335	1,401	1,442	1,466	1,463	1,555	1,745	1,679	1,700	1,734	1,812	1,894	2,016	2,183	2,321	2,434	2,629
Karnataka	4,797	4,539	3,857	3,917	4,022	4,124	4,244	4,538	4,822	5,114	5,447	5,718	5,997	6,121	6,344	6,562	7,137	7,901	9,031	10,936	11,796
Kerala	2,718	2,419	2,111	2,025	2,063	2,119	2,253	2,441	2,509	2,645	2,716	2,791	2,655	2,711	2,650	2,520	2,576	2,548	2,544	2,534	2,532
Madhya Pradesh	5,283	5,343	5,388	5,506	6,283	6,374	6,572	6,855	7,167	7,514	8,149	8,838	9,599	10,779	12,148	13,445	14,713	15,911	17,109	17,999	19,004
Maharashtra	6,094	6,238	6,379	6,567	6,769	6,978	7,210	7,455	7,679	8,044	8,469	8,734	9,089	9,542	10,153	10,402	11,102	11,655	12,024	13,703	14,305
Manipur	68	69	71	75	77	77	78	78	78	78	79	80	82	82	79	79	82	86	90	71	76
Meghalaya	66	68	69	71	73	74	77	77	78	79	80	81	82	83	84	84	85	87	88	89	90
Mizoram	14	15	15	16	15	16	17	17	11	11	14	14	15	20	22	24	25	26	24	25	25
Nagaland	57	58	63	69	74	67	45	53	78	76	78	79	81	76	77	79	74	73	62	56	61
Orissa	929	941	997	1,283	1,342	1,431	1,625	1,598	1,651	1,671	1,721	1,724	1,861	1,903	1,930	2,003	2,088	2,311	2,370	2,373	2,402
Punjab	7,932	8,173	8,391	8,554	8,909	9,168	9,282	9,387	9,389	9,423	9,551	9,724	10,011	10,351	10,774	11,282	11,855	12,599	13,348	13,394	14,077
Rajasthan	7,758	7,789	8,054	8,310	8,713	10,309	11,377	11,931	12,330	13,234	13,512	13,946	14,573	16,934	18,500	20,850	22,427	23,668	25,573	30,723	33,265
Sikkim	37	45	48	46	48	49	42	42	44	43	45	42	46	50	67	54	59	61	84	74	87
Tamil Nadu	4,988	4,622	4,752	4,784	5,474	6,277	6,540	6,651	6,787	6,831	6,968	7,005	7,049	7,132	7,244	7,556	7,742	8,362	8,759	9,790	10,107
Telangana														4,207	4,442	4,681	4,965	5,416	5,590	5,765	5,808
Tripura	90	79	84	86	87	89	91	96	100	104	111	118	130	141	152	160	174	185	199	206	217
Uttar Pradesh	14,648	15,288	15,943	16,512	17,356	18,094	18,861	19,537	20,203	21,031	22,556	23,330	24,194	25,198	26,387	27,770	29,052	30,519	31,864	31,359	33,005
Uttarakhand	1,066	1,079	1,188	1,195	1,206	1,213	1,221	1,230	1,377	1,383	1,417	1,478	1,550	1,565	1,656	1,692	1,742	1,792	1,845	1,797	1,856
West Bengal	3,515	3,600	3,686	3,790	3,891	3,983	4,087	4,176	4,300	4,471	4,672	4,859	4,906	4,961	5,038	5,183	5,389	5,607	5,869	6,165	6,414
A&N Islands	23	26	25	24	20	23	24	26	24	25	26	21	14	16	15	16	17	18	19	15	17
Chandigarh	43	43	44	43	46	46	47	47	46	45	45	44	44	44	43	36	42	45	49	52	57
Ladakh																				15	27
D&N Haveli	8	8	8	4	5	5	10	10	10	11	11	11	11	9	9	8	8	1	1	1	2
Daman & Diu	1	1	1	1	1	1	1	1	1	1	1	1	1	1							
Delhi	294	296	299	303	310	288	445	450	466	480	502	287	284	280	281	279	279				
Lakshadweep	2	2	1	1	2	2	2	2	2	2	2	2	6	4	3	3	3	4	4	4	0
Puducherry	37	37	40	41	43	45	46	46	46	47	45	47	47	48	48	48	49	49	50	50	50

Source : Source: Basic Animal Husbandry Statistics, MoFAHD, DAHD, GoI

1.4.2 Current Scenario of Dairy Sector

India has a large cattle population and ranks high in global livestock commerce. Dairy production accounts for 70% of animal output. India's cattle export trade has reached unprecedented heights. The newly established dairy industry in India, together with the reintroduction of the corporate sector as a result of the government's liberalized policies, improves the operation of the National Dairy Development Board in order to produce a white revolution. NDDB commenced operations with the goal of making dairying a means to a better future for millions of small-scale milk producers. In the previous nine years, India has seen significant development in the production and consumption of milk and dairy products. India is now the world's greatest milk producer, accounting for 24% of worldwide milk output. India's milk output has increased by more than 61%, from 137.7 million tonnes in 2013–14 to 221.1 million tonnes in 2021–22. Furthermore, milk availability per capita has grown from 303 grams per day in 2013–14 to 444 grams per day in 2021–22, an almost 1.5-fold increase.

1.4.3 Production

The Indian dairy sector differs from other dairy product producing countries in that it emphasizes both cattle and buffalo milk. Of India's total bovine population, 40% are indigenous cows, 46% are buffaloes, and 14% are imported European or North American cattle cross-breeds. Of the nation's total milk production, approximately 35% comes from buffaloes and the remaining from dairy cows. Because of its high milk fat content, buffalo milk has always been chosen. However, as the organized sector purchases more milk, dairy cattle are becoming more popular due to higher yields and shorter dry seasons.

1.4.4 National Milk Production

Today, India is the largest producer of milk in the world, contributing 24% of global milk production. The milk production of India has registered over a 61 percent increase from 137.7 million tonnes in 2013–14 to 221.1 million tonnes in 2021–22. Moreover, the per-capita availability of milk has increased from 303 grams per day in 2013–14 to 444 grams per day in 2021–22, a nearly 1.5-fold increase.

The milk output saw an annual growth rate of 5.29% in 2021–2022. Rajasthan (15.05%), Uttar Pradesh (14.93%), Madhya Pradesh (8.06%), Gujarat (7.56%), and Andhra Pradesh (6.97%) are the top five states that produce the most milk. (Animal Husbandry Statistics 2022)

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Table 1.3 National Milk Productions

Milk production and Per Capita Availability (PCA) of milk in India

Year	Production (Million tonnes)	Per Capita Availability (gms/day)
1991-92	55.6	178
1992-93	58.0	182
1993-94	60.6	186
1994-95	63.8	192
1995-96	66.2	195
1996-97	69.1	200
1997-98	72.1	205
1998-99	75.4	210
1999-2K	78.3	214
2000-01	80.6	217
2001-02	84.4	222
2002-03	86.2	224
2003-04	88.1	225
2004-05	92.5	233
2005-06	97.1	241
2006-07	102.6	251
2007-08	107.9	260
2008-09	112.2	266
2009-10	116.4	273
2010-11	121.8	281
2011-12	127.9	290
2012-13	132.4	299
2013-14	137.7	307
2014-15	146.3	322
2015-16	155.5	337
2016-17	165.4	355
2017-18	176.3	375
2018-19	187.7	394
2019-20	198.4	406
2020-21	210.0	427
2021-22	221.1	444

Source: Basic Animal Husbandry Statistics, MoFAHD, DAHD, GoI

1.5 SCENARIO OF UTTAR PRADESH DAIRY SECTOR

The dairy industry in Uttar Pradesh, a northern Indian state, is critical to the state's agricultural economy and rural life. The following is an overview of the dairy situation in Uttar Pradesh.

Uttar Pradesh is one of India's top milk-producing states. The state has a considerable dairy animal population, which includes cattle (both indigenous and crossbred), buffaloes, goats, and sheep. Smallholder farmers provide the majority of milk, with a concentration on mixed crop-livestock agricultural methods. The cooperative movement has played an important role in the growth of Uttar Pradesh's dairy sector. Uttar Pradesh has a well-developed milk processing infrastructure, with numerous milk processing plants and dairy product manufacturing units.To enable effective milk collection and storage, the state maintains a large network of milk collection facilities, chilling plants, and bulk milk coolers.The dairy sector plays a significant role in rural livelihoods and income generation in Uttar Pradesh.The Uttar Pradesh government has launched a number of efforts to help the dairy sector expand and prosper.

1.5.1 Dairy Industries in Kanpur Dehat (U.P)

Kanpur Dehat District, located in the state of Uttar Pradesh, India, is an agricultural region with a significant presence in the dairy industry. Kanpur Dehat has a well-established dairy industry, with a substantial number of dairy farmers and milk processing units. The region's favourable agro-climatic conditions, availability of grazing lands, and proximity to major markets contribute to the development of the dairy sector. Milk production is a key agricultural activity in Kanpur Dehat. The region has a significant population of dairy animals, including cattle and buffaloes. To enable the effective collection and purchase of milk, milk collecting centres and chilling units have been erected around Kanpur Dehat. These facilities serve as go-betweens for dairy farmers and milk processing plants. Kanpur Dehat has multiple milk processing plants that turn gathered milk into a variety of dairy products. Liquid milk, ghee, butter, paneer, yogurt, and other value-added products are examples.

1.6 CONSUMPTION PATTERN

Milk and dairy product consumption patterns varied among areas and nations. However, milk and dairy products form a significant element of many people's diets all over the world. Dairycooperatives and organised dairy processing units produce the majority of the processed liquid milk sold in the country. Milk and dairy product demand is income-elastic, and rising per capita income is projected to boost demand for milk and dairy products. Rural families in India consume over half of the total milk output. The remaining 50% of milk output is used domestically. Almost half of the milk sold in the domestic market is consumed as fluid milk, 35% as traditional products (paneer, cheese, yoghurt, and milk-based sweets), and 15% for the production of butter, ghee, milk powder, and other processed dairy products (including baby foods, ice cream, whey powder, casein, and milk albumin). The organized dairy industry consumes 15% of total milk output in India, which it principally uses to produce liquid milk, butter,

cheese, and milk powder. Although the organized sector manufactures some traditional items, the unorganized sector dominates this market. The organized sector employs approximately 40 to 50 percent of Indian dairy farmers; however, it is estimated that approximately 65 percent of milk in India is consumed (in fluid or other forms) on farm or by the unorganized sector (local milk vendors, wholesalers, retailers, and producers themselves). Approximately 46% of the total milk provided by the organized and unorganized sectors is eaten in fluid form, with the remainder processed into different milk products such as butter, yogurt, milk powder, and so on. Based on industry estimates, the following is an assessment of India's milk product mix:

Table 1.4 India's Milk Product Mix

Variant	**Share Percent**
Fluid Milk (Packed & Loose)	46.00%
Ghee	27.50%
Butter	6.50%
Yogurt,Dahi&Chach	7.00%
Khoa (Partially Dehydrated Condensed Milk)	6.50%
Milk Powders Including IMF	3.50%
Paneer &Chhanna	2.00%
Others including Cream, Ice Cream	1.00%

1.7 COMPANY PROFILE

Tasty Dairy Specialities Limited was established on July 30, 1992.It is a public limited company.

