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A Study On Dairy Supply Chain Management In India – Its Development, Policies & Barriers

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ABSTRACT

The Dairy sector is one of the most thriving businesses in the Indian market and been retained its world no 1 position as the largest Milk producer since 1997. In India, it is estimated that about 48% of milk produced is consumed at the producer level, and the remaining 52 % is available for sale in urban areas out of this only 40 % of produced milk is handled by the organized sector (Dairy Cooperatives & Private dairies) and remaining 60 % of the milk production is distributed through Unorganised dairy sector Hence government has introduced many schemes to increase the share of organized flow in the dairy sector. In this paper, we discussed the stats and figures of the Indian dairy market size and its growth over the past decade. I have conducted direct interviews with various stakeholders of the dairy chain and made the process flow chart showing how the milk is procured and reaches the end consumer both in the organized and unorganized sector and major emphasis made on cold chain aspects of the dairy sector.

Keywords: Dairy Supply Chain, Dairy products, Government policies & Barriers.

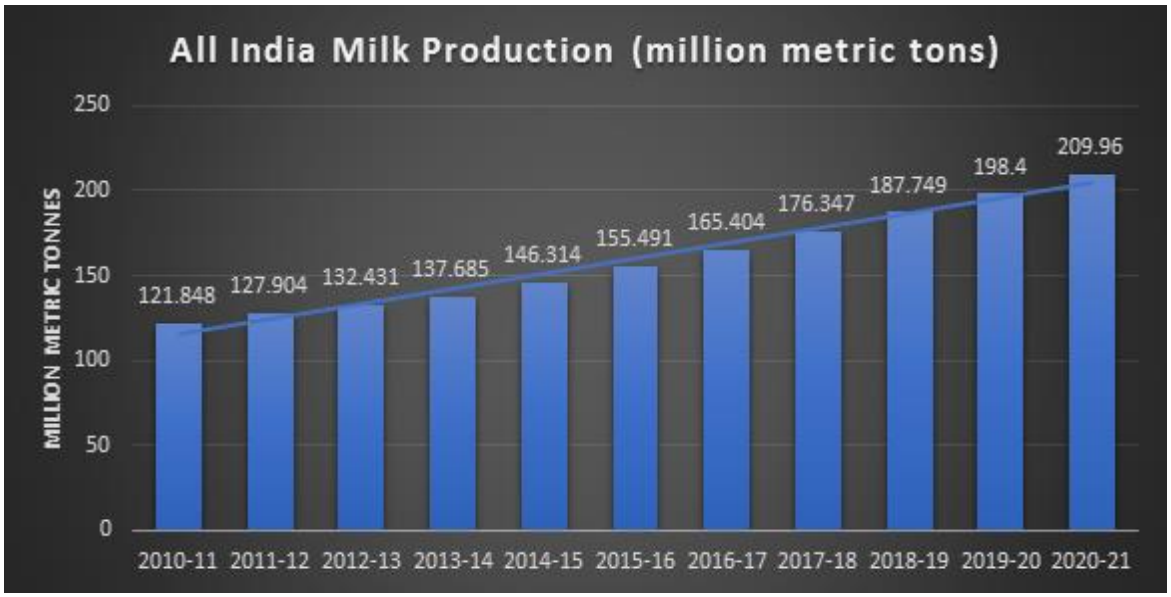
INTRODUCTION

Dairy products are defined as the foods prepared from the milk of mammals. Some of the common dairy products are Milk, Cream, Cheese, butter, etc. over the past few decades there is raising concerns over having healthy diets and preferring vegetarianism over meat health advantages of milk and its products, people started to prefer to take more milk and its products [10]. In India, more than 70 % of the population are living in villages and whose main occupation is practicing agriculture for their livelihood. Usually, they prepare 3 crop seasons in a year hence returns will take months [4]. So, dairy became a secondary source of income for the majority of the farmers as they provide good employment and income-generating opportunities for many households, and on top of this will give quick returns for the small-scale milk producers [12]. Here both agriculture and animal husbandry share a symbiotic relationship i.e., Agricultural waste and by-products can be supplied as food for the livestock, and in return, animals provide the necessary manure which can use as fertilizers in farming [4]. Dairy supply chain management is the process of managing the supply of milk from milk farms and processing it as per requirement and transporting it to the end consumers.