1.7.1 Name of The Company

Tasty Dairy Specialities Limited
D-3, UPSIDC Industrial Area, Jainpur, Kanpur Dehat (Uttar Pradesh) -209 311,

1.7.2 Company Introduction

Tasty Dairy Specialities Limited is active in milk processing as well as bulk milk procurement and VLC milk procurement. And manufacturing packed milk in different variants, chach, skimmed milk powder, whole Milk Powder, butter, ghee, concentrated milk, and other value-added milk products. The company is located in the richest milk belt in Uttar Pradesh. With its current infrastructure and machinery, the company can handle over 3,00,000 litres of raw milk per day.

1.8 STATEMENT OF THE PROBLEM

The dairy sector faces considerable issues due to the high cost of milk product manufacture and handling losses in composite dairy plants. Manufacturing costs for composite dairy plants are increasing owing to a variety of variables such as increased raw material prices, labour expenditures, energy costs, equipment maintenance, packaging fees, transportation charges, and administrative costs. Many dairy producers lack a thorough grasp of their cost structure and the elements that influence manufacturing expenditures. Significant handling losses occur in composite dairy facilities at many phases of milk processing. Handling losses not only results in financial losses for dairy producers, but they also have an influence on the quality and safety of milk products. Technological developments in the dairy business offer the ability to optimise operations, minimise costs, and eliminate handling losses. However, these technologies are frequently underutilised in composite dairy operations. The task is to find acceptable technologies, overcome implementation constraints, and integrate them into current production processes in order to achieve targeted cost savings and loss avoidance goals.

1.9 OBJECTIVES OF THE STUDY

I. To work out the cost of manufacturing various dairy products.
II. To examine the milk utilisation pattern in the product mix of the dairy plant.
III. To quantify the handling loss of milk solids during the manufacturing of milk & milk products.
IV. To investigate the main influencing factors and variations in handling losses during flush and lean seasons.

1.10 SCOPE OF THE STUDY

Conduct a detailed assessment of the cost components involved with milk product processing in a composite dairy plant. Analyse the costs of acquiring raw ingredients such as milk, additives, and packaging materials. Analyse the costs of obtaining, operating, and maintaining essential equipment, machinery, and infrastructure. Calculate the labour costs for effective milk product manufacturing, including salary, benefits, and training fees. Overhead costs such as utilities, transportation, and administrative

charges should be evaluated to assess their influence on overall production expenses. Study the entire milk product manufacturing process within the composite dairy plant, from raw material handling to finished product packaging. Identify and examine the key stages involved in each process. Investigate and quantify the losses incurred during the handling of milk throughout the dairy plant's operations, as well as the seasonal variation in handling losses. Examine the expenses of quality control tasks such as testing, inspection, and monitoring. Examine the milk utilization pattern in the product mix of the plant.

1.11 RATIONALE

The examination of milk product manufacturing costs and handling losses in composite dairy facilities is an important issue for a number of reasons. The dairy sector is a significant contributor to the world economy, and milk product production accounts for a significant share of this industry. Understanding the cost variables and identifying possible loss areas in composite dairy facilities may assist manufacturers in optimizing their operations, lowering expenditures, and increasing profitability. It also helps them make educated pricing, resource allocation, and process improvement decisions, eventually benefiting both the sector and the economy as a whole. By analysing and resolving the variables that contribute to handling losses, dairy producers may improve quality assurance methods and provide products that satisfy regulatory standards and consumer expectations. The dairy sector, like any other food industry, confronts the issue of reducing waste and implementing sustainable practices. The dairy industry is seeing fast technological improvements, ranging from automation and data analytics to process optimization and packaging innovations. Analysing the cost structure and handling losses in composite dairy facilities might reveal where these technical advances can be utilized most efficiently. Dairy producers may simplify their operations, boost productivity, and remain competitive in a fast-changing market by embracing innovative technology and implementing best practices. Since the dairy industry is a seasonal one and raw milk availability in India, particularly in North India, has lean and flush seasons, The composite milk plant cost of making products can stabilize the operating plant throughout the year at reasonable capacity. Products like spray-dried milk powders can be made based on the availability of raw milk (skimmed milk powder, Whole Milk powder, etc.). This extra butter and milk powder made during the flush season will be used during the summer or lean season to make up for the market's lack of milk and milk products by reconstituting or recombining them with raw milk that is readily accessible at that time. Thus, the plant will be in full operation throughout the year. The rising cost of raw milk, electricity, and other expenses is driving dairy plants to put more focus on reducing milk solids losses.

Estimation of manufacturing costs and handling losses of various milk products is an unavoidable part of management's responsibility to take the right decisions for product manufacturing, policy, and planning purposes to ensure maximum turnout from the plant. To study the cost of manufacturing and dairy plant losses and handling losses, they need to be so low that they will help prevent total solid losses, improve the efficiency of plants, and reduce the manufacturing cost of products. During the manufacturing of milk products, milk solids are lost directly in the form of milk, cream, residue, by-products, and final products. Milk solids recovery assessment in dairy plants during their routine operational practices with the aim of reducing milk solids losses. The study offers good scope for the estimation of costs and their control in the dairy factories so as to improve their operational efficiency. The analysis will be useful to improve milk production, milk procurement, and the processing of dairy products in the dairy sector. The research findings of the study will be helpful to planners, policymakers, administrators, researchers, and other stakeholders.

CHAPTER II

REVIEWOF LITERATURE

This review of the literature gives a general summary of the studies and research that have been done on handling losses and manufacturing costs in composite dairy facilities. The review lays the groundwork for the current investigation by emphasizing major findings, techniques, and gaps in the literature.

2.1 MILK UTILIZATION PATTERN

The pattern of milk use in a Composite Dairy Plant is determined by the products manufactured. Here are some examples of frequent milk consumption patterns. Typically, a portion of the milk is used to manufacture various types of fluid milk, such as whole milk, Skimmed Milk, and Flavour Milk. Dhahi, Chach. Milk is used extensively in the manufacturing of Skimmed Milk Powder, Whole Milk Powder ,Dairy Whitener, Ghee, Butter, Paneer and Cheese. Separating milk fat from milk yields butter and ghee. Milk is used to make yogurt and other fermented foods. Milk is frequently transformed into spray dried milk powder and condensed milk.

Murali (2001) conducted a study on the economics of milk processing and dairy product manufacturing in a co-operative dairy plant in Tamil Nadu and discovered that Skim Milk Powder, Butter, Ghee, Standardized Milk, Khoa, and Flavoured Milk used bulk to the extent of 53.86, 32.54, 11.84, 0.85, 0.73, and 0.12 percent, respectively. Other products contributed just 0.06 percent of total milk inflow.

Singh (2001) investigated the milk consumption trend in Uttar Pradesh's western plain zone. He discovered that the percentage of milk used for khoa-based sweets was 51%, compared to 21% for Channa-based sweets as the self-life of The former is preferable. The remaining 28% milk was utilized for tea, Dahi, and sweets. Making and selling raw milk. Burfi, Gulab jamun, milk cake, and other khoa-based desserts were available. Peda and Kalakand, which received 17, 10, 9.8 and 8% milk respectively manufacture, and so forth. Rasmalai (9%) ranked first among Channa-based desserts.in comparison to Rosogolla (78%o) and Rajbhog (5%o).

Feroze (2003) performed research at the Haryana Cooperative Dairy Plant. The study found that ghee consumed the most total solids (25.87%), followed by FCM (24.12%). SM (16.84%) and SMP (17.39%). DTM, Paneer, and SM each used less than 10% of the total TS.

Vinod (2005) discovered that 36.12 percent of milk eaten as fluid and 63.88 percent converted into Dahi and Ghee in his study on the economic analysis of milk production, usage, and disposal pattern in rural regions of Bidar district (Karnataka). The average amount of milk retained for family use was highest in the big herd size group (2.98 l.) and lowest in the small herd size group (1.20 l.). In the small size family group, 37.50% was eaten as fluid milk, followed by conversion into Dahi (31.66%), and ghee (30.88%). In the case of big household categories, 35.23 percent were taken in fluid form, followed by Dahi (32.88%), and Ghee (31.87%).

2.2 COST OF MANUFACTUING OF DIFFERENT DAIRY PRODUCTS

The economic efficiency of dairy facilities is inextricably linked to the costs of processing and manufacturing dairy products. The study of the current cost structure for the various dairy products in a dairy plant, as well as a proper costing approach, is required for optimal operation planning. Manufacturing Costs in the Dairy Industry, Several studies have looked into the various cost components involved in the production of milk products.

Chauhan et al. (2007) carried a research on the economics of milk product production in Haryana. They gathered data from 61 milk product manufacturing facilities and discovered that on average, milk product manufacturing units handled 130 litres of milk per day in Haryana's Eastern Zone, while it was 196 litres per day in the Western Zone. The cost of production for items like as butter, paneer, and ghee was found to be Rs.44.55/Kg. The cost of Ghee manufacture in the eastern zone was Rs.70.81/Kg and Rs.71.87/Kg, respectively, but the cost of Ghee manufacturing in the western zone was Rs.137.59/Kg. All of the goods were lucrative and produced in excess of the break-even point.

Ray (2008) conducted a study on the economics of manufacturing indigenous milk products in West Tripura district and discovered that the average cost of manufacturing Rasogolla, Lal mohan, Boil cake, Peda, Khirsandesh, Kalakand, Khirtoa, Mistidoi, and Chhanarpayesh was Rs.57.97/kg, Rs.91.41/kg, Rs.115.42/kg, Rs.98.33/kg, Rs.70. Rs.99.68/kg, Rs.27.87/kg, and Rs.102.97/kg, respectively.

Smith et al. (2017) did a complete cost study of a dairy processing factory and found important contributions as raw material costs, labour expenses, equipment costs, and packaging costs. They underlined the need of cost-cutting initiatives in order to improve financial performance. Similarly, Gupta and Singh (2019) investigated the influence of raw material prices and labour costs on manufacturing costs in Indian dairy facilities, emphasizing the need of efficient procurement and labour management techniques.

C.PareshKarabhai (2019) According to study the Ghee has a higher fat percentage, the majority of milk fat was utilized to make it. Taza milk received the lion's share of milk SNF. The plant's total solids consumption pattern Taza milk received the lion's share of milk. In the case of milk, the amount of ghee produced is smaller, but it contains more fat, whereas Butter Milk, Dahi , and Taza milk have less fat than the other products. The cost of producing Ghee was around Rs. 323 per litre, which was the highest among all dairies. The primary issue confronting the Village milk collecting facility is its remote location from the premises of milk producers. The main issue was bad roads for conveying the milk.