Currently, India is the world's largest milk-producing country with 22% of the global production share followed by the United States, China, Pakistan & Brazil [1], apart from this it is also the largest consumer of milk in the world to feed its growing population. Around 80 million people are employed in this dairy sector and it is expected to reach 355 billion $ by 2025 [23]. As per the National Dairy Development Board, In 1991-92 India's milk production stood at 55.6 million tonnes with a per capita availability of 178 gms/day and in 2018-19 it rose to 187.75 million tonnes with a per capita availability of 394 gms/day [2] thanks to schemes like operations flood programs which lead to the sustained growth of dairy sector from the past 2 decades. As per the press statement released by the Ministry of Fisheries, Animal Husbandry & Dairying dated Jun 01, 2021[8]. It observed that Milk production in India has an annual growth rate of 6.3% per year from the past 6 years while world annual milk production growth rate stood at 1.5% per year. The dairy sector has become the livelihood for 8 crore dairy farmers across India. During the year 2019-20, India has produced 198.4 million tonnes of milk which values at 7.72 lakhs cores (as per 2018-19 prices) which are greater than the valuation of wheat and paddy combined and as per the

Economic survey 20-21 [9] During 2020-21, the milk production rose to 209.96 million tonnes with per capita availability of 427 gms/day maintaining its legacy of top milk producer of the world.

ICMR recommended a healthy diet includes the consumption of 300 gms of milk per day but only 12 states &Union Territories have been said to have surplus amounts & rest of the states/UT are said to be below the minimum requirement.



Source: https://www.nddb.coop/information & [8],[9]

As per 2018-19 stats of NDDB, The Top 5 milk producing states include Uttar Pradesh (16.25 % 30.52 MMT) Rajasthan (12.60% - 23.66 MMT) Madhya Pradesh (8.47 % - 15.91 MMT) Andhra Pradesh (8.01% -15.04 MMT) and Gujarat (7.71% - 14.49 MMT) [3]

Due to its perishability and being temperature sensitive, people mostly depend on nearby local cattle owners for their milk consumption but over the past two decades, the dairy industry has seen a tremendous growth many of the players like Amul, Mother dairy, Nandhini milk, Dynamix dairy, Milma milk, Vijaya dairy, Cavin Milk, heritage foods, etc came to the market with a good dairy supply chains and made it a sustainable business.

LITERATURE REVIEW

India's dairy usage dates back to 8000 years ago with the first domestication of zebu cattle which is assumed to be originated from India and later in the Indus valley civilization there are pieces of evidence of the usage of Milk [21]. Majorly the animals are used for ploughing and producing the milk. Moreover, from the Vedic manuscripts, we can see tremendous importance has been given to the cows and the importance of the milk. Over the period of time Milk, ghee and yogurt (Curd) have become a common element in people's diets. Back in the 1930's various reports suggested that India's per capita consumption of milk and related dairy products has been very low (200 g) which is very low compared to the other countries. Low productivity of the livestock and poverty are the major challenges that are hindering the growth.

National Dairy Development Board was founded in 1965. With the development of Cooperative milk societies, procurement and distribution of milk have increased significantly. In 1970 Government of India launched one of its largest rural development programs called the Operations Flood program which is a national milk supply network that helps the rural milk producers across the 700 towns to connect with consumers and ensure they get their fair market share and the major credit goes to one man, Dr. Varghese Kurien who was known as the father of India's White Revolution. The operation flood program was his idea that changed India from being an importer of Milk and milk products to being the largest producer of milk & its products in the world. This Operation flood was executed in three phases.

Phase I (1970-80): This phase is funded by European Union &EEC (European economic community) through the world food program. During this phase, NDDB developed its dairy products in all metropolitan cities like New Delhi, Mumbai, Kolkata & Chennai.