Mir Miraj Alli et. al.(2020) According to a study conducted at the Odisha State Co-operative Milk Producers Federation Ltd. (OMFED) dairy plant of Balasore district, with a handling capacity of 50,000 LPD for the fiscal year March 2013-April 2014, Sweet Dahi was the most profitable product (40.55%), followed by Sweetened Flavoured Milk (28.7%), and Toned Milk (24.76%), while Paneer manufacturing was the least profitable (5.71%). There is a need to investigate the possibility of increasing profits in Paneer manufacturing by raising the product price or by taking appropriate steps to use residual whey for by-products such as whey-based beverages, whey powder, and in the pharmaceutical industry to reduce costs. Sweet Dahi had the highest percentage of packaging cost (28%) followed by Sweetened Flavoured Milk (22%), and Rabidi (13%). Because the packaging costs for certain items appear to be greater, the plant's management may investigate and search for alternative methods. Paneer production was the least lucrative of the several goods created. Sweet Dahi had the highest percentage of packaging cost (28%) followed by Sweetened Flavoured Milk (22%), and Rabidi (13%). Because the packaging costs for certain items appear to be greater, the plant's management may investigate and search for alternative methods. Paneer production was the least lucrative of the several goods created. Sweet Dahi had the highest packaging cost share, followed by Sweetened Flavoured Milk and Rabidi. Toned milk accounts for almost 90% of overall income.

G.N. Narnaware et.al. (2021)Butter and Ghee are two of the most essential traditional dairy products that are commonly utilized in daily cooking. Economic analysis of this product is required to optimize the cost of each component used in the production of butter and ghee. As a result, the product will maintain its existence in a competitive market. As a consequence, the consumer will benefit from the lowest possible price. As a result, the product cost was determined at the NDRI Experimental Dairy, and the production cost of butter and ghee was Rs.41.34 per 500 gm. and Rs.126.53 per kg., respectively.

Anuradha Singh et.al. (2021)The largest profit was achieved in Dahi making, which provided a profit over cost of 23.76 percent. Other high-profit goods were double-toned milk and ghee, which generated profits of 15.21 and 11.88 percent, respectively. With a cost of Rs 16.05 per kg, Paneer has the lowest profit margin of 7.76%. The information on the profitability of various goods in Haryana might be useful in reorienting the product mix and production scale by superimposing the cost of manufacturing and demand for other items over it.

2.3 HANDLING LOSSES OF MILK SOLIDS

Handling losses are a key problem in the dairy industry since they result in product waste as well as monetary losses. Studies have proven how important it is to address handling losses in order to boost operational performance and minimise expenses. It is highlighted in the literature how important it is to decrease these losses by better handling techniques, smarter transportation methods, better by-product management, and process optimisation.

Devahastin et al. (2016) evaluated dairy supply chain handling losses and discovered that losses occurred at several phases, including shipping, processing, and packing. They underlined the importance of better handling techniques in order to reduce losses and increase overall profitability.

A study by Themen(2021),According to a research including four dairy processing farms in the United Kingdom (25% of total production), the most significant loss was caused by "separator de-sludge," which is a by-product of the cream-milk separation process. This quantity of milk loss accounts for around 0.2% of total consumption. Other milk losses occur in milk processing facilities during cleaning, line changes, and product rejection; however, cleaning/switchover losses that are directly related to milk were not determined in that research.

Katalin Tóth et,al (2021)Measurement of Food Losses in a Hungarian Dairy Processing Plant. The extent of milk loss at the corporate level was assessed in this study, which was complemented by loss figures for each dairy product. 1203.4-1406.8 L of raw material per day may be accounted for as losses during the investigated processing steps (receiving raw milk, skimming, pasteurization, Extended Shelf-Life (ESL) milk, cheese milk, sour cream, yoghurt, and kefir), accounting for 0.9-1% of daily production.

According to the literature analysis, production costs in composite dairy plants are impacted by raw material expenses, labour, energy, equipment, and packaging costs. Handling losses due to spillage reduce profitability. Modern technology, automated equipment, and effective inventory management can help to decrease losses and improve costs. Customer satisfaction is ensured through quality assurance throughout the production process. Sustainability activities, such as lowering water and energy use and waste, are critical. However, there are study gaps in particular cost breakdowns and extensive investigations on handling losses. More research is required to successfully address these gaps. Understanding the milk utilization pattern within the plant is also critical for improving cost-efficiency and decreasing waste.

CHAPTER III

REASEARCH METHODOLOGY

Methodology is the systematic method to performing research, problem solving, and reaching particular goals in a structured and scientific manner. In a composite dairy plant, the analysis of milk product manufacturing costs and handling losses entails investigating the many components that contribute to the total cost of producing milk and milk products and identifying losses occur during handling and processing. This study aids in the identification of inefficiencies, the optimization of processes, and the reduction of costs in dairy production.

3.1 STUDY AREA

The current study was conducted at the composite dairy plant of Tasty Dairy Specialities Ltd in Kanpur Dehat (U.P) India. Kanpur Dehat, in Uttar Pradesh, India, has a hot semi-arid climate with scorching summers and cold winters. It receives an average annual rainfall of 900-1,000mm, with the most of this falling during the monsoon season. The average temperature ranges between 25°C and 32°C. The region has a substantial milk production capacity, as well as agricultural and dairy farming industries. Dairy processing and value addition options abound, such as milk chilling, processing, milk spray drying and other dairy product production.

Fig.3.1 Map of District Kanpur Dehat

3.2 SAMPLING TECHNIQUE

3.2.1. Quantitative Data Collection

Manufacturing Cost Data: To quantify various manufacturing cost components, financial data such as expenditure reports, invoices, and production reports were gathered. These are the expenses of raw materials, labour, equipment & machinery, packaging, utilities, and quality control.

Data on Handling Losses: Data on handling losses in manufacturing processes were collected. This might entail going over manufacturing records and quality control data.

3.2.2 Qualitative Data Collection

Interviews: In-depth interviews were performed with key employees engaged in milk product manufacture, including plant managers, production supervisors, quality control personnel, and operators. These interviews were designed to elicit their thoughts on production costs, handling losses, and potential areas for improvement.

Observations: On-site observations were undertaken to evaluate handling procedures, manufacturing processes, and equipment use. These observations provided insights towards managing losses and identifying possible inefficiencies.

3.3 SOURCES OF DATA

Data was collected from plant records through the Account Department and Operations Management Department on production volumes, financial records, and operational practices in the Plant by the observation method. The secondary data was collected from the company's database and internet sources. The cost of processing and handling losses in the dairy plant was analysed by collecting primary data relating to manufacturing and value-added activity from the processing plant. The data was collected from both primary and secondary sources. The secondary data was collected from the company's database and internet sources.

3.4 STATISTICAL ANALYSIS

Based on the well-structured interviews, Primary Data, and Secondary data of plant was collected. In addition to following statistical tool was also used.

3.4.1 Milk Utilization Pattern

A dairy factory's milk utilization calculation entails measuring the composition of various components in milk, such as Fat, SNF (Solids Not Fat), and Total Solids. Here are some typical milk use formulas:

1.Total Intake of Fat = Total quantity of milk received at plant * Fat % in Milk/100
2. Total Intake of SNF = Total quantity of milk received at plant * SNF % in Milk/100
3. Fat Utilization = (Total Quantity of Product Manufactured * Fat % in Product)/100
4. SNF Utilization = (Total Qty. of Product of Manufactured * SNF % in Product)/100
5. Total Solid Utilization = Fat Utilization + SNF Utilization

3.4.2 Tabular Analysis

The cost of processing at a dairy plant was investigated by collecting primary data on processing and value addition activities from the processing plant. To compute the cost components, the total spending will be divided into fixed and variable expenses, as shown below.

Total cost = total variable cost + total fixed cost

3.4.2.1 Fixed Cost

A dairy plant's fixed costs are expenses that stay roughly constant regardless of the amount of Products Manufacturing. These expenses are incurred to construct and maintain the dairy plant's infrastructure and operations.

The following equations were used to calculate fixed costs for various processing activities in the manufacture of milk and milk products at the Dairy Plant.

Interest

In the context of a dairy unit, interest refers to the cost of borrowing money or the return on invested capital. The interest expense is computed as follows:

Interest Expense = Principal Amount x Interest Rate x Time

Depreciation

Depreciation is the process of allocating the cost of a physical item over its useful life.

The formula for straight-line depreciation is:

Depreciation Expense = (Cost of Asset - Residual Value) / Useful Life.

Salary of Administration & Staff

Data Available with human resource & account department.

3.4.2.2 Variable Cost

The variable cost of a dairy plant can vary based on various factors, including the facility's size and capacity, the specific activities and processes involved, the area where the plant is situated, and the cost of raw materials and utilities.

The following input data was used to calculate variable costs for various processing activities at the Milk Processing Unit.

Raw Materials ,Labour, Electricity, Steam, Packaging, Repair & Maintenance, CIP Chemicals and Quality Control.

3.4.3.3 Cost of Milk Product Manufacturing & Cost of Processing

Processing Costs: The processing cost largely focuses on the expenditures immediately related with changing raw milk into processed dairy products.

Cost of Manufacturing: The cost of manufacturing is a larger phrase that includes both direct processing costs and indirect charges associated with the total manufacturing processes in the dairy sector.

The total manufacturing cost was computed by adding the fixed and variable costs.

3.5.3.4 Analysis of Handling Losses

Handling losses in a milk processing plant relate to the wastage or reduction in the quantity of milk that happens during the various steps of handling and processing. These losses can be caused by a variety of circumstances and can occur at various stages of the milk processing unit's operation.

For computing handling losses and recovery of Fat, SNF, and T.S., the following formulas are applied.

1. Fat Handling Loss and Recovery

Fat Handling Loss (%)

Handling Loss = [(Initial Fat - Final Fat) / Initial Fat] * 100

Fat Recovery (%)

Fat Recovery = [(Processed Fat / Initial Fat) * 100]

Where:

Initial Fat: Fat content at the beginning of the process.

Final Fat: Fat content after the process is completed.

Processed Fat: Fat content obtained after processing.

2. SNF (Solids-Not-Fat) Handling Loss and Recovery

SNF Handling Loss (%)

Handling Loss = [(Initial SNF - Final SNF) / Initial SNF] * 100

SNF Recovery (%)

SNF Recovery = [(Processed SNF / Initial SNF) * 100]

Where:

Initial SNF: SNF content at the beginning of the process.

Final SNF: SNF content after the process is completed.

Processed SNF: SNF content obtained after processing.

3. Total Solids (T.S.) Handling Loss and Recovery

T.S. Handling Loss (%)

Handling Loss = [(Initial T.S. - Final T.S.) / Initial T.S.] * 100

T.S. Recovery (%)

T.S. Recovery = [(Processed T.S. / Initial T.S.) * 100]

Where:

Initial T.S.: Total Solids content at the beginning of the process.

Final T.S.: Total Solids content after the process is completed.

Processed T.S.: Total Solids content obtained after processing.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter is dedicated to presenting and interpreting the data analysis findings. The data from the sample population is rigorously evaluated and the findings are presented using a range of analytical approaches. Under the enumerated topics.

Milk utilization pattern in the product mix of dairy plant.

Cost of manufacturing various dairy products.

Handling loss of milk solids during the manufacturing of milk & milk products.

Variations in handling losses during flush and lean seasons.

4.1 MILK UTILIZATION PATTERN IN THE PRODUCT MIX OF THE DAIRY PLANT

Milk is delivered to the dairy plant by bulk milk merchants as well as via village level collections (VLCs). The average daily milk procurement was 204200 Kg. The majority of milk collected at the village level was utilized for market milk supply and cultured milk products, while bulk milk was used to make SMP,WMP, Ghee, and Butter. Milk consists major of two components, Fat and Solids Not Fat (SNF). Although the levels of these components in milk are those found in nature, they can be adjusted/standardized throughout the manufacturing process to match the demands of the products standard. To determine how much milk was used at the factory, the utilization of fat, solid not fat, and total solids (TS) for various products was determined.

4.1.1 Fat Utilization Pattern

The total kg of fat used for different products was calculated in order to establish how much milk fat was used at the facility. The plant's overall fat usage pattern is shown in Figure. 4.1. Major share of milk fat was used for Ghee making (40.10%) due to Ghee having more fat content followed by White Butter (26.89%). WMP (18.54%), FCM (7.94%).TM (2.86), DTM (1.18%),TSM (0.92%), Chach (0.66%), Masala Chach (0.52 %) ,SMP (0.36 %) and SM (0.03%).

Figure 4.1: Fat Utilization Pattern in Percentage

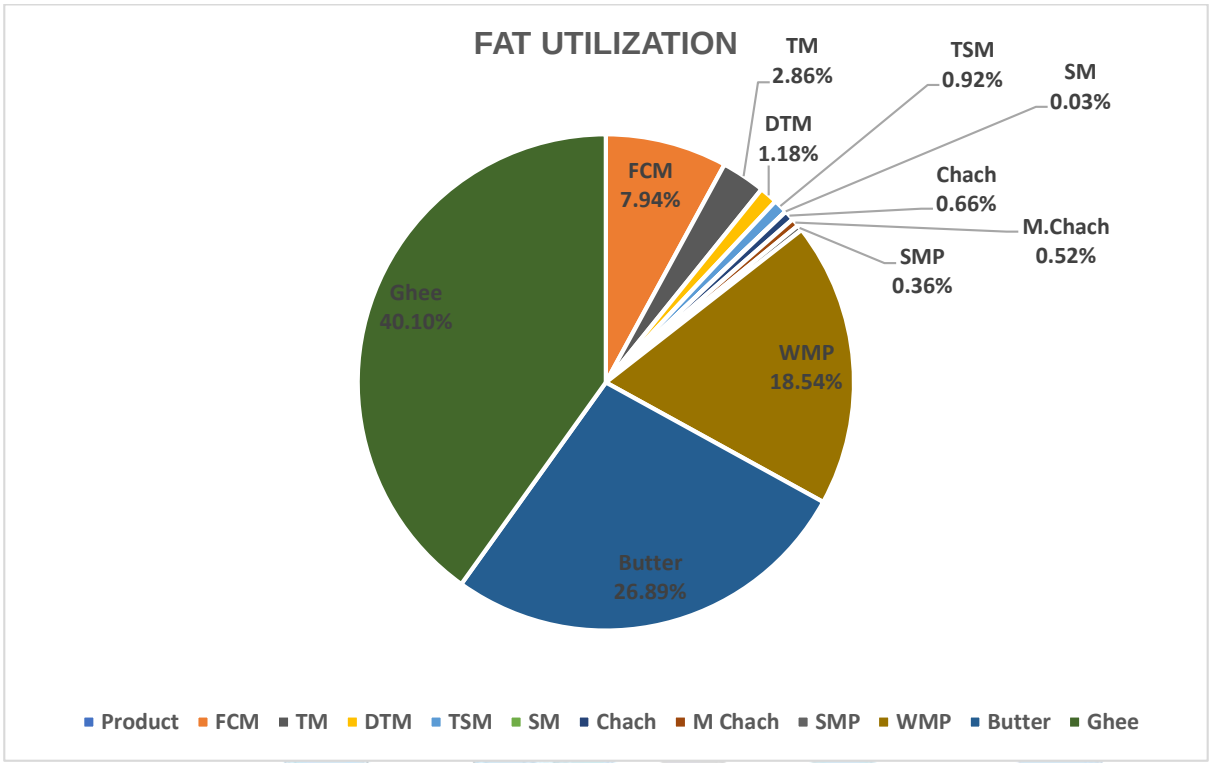


Fig. 4.1 Fat Utilization Pattern in Percentage

4.1.2 SNF Utilization Pattern

The total kg SNF used for various products was calculated to estimate the milk SNF usage at the composite milk plant. The overall SNF use pattern at the facility is depicted in Fig 4.2, SMP (39.04%) utilized the most milk SNF, followed by WMP(33.13%),FCM (7.95%),T M (5.34%) DTM (4.50%), TSM (3.96%), SM (2.97) ,Chach (1.79%) , Masala Chach (1.43%) and (Butter & Ghee) (0%).

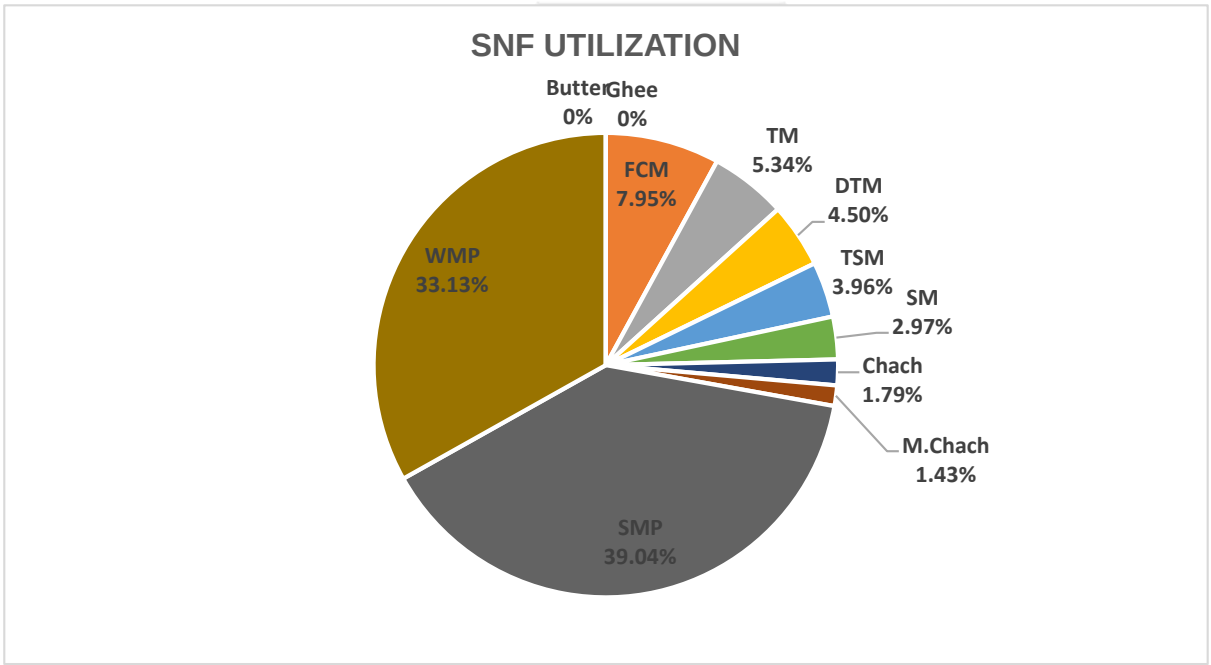


Fig. 4.2 SNF Utilisation Pattern in Percentage

4.1.3 Total Solid Utilisation Pattern

The total solids (TS) utilised for various products were calculated to establish the overall solid usage at the composite milk plant. For this purpose, Fat and SNF are given equal weightage. Figure 4.3, depicts the plant's total solids use trend. WMP (27.27%) used the most milk solids, followed by SMP (23.50%), Ghee (16.11%), White Butter (10.80%), FCM (7.94%) , T.M (4.34%) , DTM (3.16%),TSM (2.68%) SM (1.79%) Chach (1.34%) and Masala Chach (1.06%).

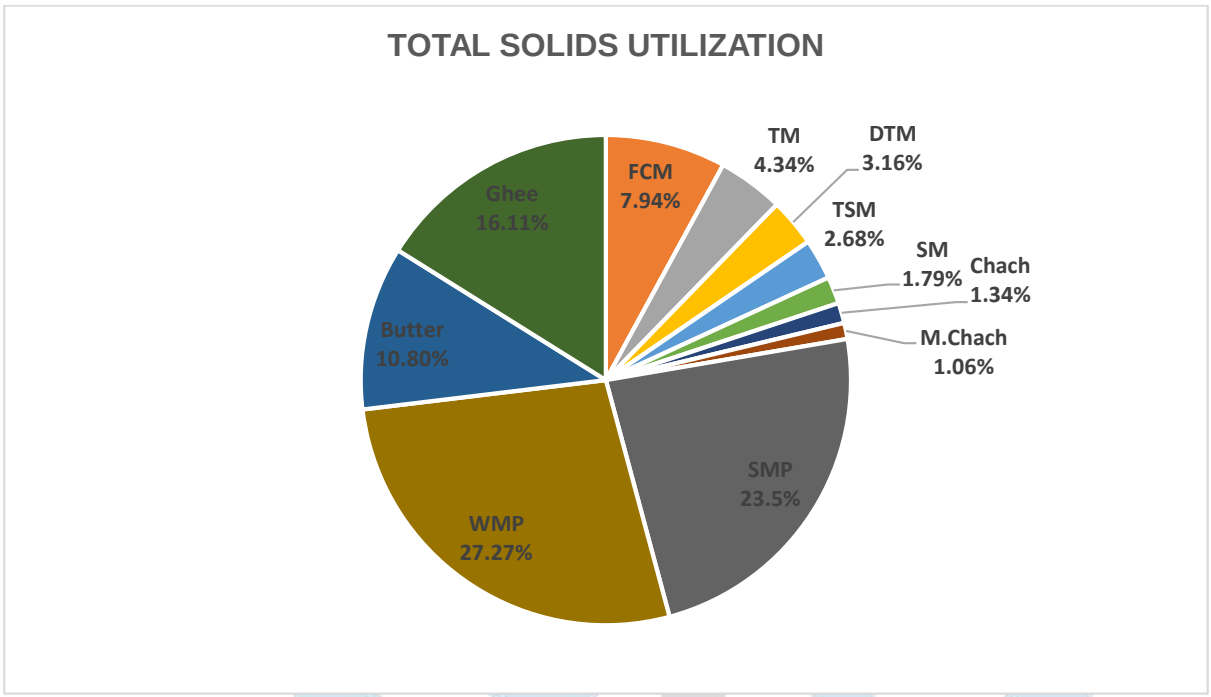
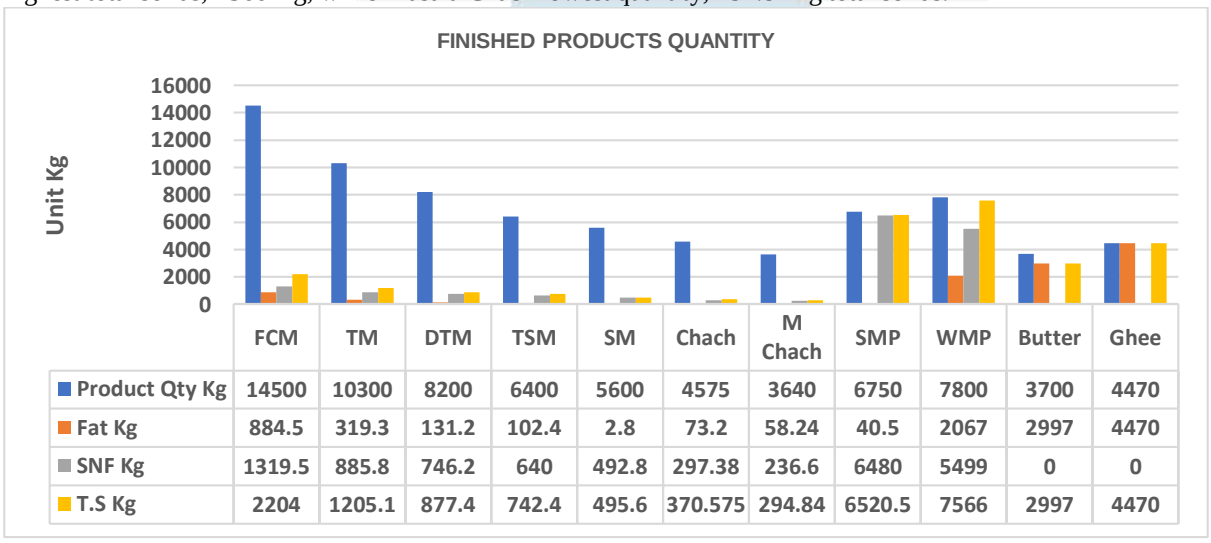