Phase II (1981-85): This phase was executed in major cities increasing the milk sheds from 18 to 136. By the end of the phase, it has 43000 Village cooperatives involving 4.25 million milk producers across the country. By 1989 domestic milk powder production has grown to 1,40,000 tons which were

due to setting up the dairies as a part of this program.

Phase III (1985-96) Now the program is expanded further to smaller towns. By the 1990s milk sheds have increased to 173 and with the addition of new ones the overall Dairies cooperative count increased to 72,000. Apart from this, there has been major emphasis given to other services like Veterinary health services, Artificial inseminations, Member training & Research, and development in animal health & nutrition [5].

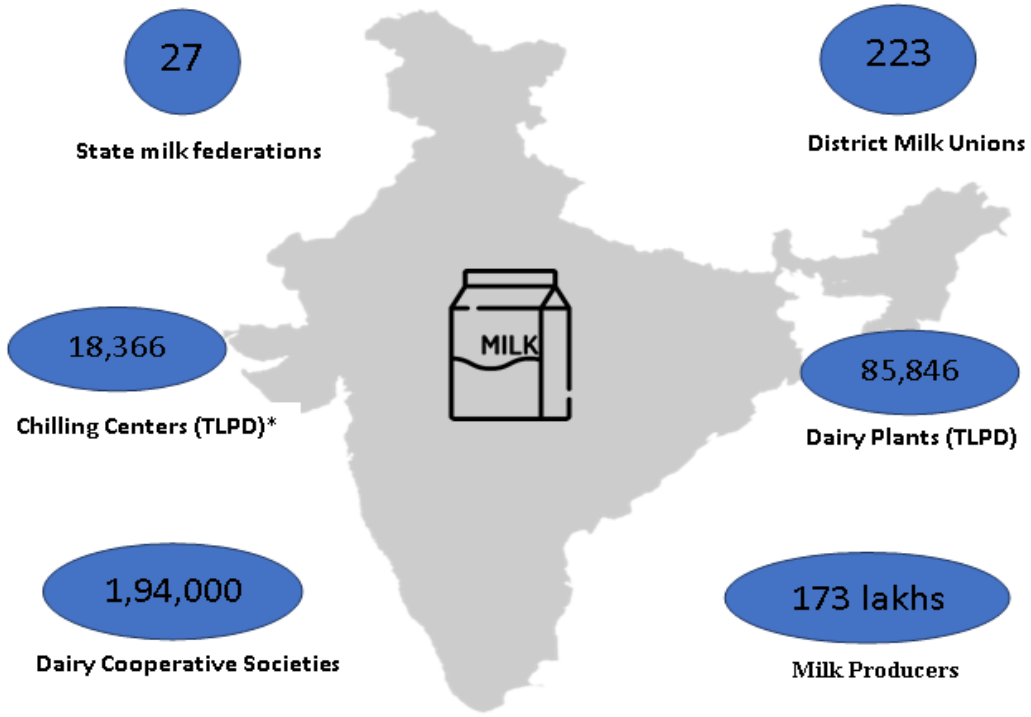
This program has not only increased the milk production but also made India as Largest Milk producer in the world by 1997 and since then it maintained its legacy till now [5]. As per the National Cooperative Dairy Federation of India (NCDFI) currently India has 27 State milk federations, 223 District milk unions, 1.96 lakh village milk societies, and 172.63 lakh dairy farmer members [6].

2. (J.L. Glover, D. Champion, K.J. Daniels, et al. 2014) found that two important challenges in the dairy supply chain are sustainability and the more energy consumption. They applied Institution theory to study the sustainability practices to achieve cost reduction and profit maximization for all stakeholders. Unlike previous studies where institution theory was applied to only Organizations, they applied this to study the retailer stakeholders. The team conducted 70 semi-structured telephonic interviews and arrived at the conclusion that supermarkets and how they became a dominant player in the chain and they exert pressure on smaller organizations and conclude government policies should be structured in a such a way that every stakeholder a benefited instead of the dominant players [7].