Fig. 4.3 Total Solids Utilisation Pattern in Percentage

4.1.4 Component-wise Product Analysis

Figure 4.4 depicts the utilisation of milk components in different product Manufacturing. Ghee was utilised highest Fat 4470 Kg , while Skimmed Milk (SM) was utilised lowest Fat 2.8 Kg. Skimmed Milk Powder (SMP) was utilised highest SNF 6480 Kg, while Ghee & Butter were utilised no SNF, since Ghee & Butter have only fat content. Whole Milk Powder (WMP) was utilised highest total solids, 7566 Kg, while Masala Chach lowest quantity, 294.84 kg total solids.



	FCM	TM	DTM	TSM	SM	Chach	M Chach	SMP	WMP	Butter	Ghee
Product Qty Kg	14500	10300	8200	6400	5600	4575	3640	6750	7800	3700	4470
Fat Kg	884.5	319.3	131.2	102.4	2.8	73.2	58.24	40.5	2067	2997	4470
SNF Kg	1319.5	885.8	746.2	640	492.8	297.38	236.6	6480	5499	0	0
T.S Kg	2204	1205.1	877.4	742.4	495.6	370.575	294.84	6520.5	7566	2997	4470

Fig.4.4 Finished Products Quantity

Table 4.1 Quantity of Finished Products

Product	Qty Ltr	Qty Kg	Fat %	SNF %	Fat Kg	SNF Kg
FCM	14078	14500	6.1	9.1	884.5	1319.5
TM	10000	10300	3.1	8.6	319.3	885.8
DTM	7961	8200	1.6	9.1	131.2	746.2
TSM	6214	6400	1.6	10	102.4	640
SM	5437	5600	0.05	8.8	2.8	492.8
Chach	4442	4575	1.6	6.5	73.2	297.38
M Chach	3534	3640	1.6	6.5	58.24	236.6
SMP		6750	0.6	96	40.5	6480
WMP		7800	26.5	70.5	2067	5499
Butter		3700	81	0	2997	0
Ghee		4470	100	0	4470	0
Closing Balance					168	312
Total		75935			11314	16909.28
Opening Balance					190	375.00
Milk Receipt		204200	5.5	7.9	11231	16131.8
SMP Reconstituted		635	0.6	95.5	3.81	606.425
Total					11425	17113.23

Figure 4.4: Finished Products Quantity

4.2 COST OF MANUFACTURING DAIRY PRODUCTS

The cost of manufacturing of dairy products was analysed during the study period of project. The cost of different products was broken down into fixed and variable costs in detail. Below is a detailed breakdown of the costs associated with various items, broken down into total and per-unit expenses as well as fixed and variable costs.

The average landed cost of raw chilled milk was Rs. 54.5 per kg during the research period, and a reckoner was applied for the computation of the raw chilled milk price for the fat standard of 6.5% and the SNF standard of 8.5% in a ratio of 60:40.

4.2.1 Cost of Manufacturing Full Cream Milk (FCM)

According to Table 4.2, the cost of producing FCM was Rs. 57.70 per litre. During the research period, the monthly output of full-cream milk was 422,330 litres. Component cost during the study period for the facility found that raw materials alone accounted for 96.90 percent of overall expenditure. The cost of packing material was 1.57 percent, followed by electricity at 0.36 percent, while the remaining components contributed 1.17 percent of total production costs. In the entire cost of production, the fixed cost was 0.59 percent and the variable cost was 99.41 percent.

Table 4.2: Manufacturing Cost of FCM

Table 4.2 Manufacturing Cost of FCM						
Sr. No	**Cost Component**	**Total Cost (Rs.)**	**Variable Cost (Rs.)**	**Fixed Cost (Rs.)**	**Total Cost Per Unit (Rs/Ltr)**	**% Cost**
1	**Raw Material**	23501534	23501534		55.65	96.90
2	**Labour**	54902.90	54902.90		0.13	0.23
3	**Electricity**	86875.2	86875.2		0.21	0.36
4	**Steam**	60088.68	60088.68		0.14	0.25
5	**Packaging**	380097	380097		0.9	1.57
6	**Repair and Maintenance**	12669.9	12669.9		0.03	0.05
7	**CIP Chemicals**	4223.3	4223.3		0.01	0.02
8	**Quality Control**	8446.6	8446.6		0.02	0.03
9	**Administration & Supervision**	67572.8		67572.8	0.16	0.28
10	**Interest**	42233		42233	0.1	0.17
11	**Depreciation on Equipment & Building**	33786.4		33786.4	0.08	0.14
12	**Total Cost**	24252430	24108838	143592.2	**57.4**	
13	**Per Unit Cost (Rs./Ltr)**				**57.7**	
14	**Percentage**	100.00	99.41	0.59		
15	**Processing Cost (Rs./Ltr)**	**1.78**				
16	**Total Production in Month Ltr**	422330				

4.2.2 Cost of Manufacturing Toned Milk (TM)

According to Table 4.3, the manufacturing cost of Toned Milk was Rs. 40.70 per litre of milk. During the research period, the monthly output of toned milk was 300,000 litres. A component-wise cost study for the facility found that raw materials alone accounted for around 95.38 percent of total expenditure. The cost of packing material was 2.46 percent, while the cost of electricity was 0.51 percent. The remaining items contributed 1.65 percent. In the overall cost of production, fixed costs were 0.84 percent and variable costs were 99.16 percent.

Table 4.3: Manufacturing Cost of TM

Table 4.3 Manufacturing Cost of T M						
Sr. No	**Cost Component**	**Total Cost (Rs.)**	**Variable Cost (Rs.)**	**Fixed Cost (Rs.)**	**Total Cost Per Unit (Rs/Ltr)**	**% Cost**
1	**Raw Material**	11634423	11634423		38.78	95.38
2	**Labour**	39000.00	39000.00		0.13	0.32
3	**Electricity**	61718.4	61718.4		0.21	0.51
4	**Steam**	42688.56	42688.56		0.14	0.35
5	**Packaging**	300000	300000		1	2.46
6	**Repair and Maintenance**	9000	9000		0.03	0.07
7	**CIP**	3000	3000		0.01	0.02
8	**Quality Control**	6000	6000		0.02	0.05
9	**Administration & Supervision**	48000		48000	0.16	0.39
10	**Interest**	30000		30000	0.1	0.25
11	**Depreciation on Equipment & Building**	24000		24000	0.08	0.20
12	**Total Cost**	12197830	12095830	102000	**40.7**	
13	**Per Unit Cost (Rs./500 ML)**				**20.3**	
14	**Percentage**	100.00	99.16	0.84		
15	**Processing Cost (Rs./Ltr)**	**1.88**				
16	**Total Production in Month Ltr**	300000				

4.2.3 Cost of Manufacturing Doble Toned Milk (DTM)

According to Table 4.4, the cost of producing DTM was Rs. 34.20 per litre. During the research period, the monthly output of double-toned milk was 238,835 litres. A component cost study for the facility found that raw materials alone accounted for about 94.51percent of overall expenditure. The cost of packing material was 2.92 percent, followed by electricity at 0.60 percent, while the remaining components contributed 1.97 percent of total production costs. In the entire cost of production, the fixed cost was 0.99 percent and the variable cost was 99.01 percent.

Table 4.4: Manufacturing Cost of DTM

Table 4.4 Manufacturing Cost of DTM						
Sr. No	**Cost Component**	**Total Cost (Rs.)**	**Variable Cost (Rs.)**	**Fixed Cost (Rs.)**	**Total Cost Per Unit (Rs/Ltr)**	**% Cost**
1	**Raw Material**	7721461	7721461		32.33	94.51
2	**Labour**	31048.55	31048.55		0.13	0.38
3	**Electricity**	49104	49104		0.21	0.60
4	**Steam**	33963.6	33963.6		0.14	0.42
5	**Packaging**	238835	238835		1	2.92
6	**Repair and Maintenance**	7165.05	7165.05		0.03	0.09
7	**CIP**	2388.35	2388.35		0.01	0.03
8	**Quality Control**	4776.7	4776.7		0.02	0.06
9	**Administration & Supervision**	38213.6		38213.6	0.16	0.47
10	**Interest**	23883.5		23883.5	0.1	0.29
11	**Depreciation on Equipment & Building**	19106.8		19106.8	0.08	0.23
12	**Total Cost**	8169947	8088743	81203.9	**34.2**	
13	**Per Unit Cost (Rs./500 ML)**				**17.1**	
14	**Percentage**	100	99.01	0.99		
15	**Processing Cost (Rs./Ltr)**	**1.88**				
16	**Total Production in Month Ltr**	238835				

4.2.4 Cost of Manufacturing Skimmed Milk (SM)

According to Table 4.5, the manufacturing cost of Skimmed Milk was Rs. 25.40 per litre of milk. During the research period, the monthly output of skimmed milk was 163,107 litres. A component-wise cost study for the facility found that raw materials alone accounted for 92.60 percent of total expenditure. The cost of packing material was 3.94 percent, while the cost of electricity was 0.81 percent. The remaining items contributed 2.65 percent. In the overall cost of production, fixed costs were 1.30 percent and variable costs were 98.70 percent.

Table 4.5 Manufacturing Cost of S M						
Sr. No	**Cost Component**	**Total Cost (Rs.)**	**Variable Cost (Rs.)**	**Fixed Cost (Rs.)**	**Total Cost Per Unit (Rs/Ltr)**	**% Cost**
1	**Raw Material**	3833919.18	3833919.18		23.51	92.60
2	**Labour**	21203.91	21203.91		0.13	0.51
3	**Electricity**	33552.00	33552.00		0.21	0.81
4	**Steam**	23206.80	23206.80		0.14	0.56
5	**Packaging**	163107.00	163107.00		1	3.94
6	**Repair and Maintenance**	4893.21	4893.21		0.03	0.12
7	**CIP**	1631.07	1631.07		0.01	0.04
8	**Quality Control**	3262.14	3262.14		0.02	0.08
9	**Administration & Supervision**	26097.12		26097.12	0.16	0.63
10	**Interest**	16310.70		16310.7	0.1	0.39
11	**Depreciation on Equipment & Building**	13048.56		13048.56	0.08	0.32
12	**Total Cost**	4140231.69	4084775.31	55456.38	**25.4**	
13	**Per Unit Cost (Rs./500 ML)**				**12.7**	
14	**Percentage**	100.00	98.7	1.3		
15	**Processing Cost (Rs./Ltr)**	**1.88**				
16	**Total Production in Month Ltr**	163107				

Table 4.5: Manufacturing Cost of SM

4.2.5 Cost of Manufacturing Tea Special Milk (TSM)

According to Table 4.6, the cost of producing TSM was Rs. 36.60 per litre. During the research period, the monthly output of Tea Special Milk was 186,408 litres. A component cost study for the facility found that raw materials alone accounted for 94.87 percent of the overall expenditure. The cost of packing material was 2.73 percent, followed by electricity at 0.56 percent, while the remaining components contributed 1.84 percent of total production costs. In the entire cost of production, the fixed cost was 0.90 percent and the variable cost was 99.10 percent.

Table 4.6 Manufacturing Cost of TSM

Sr. No	Cost Component	Total Cost (Rs.)	Variable Cost (Rs.)	Fixed Cost (Rs.)	Total Cost Per Unit (Rs/Ltr)	% Cost
1	**Raw Material**	6469687.60	6469687.60		34.71	94.87
2	**Labour**	24233.04	24233.04		0.13	0.36
3	**Electricity**	38347.20	38347.20		0.21	0.56
4	**Steam**	26523.48	26523.48		0.14	0.39
5	**Packaging**	186408.00	186408.00		1	2.73
6	**Repair and Maintenance**	5592.24	5592.24		0.03	0.08
7	**CIP**	1864.08	1864.08		0.01	0.03
8	**Quality Control**	3728.16	3728.16		0.02	0.05
9	**Administration & Supervision**	29825.28		29825.28	0.16	0.44
10	**Interest**	18640.80		18640.8	0.1	0.27
11	**Depreciation on Equipment & Building**	14912.64		14912.64	0.08	0.22
12	**Total Cost**	6819762.52	6756383.80	63378.72	**36.6**	
13	**Per Unit Cost (Rs./500 ML)**				**18.3**	
14	**Percentage**	100.00	99.1	0.9		
15	**Processing Cost (Rs./Ltr)**	**1.88**				
16	**Total Production in Month Ltr**	186408				

4.2.6 Cost of Manufacturing Chach

According to Table 4.7, the cost of producing Chach was Rs. 28.90 per litre. During the research period, the monthly output of Chach was 133252 litres. A component cost study for the facility found that raw materials alone accounted for 90.94 percent of the overall expenditure. The cost of packing material was 5.37 percent, followed by electricity at 1.00 percent, while the remaining components contributed 2.69 percent of total production costs. In the entire cost of production, the fixed cost was 1.20 percent and the variable cost was 98.80 percent.

Table 4.7 Manufacturing Cost of Chach

Sr. No	Cost Component	Total Cost (Rs.)	Variable Cost (Rs.)	Fixed Cost (Rs.)	Total Cost Per Unit (Rs/Ltr)	% Cost
1	**Raw Material**	3392795.16	3392795.16		25.46	90.94
2	**Culture cost**	106601.60	106601.60		0.80	
3	**Labour**	23985.36	23985.36		0.18	0.62
4	**Electricity**	38376.00	38376.00		0.29	1.00
5	**Steam**	26543.40	26543.40		0.20	0.69
6	**Packaging**	206540.60	206540.60		1.55	5.37
7	**Repair and Maintenance**	3997.56	3997.56		0.03	0.10
8	**CIP**	1332.52	1332.52		0.01	0.03
9	**Quality Control**	2665.04	2665.04		0.02	0.07
10	**Administration & Supervision**	21320.32		21320.32	0.16	0.55
11	**Interest**	13325.20		13325.2	0.1	0.35
12	**Depreciation on Equipment & Building**	10660.16		10660.16	0.08	0.28
13	**Total Cost**	3848142.92	3802837.24	45305.68	**28.9**	
14	**Per Unit Cost (Rs./200 ML)**				**5.8**	
15	**Percentage**	100.00	98.8	1.2		
16	**Processing Cost (Rs./Ltr)**	**2.62**				
17	**Total Production in Month Ltr**	133252				

4.2.7 Cost of Manufacturing Masala Chach

According to Table 4.8, the cost of producing Masala Chach was Rs. 30.00 per litre. During the research period, the monthly output of Masala Chach was 106,019 litres. A component cost study for the facility found that raw materials alone accounted for 91.28 percent of the overall expenditure. The cost of packing material was 5.16 percent, followed by electricity at 0.96 percent, while the remaining components contributed 2.59 percent of total production costs. In the entire cost of production, the fixed cost was 1.10 percent and the variable cost was 98.90 percent.

Table 4.8 Manufacturing Cost of Chach

Sr. No	Cost Component	Total Cost (Rs.)	Variable Cost (Rs.)	Fixed Cost (Rs.)	Total Cost Per Unit (Rs/Ltr)	% Cost
1	**Raw Material**	2699404.24	2699404.24		25.46	91.28
2	**Culture**	84815.20	84815.20		0.80	
3	**Spices**	120861.66	120861.66		1.14	
4	**Labour**	19083.42	19083.42		0.18	0.60
5	**Electricity**	30528.00	30528.00		0.29	0.96
6	**Steam**	21115.20	21115.20		0.20	0.66
7	**Packaging**	164329.45	164329.45		1.55	5.16
8	**Repair and Maintenance**	3180.57	3180.57		0.03	0.10
9	**CIP**	1060.19	1060.19		0.01	0.03
10	**Quality Control**	2120.38	2120.38		0.02	0.07
11	**Administration & Supervision**	16963.04		16963.04	0.16	0.53
12	**interest**	10601.90		10601.9	0.1	0.33
13	**Depreciation on Equipment & Building**	8481.52		8481.52	0.08	0.27
14	**Total Cost**	3182544.77	3146498.31	36046.46	**30.0**	
15	**Per Unit Cost (Rs./200 ML)**				**6.0**	
16	**Percentage**	100.00	98.9	1.1		
17	**Processing Cost (Rs./Ltr)**	**2.6**				
18	**Total Production in Month Ltr**	106019				

4.2.8 Cost of Manufacturing White Butter

According to Table 4.9, the cost of producing White Butter was Rs. 418.80 per Kg. During the research period, the monthly output of white butter was 111,000 Kg. A component cost study for the facility found that raw materials alone accounted for 98.24 percent of the overall expenditure. The cost of packing material was 0.77 percent, followed by electricity at 0.22 percent, while the remaining components contributed 0.76 percent of total production costs. In the entire cost of production, the fixed cost was 0.45 percent and the variable cost was 99.55 percent.

Table 4.9 Manufacturing Cost of White Butter

Sr. No	Cost Component	Total Cost (Rs.)	Variable Cost (Rs.)	Fixed Cost (Rs.)	Total Cost Per Unit (Rs/Kg)	% Cost
1	**Raw Material**	45231646	45231646		407.49	98.24
2	**Labour**	74370.00	74370.00		0.67	0.16
3	**Electricity**	99900	99900		0.90	0.22
4	**Steam**	38850	38850		0.35	0.08
5	**Packaging**	355200	355200		3.2	0.77
6	**Repair and Maintenance**	18315	18315		0.17	0.04
7	**CIP Chemicals**	6105	6105		0.06	0.01
8	**Quality Control**	12210	12210		0.11	0.03
9	**Administration & Supervision**	97680		97680	0.88	0.21
10	**Interest**	61050		61050	0.55	0.13
11	**Depreciation on Equipment & Building**	48840		48840	0.44	0.11
12	**Total Cost**	46044166	45836596	207570	**414.8**	
13	**Per Unit Cost (Rs./ 20 Kg) Carton**				**8296.25**	
14	**Percentage**	100.00	99.55	0.45		
15	**Processing Cost (Rs./Kg)**	**7.32**				
16	**Total Production in Month kg**	111000				

4.2.9 Cost of Manufacturing Ghee

According to Table 4.10, the cost of producing Ghee was Rs. 487.55 per litre. During the research period, the monthly output of white butter was 134,100 Kg. A component cost study for the facility found that raw materials alone accounted for 95.96 percent of the overall expenditure. The cost of packing material was 3.19 percent, followed by administration & supervision at 0.20 percent, while the remaining components contributed 0.64 percent of total production costs. In the entire cost of production, the fixed cost was 0.42 percent and the variable cost was 99.58 percent.

Table 4.10 Manufacturing Cost of Ghee						
Sr. No	**Cost Component**	**Total Cost (Rs.)**	**Variable Cost (Rs.)**	**Fixed Cost (Rs.)**	**Total Cost Per Unit (Rs/Kg)**	**% Cost**
1	**Raw Material**	67462615.4	67462615.4		503.08	95.96
2	**Labour**	89847	89847		0.67	0.13
3	**Electricity**	73755	73755		0.55	0.1
4	**Steam**	87165	87165		0.65	0.12
5	**Packaging**	2239470	2239470		16.7	3.19
6	**Repair and Maintenance**	26149.5	26149.5		0.2	0.04
7	**CIP Chemicals**	8716.5	8716.5		0.07	0.01
8	**Quality Control**	17433	17433		0.13	0.02
9	**Administration & Supervision**	139464		139464	1.04	0.2
10	**Interest**	87165		87165	0.65	0.12
11	**Depreciation on Equipment & Building**	69732		69732	0.52	0.1
12	**Total Cost**	70301512	70005151	296361	**524.2**	
13	**Per Unit Cost (Rs./ Ltr) Cika Pack**				**487.55**	
14	**Percentage**	100	99.58	0.42		
15	**Processing Cost (Rs./Kg)**	**21.17**				
16	**Total Production in Month kg**	134100				

Table 4.1: Quantity of Finished Products

4.2.10 Cost of Manufacturing Skimmed Milk Powder (SMP)

According to Table 4.11, the cost of producing Skimmed Milk Powder was Rs. 272.98 per Kg. During the research period, the monthly output of SMP was 202,500 Kg. A component cost study for the facility found that raw materials alone accounted for 91.30 percent of the overall expenditure. The cost of electricity was 3.03 percent, followed by steam at 2.79 percent, while the remaining components contributed 2.88 percent of total production costs. In the entire cost of production, the fixed cost was 1.33 percent and the variable cost was 98.67 percent.

Table 4.11 Manufacturing Cost of SMP

Sr. No	Cost Component	Total Cost (Rs.)	Variable Cost (Rs.)	Fixed Cost (Rs.)	Total Cost Per Unit (Rs/Kg)	% Cost
1	**Raw Material**	50469121	50469121		249.23	91.30
2	**Labour**	119475.00	119475.00		0.59	0.22
3	**Electricity**	1674000	1674000		8.27	3.03
4	**Steam**	1543800	1543800		7.62	2.79
5	**Packaging**	534600	534600		2.64	0.97
6	**Repair and Maintenance**	64759.5	64759.5		0.32	0.12
7	**CIP Chemicals**	95175	95175		0.47	0.17
8	**Quality Control**	43173	43173		0.21	0.08
9	**Administration & Supervision**	345384		345384	1.71	0.62
10	**Interest**	215865		215865	1.07	0.39
11	**Depreciation on Equipment & Building**	172692		172692	0.85	0.31
12	**Total Cost**	55278044	54544103	733941	**272.98**	
13	**Per Unit Cost (Rs./25 Kg)**				**6824.45**	
14	**Percentage**	100.00	98.67	1.33		
15	**Processing Cost (Rs./Kg)**	**23.75**				
16	**Total Production in Month Ltr**	202500				

4.2.11 Cost of Manufacturing Whole Milk Powder (WMP)

According to Table 4.12, the cost of producing Whole Milk Powder was Rs. 337 per Kg. During the research period, the monthly output of WMP was 234,000 Kg. A component cost study for the facility found that raw materials alone accounted for 93.21 percent of the overall expenditure. The cost of electricity was 2.42 percent, followed by steam at 2.24 percent, while the remaining components contributed 2.13 percent of total production costs. In the entire cost of production, the fixed cost was 0.92 percent and the variable cost was 99.08 percent.

Table 4.12 Manufacturing Cost of WMP

Sr. No	Cost Component	Total Cost (Rs.)	Variable Cost (Rs.)	Fixed Cost (Rs.)	Total Cost Per Unit (Rs/Kg)	% Cost
1	**Raw Material**	73505752.9	73505752.9		314.13	93.21
2	**Labour**	138060.00	138060.00		0.59	0.18
3	**Electricity**	1911600	1911600		8.17	2.42
4	**Steam**	1762920	1762920		7.53	2.24
5	**Packaging**	617760	617760		2.64	0.78
6	**Repair and Maintenance**	63882	63882		0.27	0.08
7	**CIP Chemicals**	95940	95940		0.41	0.12
8	**Quality Control**	42588	42588		0.18	0.05
9	**Administration & Supervision**	340704		340704	1.46	0.43
10	**Interest**	212940		212940	0.91	0.27
11	**Depreciation on Equipment & Building**	170352		170352	0.73	0.22
12	**Total Cost**	78862498.9	78138502.9	723996	**337.0**	
13	**Per Unit Cost (Rs./25 Kg)**				**8425.48**	
14	**Percentage**	100.00	99.08	0.92		
15	**Processing Cost (Rs./Kg)**	**22.89**				
16	**Total Production in Month Kg**	234000				

4.5 EXAMINATION OF LOSSES IN HANDLING

The plant data of a month for lean and flush seasons was taken for the analysis of milk handling losses as well as recovery of Fat, SNF, and total solids (TS) during the study period.

4.5.1 Analysis of Handling Losses During the Lean Season

Table 4.13 shows that during the lean season, handling losses were 1.02 percent for fat and 1.31 percent for SNF, with a recovery rate of 98.98 percent for fat and 98.69 percent for SNF. Total solid loss was 1.2 percent, while recovery was 98.80 percent.

Table 4.13 Analysis of Handling Losses in Lean Season

	PARTICULARS	QTY Ltr	QTY Kg	FAT %	SNF %	FAT Kg	SNF Kg
I	**OPENING BALANCE AS ON**						
a)	LOOSE MILK						
	RMS-1		500	5.8	8.4	29.00	42.00
	RMS-2		800	5.5	8.35	44.00	66.80
	PMT-1		500	6	9.07	30.00	45.35
b)	LOOSE CREAM		400	45	5	180.00	20.00
II	**RECEIPT**						
a)	RAW MILK RECEIPT		6339900	**5.3**	**7.6**	336014.7	481832.4
b)	SMP RECONSTITUTED		24950	0.6	95.5	149.7	23827.25
c)	RETURNED MILK						
	FCM	5630	5798.9	6.1	9.1	353.73	527.70
	TM	7362.5	7583.375	3.1	8.6	235.08	652.17
	DTM	4840.5	4985.715	1.6	9.1	79.77	453.70
	TSM	6536	6732.08	1.6	10	107.71	673.21
	SM	1355.5	1396.165	0.05	8.7	0.70	121.47
	TOTAL INPUT					**337224.40**	**508262.04**
III	**DESPATCHES**						
a)	FCM	427184	440000	6.1	9.1	26840	40040
b)	TM	296311	305200	3.1	8.6	9461.2	26247.2
c)	DTM	231282	238220	1.6	9.1	3811.52	21678.02
d)	TSM	183893	189410	1.6	10	3030.56	18941
e)	SM	147961	152400	0.05	8.8	76.2	13411.2
f)	Chach	133495	137500	1.6	6.5	2200	8937.50
g)	M Chach	99806	102800	1.6	6.5	1644.8	6682
h)	SMP		207080	0.6	96	1242.48	198796.8
l)	WMP		236500	26.5	70.5	62672.5	166732.5
j)	Butter		115000	81	0	93150	0
K)	Ghee		129420	100	0	129420	0
IV	**CLOSING BALANCE**						
a)	LOOSE MILK						
	RSM-1		500	4.7	7.6	23.50	38.00
	PMT-1		300	3.1	8.6	9.30	25.80
	PMT-2		700	1.6	9.1	11.20	63.70
b)	LOOSE GHEE						
	GST-1	200	186	100	0	186.00	0.00
	TOTAL OUTPUT					**333779.26**	**501593.72**
	Loss/Gain Kg					**-3445**	**-6668**
	Recovery %					**98.98**	**98.69**
	Handling Losses %					**1.02**	**1.31**

4.5.2 Analysis of Handling Losses During the Flush Season

Table 4.14 shows that during the flush season, handling losses were 0.90 percent fat and 1.05 percent SNF, with a recovery rate of 99.1 percent fat and 98.95 percent SNF. Total solids loss was 1%, with a 99 percent recovery rate.

Table 4.14 Analysis of Handling Losses in Flush Season

	PARTICULARS	QTY Ltr	QTY Kg	FAT %	SNF %	FAT Kg	SNF Kg
I	**OPENING BALANCE AS ON**						
a)	LOOSE MILK						
	RMS-1		500	5.6	7.5	28.00	37.50
	PMT-1		700	5.6	7.4	39.20	51.80
b)	LOOSE CREAM		400	45	5	180.00	20.00
II	**RECEIPT**						
a)	RAW MILK RECEIPT		6213800	**5.7**	**8.2**	354186.6	509531.6
b)	SMP RECONSTITUTED		16940	0.6	95.5	101.64	16177.7
c)	RETURNED MILK						
	FCM	630	648.9	6.1	9.1	39.58	59.05
	TM	362.5	373.375	3.1	8.6	11.57	32.11
	DTM	40.5	41.715	1.6	9.1	0.67	3.80
	TSM	536	552.08	1.6	10	8.83	55.21
	SM	355.5	366.165	0.05	8.7	0.18	31.86
	TOTAL INPUT					**354596.28**	**526000.62**
III	**DESPATCHES**						
a)	FCM	478447	492800	6.1	9.1	30060.8	44844.8
b)	TM	296311	305200	3.1	8.6	9461.2	26247.2
c)	DTM	259035	266806	1.6	9.1	4268.896	24279.35
d)	TSM	205922	212100	1.6	10	3393.6	21210
e)	SM	165631	170600	0.05	8.8	85.3	15012.8
f)	Chach	147961	152400	1.6	6.5	2438.4	9906.00
g)	M Chach	109825	113120	1.6	6.5	1809.92	7352.8
h)	SMP		212980	0.6	96	1277.88	204460.8
l)	WMP		237000	26.5	70.5	62805	167085
j)	Butter		132600	81	0	107406	0
k)	Ghee		128300	100	0	128300	0
IV	**CLOSING BALANCE**						
a)	LOOSE MILK						
	RSM-1		500	5.8	8.4	29.00	42.00
	PMT-1		400	3.6	8.1	14.40	32.40
	PMT-2		200	5.6	8.5	11.20	17.00
b)	LOOSE GHEE						
	GST-1	60	55.8	100	0	55.88	0.00
	TOTAL OUTPUT					**351417.48**	**520490.15**
	Loss/Gain Kg					**-3179**	**-5510**
	Recovery %					**99.10**	**98.95**
	Handling Losses %					**0.90**	**1.05**

4.6 VARIABILITY IN HANDLING LOSSES

On table 4.15, it was observed that on the season's analysis of handling losses, Fat, SNF, and Total Solids (TS) were higher in lean seasons, while the recovery was lower in lean seasons and vice versa in flush seasons.

Table 4.15 Variation In Handling Losses and Recovery			
Handling Losses %	Lean Season	Flush Season	Variation %
FAT	1.02	0.9	0.12
SNF	1.31	1.05	0.26
T S	1.2	1	0.2
Recovery %			
FAT	98.98	99.1	0.12
SNF	98.69	98.95	0.26
T S	98.2	99	0.8

CHPTER V

SUMMARY AND CONCLUSION

The dairy business is critical to the global food market, as milk products are an integral element of people's diets. To maintain effective production and supply of high-quality milk products, it is critical to examine manufacturing costs and handling losses in composite dairy plant. Composite dairy plants involve a wide range of activities, from milk collection and processing through the manufacturing of various dairy products such as market milk, cheese, butter, ghee, dried milk powders, yogurt, etc.

The major goal of this research is to acquire insights into the cost structure of milk product manufacturing and identify possible areas for improvement. Understanding the elements that contribute to handling losses will allow us to apply steps to reduce waste and enhance overall productivity. By systematically examining these aspects, we aim to provide valuable recommendations to dairy plant operators and stakeholders to enhance profitability and sustainability.

The project work was done particularly to meet the following objectives:

To work out the cost of manufacturing various dairy products.

To examine the milk utilization pattern in the product mix of dairy plant.

To quantify the handling loss of milk solids during the manufacturing of milk & milk products.

To investigate the main influencing factors and variations in handling losses during flush and lean seasons.

5.1 MAJOR FINDING OF STUDY

The outcomes of this investigation are succinctly outlined below.

5.1.1 Milk Utilization Pattern in the Product- mix of the Dairy Plant

To determine the milk utilization at the plant, fat, solids not fat, and total solids utilized for various products were worked out.

The total kg of fat used for various products was calculated to establish the milk fat utilization at the facility. Ghee was made from a large portion of milk fat (40.10 percent). Ghee has the highest fat concentration, followed by Butter (26.89 percent), WMP (18.54 percent), FCM (7.94 percent), T M (2.86 percent), DTM (1.18 percent), TSM (0.92 percent), Chach (0.66 percent), M. Chach (0.52 percent), SMP (0.36 percent), and SM (0.03 percent).

The total kg of SNF used for various products was calculated to establish the milk SNF usage at the factory. SMP (39.04 percent) received the most milk SNF, followed by WMP (33.13%), FCM (7.95 percent), TM (5.3 percent), DTM (4.5 percent), TSM (3.86 percent), SM (2.97 percent), Chach (1.79 percent), and M. Chach (1.43 percent).

The total solids (TS) utilized for various products were calculated to establish the overall solid usage at the facility. Fat and SNF are given equal weightage for this function. It was discovered that the total solids utilization pattern at the plant was that a share of milk solids was used for WMP (27.27 percent), SMP (23.50 percent), Ghee (16.11 percent), Butter (10.80 percent), FCM (7.94 percent), TM (4.34 percent), DTM (3.16 percent), TSM (2.68 percent), SM (1.79 percent), Chach(1.34 percent), and M. Chach(1.06 percent).

The study revealed that the quantity of ghee and butter manufactured was less than that of other products, but it used more fat. Where TM, DTM, TSM, Chach, M. Chach, SMP, and SM utilize less fat than ghee and butter. SNF utilization was mostly in proportion to the quantity of product, except for ghee and butter, because ghee and butter have only fat content. SMP and WMP have less moisture content. Ghee has a very low moisture contentalmost nil.

5.1.2 Manufacturing Cost of Individual Dairy Products

The cost of manufacturing dairy products, which were manufactured, was estimated during the study period. The detailed breakdown of components and costs of various products divided into fixed and variable costs.

The manufacturing cost of FCM was determined at Rs. 57.70 per litre. During the research period, component costs indicated that raw materials alone accounted for 96.90 percent of total expenditure. The cost of packaging material was 1.57 percent, followed

by electricity at 0.36 percent, while the remaining components contributed 1.17 percent of overall manufacturing expenses. The fixed cost was 0.59 percent of the total cost of manufacturing, while the variable cost was 99.41 percent.

The study revealed that the cost of manufacturing toned milk was Rs. 40.70 per litre of milk. During the research period, the cost of raw materials alone accounted for about 95.38 percent of total expenditure. The cost of packaging materials was 2.46 percent, while the cost of electricity was 0.51 percent. The remaining items contributed 1.65 percent. Fixed costs comprised 0.84 percent of total manufacturing costs, while variable costs comprised 99.16 percent.

It was observed that the cost of production of DTM was Rs. 34.20 per litre. A component cost study of raw materials alone accounted for about 94.51 percent of overall expenditure. The cost of packing material was 2.92 percent, followed by electricity at 0.60 percent, while the remaining components contributed 1.97 percent of total production costs. In the entire cost of production, the fixed cost was 0.99 percent and the variable cost was 99.01 percent.

It was observed that the cost of manufacturing skimmed milk was Rs. 25.40 per litre . The component-wise cost of raw materials alone accounted for 92.60 percent of total expenditure. The cost of packing material was 3.94 percent, while the cost of electricity was 0.81 percent. The remaining items contributed 2.65 percent. In the overall cost of production, fixed costs were 1.30 percent and variable costs were 98.70 percent.

The result showed that the cost of production of TSM was Rs. 36.60 per litre. The component cost of raw materials alone accounted for 94.87 percent of the overall expenditure. The cost of packing material was 2.73 percent, followed by electricity at 0.56 percent, while the remaining components contributed 1.84 percent of total production costs. In the entire cost of production, the fixed cost was 0.90 percent and the variable cost was 99.10 percent.

The study revealed that the cost of manufacturing chach was Rs. 28.90 per litre. The cost of raw materials alone accounted for 90.94 percent of the total expenditure. The cost of packaging material was 5.37 percent, followed by electricity at 1.00 percent, while the remaining components contributed 2.69 percent to overall manufacturing expenses. The fixed cost was 1.20 percent of the total cost of production, and the variable cost was 98.80 percent.

It was discovered that the cost of manufacturing Masala Chach was Rs. 30.00 per litre. The cost of raw materials alone accounted for 91.28 percent of the total expenditure. The cost of packaging material was 5.16 percent, followed by electricity at 0.96 percent, while the remaining components contributed 2.59 percent of overall manufacturing expenses. The fixed cost was 1.10 percent of the total cost of manufacturing, while the variable cost was 98.90 percent.

It was discovered that the cost of manufacturing white butter was Rs. 418.80 per kg. The cost of raw materials alone accounted for 98.24 percent of the total expenditure. The cost of packaging material was 0.77 percent, followed by electricity at 0.22 percent, while the remaining components contributed 0.76 percent of overall manufacturing expenses. The fixed cost was 0.45 percent of the total cost of manufacturing, while the variable cost was 99.55 percent.

The result showed that the cost of manufacturing ghee was Rs. 487.55 per litre. A component cost study of raw materials alone accounted for 95.96 percent of the overall expenditure. The cost of packing material was 3.19 percent, followed by administration and supervision at 0.20 percent, while the remaining components contributed 0.64 percent of total production costs. In the entire cost of production, the fixed cost was 0.42 percent and the variable cost was 99.58 percent.

The findings indicated that the cost of producing Skimmed Milk Powder was Rs. 272.98 per Kg. The cost of raw materials alone accounted for 91.30 percent of total expenditure. The cost of electricity was 3.03 percent, followed by steam at 2.79 percent, while the remaining components contributed 2.88 percent to overall production expenses. The fixed cost was 1.33 percent of the total manufacturing cost, while the variable cost was 98.67 percent.

It was discovered that the cost of manufacturing Whole Milk Powder was Rs. 337 per Kg. The cost of raw materials alone accounted for 93.21 percent of total expenditure. The cost of electricity was 2.42 percent, followed by steam at 2.24 percent, while the remaining components contributed 2.13 percent to overall production expenses. The fixed cost was 0.92 percent of the total manufacturing cost, while the variable cost was 99.08 percent.

5.1.3 Examination of Losses During Handling

This study was executed with a central focus on managing losses within a milk processing plant throughout the study duration, encompassing both flush and lean seasons. It provided a concise overview of losses related to Fat, SNF, and Total Solids, along with an examination of the seasonal fluctuations in these losses.

The study revealed that during the lean season, handling losses were 1.02 percent for Fat and 1.31 percent for SNF, with a recovery rate of 98.98 percent for Fat and 98.69 percent for SNF. Total solid loss was 1.2 percent, while recovery was 98.80 percent.

The study revealed that during the flush season, handling losses were 0.90 percent Fat and 1.05 percent SNF, with a recovery rate of 99.1 percent Fat and 98.95 percent SNF. Total solids loss was 1%, with a 99 percent recovery rate.

It was observed that on the season's analysis of handling losses, Fat, SNF, and Total Solids (TS) were higher in lean seasons, while the recovery was lower in lean seasons and vice versa in flush seasons.

Higher levels of Fat, SNF, and T.S. were observed in received milk during the flush season, whereas these proportions were relatively lower during the lean season.

5.2 CONCLUSION

"In the production of a diverse range of dairy products, the allocation of milk components played a crucial role. Skimmed Milk Powder utilized the highest SNF content due to its inherently higher concentration compared to other products. Ghee, rich in fat, consumed the majority of milk fat. Whole Milk Powder, with its emphasis on total solids, incurred the highest manufacturing cost. Interestingly, Skimmed Milk exhibited the lowest cost, leveraging minimal fat content. Handling losses were notably greater during lean seasons, while recovery rates of FAT, SNF, and Total Solids were enhanced during flush seasons. This fluctuation was mirrored in milk receipt percentages. Ultimately, these findings underscore the intricate balance between product composition, processing efficiency, and cost considerations in dairy manufacturing."

5.3 SUMMARY

The milk processing operation focused on optimizing the utilization of different components in the milk, resulting in the production of various products. Skimmed Milk Powder, with its higher Solids-Not-Fat (SNF) content, was the primary choice for utilizing the lion's share of milk SNF. Conversely, Ghee, rich in milk fat, absorbed the majority of milk fat. Skimmed Milk, in contrast, contained minimal fat content in its production. In the production process, Ghee required the most milk fat, Skimmed Milk Powder demanded the highest SNF content, and Whole Milk Powder utilized the greatest amount of total solids. Notably, the cost per unit of Whole Milk Powder was the highest, while Skimmed Milk production incurred the lowest cost among the product mix.

The processing operation encountered handling losses, which were more pronounced during the lean season but comparatively reduced during the flush season. During the flush season, there was a higher recovery of FAT, SNF, and Total Solids compared to the lean season. This trend corresponded with higher percentages of these components in the received milk during the flush season, and conversely, lower percentages during the lean season.

CHAPTER VI

RECOMMENDATIONS

Based on the analysis of Milk Products Manufacturing costs and Handling Losses, optimizing the product mix ratios based on milk component utilization could reduce costs. Efficient allocation of components for Ghee and Skimmed Milk Powder, along with cost-effective Whole Milk Powder production, should be pursued. To manage handling losses, enhance storage practices, packaging, and inventory management, particularly during the lean season. Develop a seasonal production plan, considering milk composition fluctuations. Prioritize quality control and explore diversifying the product range to align with varying milk components. Market analysis can identify premium opportunities. Research innovative processing techniques and foster collaborations for insights. Implementing these measures will enhance operational efficiency, reduce costs, and boost profitability.

CHAPTER VII

LIMITATION

It is possible for processing costs related to milk and milk products to vary between different plants. Handling losses may be influenced by the variety of products, the processing parameters, the effectiveness of the machinery, the number of hours the plant is operational, and the productivity of the technical staff.

This project's limitations include a focus on a specific composite dairy plant, which may limit generalizability. The analysis assumes consistency in the quality of milk components, potentially overlooking natural variations. External factors like market dynamics and technological advancements are not extensively addressed. The conclusions are based on existing practices and may not encompass the entire spectrum of possibilities. Moreover, the analysis doesn't consider environmental or sustainability factors, which could impact long-term viability.

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