3. **Amul Supply Chain Model** (About Us - The Amul Model: Amul - The Taste of India)

Anand Milk federation union limited referred to as "Amul" is the first dairy cooperative in India. Their Supply chain model famous for called the Anand pattern (named after the Anand town from which it was originated). The main aim of the model is to connect the milk producer with the end consumer by eliminating the middle man. The model was a huge success a later its implemented across the country forming the milk grid of dairy societies from all over India. It is a three-tier structure with a dairy cooperative society at a village level and these will be federated under milk unions at the district level and which in turn comes under the State milk federation that is Milk is collection is done at the village level by milk collection centres and the procurement and milk processing is done by the milk unions at the district level and marketing of milk and milk products is by respective state milk federation. The beauty of this model is it's not only eliminating the Internal competition between the milk unions but also ensured better economics of scale.

Overview of Dairy Industry in India



Source: https://www.nddb.coop/sites/default/files/pdfs/NDDB_Annual_Report_2019_20_Eng.pdf & Final - Annual Report - 2019-20 - Single Page - 05012021.cdr (ncdfi.coop) (* Thousands litres per day -capacity)

Government Schemes to Support the Dairy Sector

As per the Integrated sample survey conducted by the Ministry of Fisheries, Animal husbandry and dairying, it is observed that the average annual productivity of the cattle in India in 2019 is 1777 kg per animal per year against the global average of 2699 kg per animal per year (as per FAO stats) [22]. But from 2014-to 19 the average annual productivity of cattle is increased by 27.95% which is the highest productivity increase in the world and the Government of India is making efforts for strengthening infrastructure for the production of quality milk, procurement, processing, and marketing of milk and milk products through following Dairy Development Schemes.

National Programme for Dairy Development (NPDD)

This Scheme will improve the quality of milk and its corresponding products by increasing the share of organized milk procurement. there are two components in this scheme are Component A: This focuses on creating & improvising the infrastructure facilities like Quality milk testing equipment in milk collection centres and strengthening the Cold chain infrastructure like Chilling centres facilities for Cooperative Dairy Federations, Cooperative milk producers' union, SHG (Self-help groups) run private dairy, Milk producers' companies & dairy farmers/producers' organizations in all over the country Component B: This includes dairying through cooperatives (DCT) which is done by providing financial assistance from Japan's international cooperation agency as per the pre-signed a project agreement for the period 2021-22 to 2025-26. The main objective of this is to increase the sale of milk & milk products by giving more access to farmers in the organized sector. Improvising the dairy processing facilities and strengthening the capacity of producer-owned institutions and helping them in marketing thus increasing their return in that area.[13]

National Dairy Plan

Phase I: It's a central sector scheme with an outlay of Rs.2242 crores implemented by the National dairy development board (NDDB) with the network of end implementing agencies (EIA) from Mar 2012 to Nov 2019 across 18 major dairy states in the country. The main objective of this phase is to enhance the productivity of milch animals through scientific breeding and nutrition and thereby increase the milk production to meet the growing population's needs and also create awareness among dairy farmers and provide them the market access to the organized sector [14]

Phase II: The second phase of the national dairy plan comes with a budget of 8000 crores to be spent during the period of 2020-2025. This primarily focuses on improving milk processing infrastructure and upgrading the quality milk

testing equipment in the milk collection centers across the country.[15]

Dairy Entrepreneurship Development Scheme (DEDS)

Ministry of Fisheries, Animal Husbandry & Dairying is implementing this scheme with the objective to provide self-employment opportunities and encourage the Entrepreneurship culture in the dairy sector especially in rural areas. Under this program, capital subsidies will be provided for eligible borrowers for their bankable projects. A 25 % subsidy is offered to general category people and a 33.3 % subsidy of the total loan is offered to SC/ST community people [16].

Supporting Dairy Cooperatives and Farmer Producer Organizations (SDCFPO)

Under this scheme, a working capital loan is sanctioned to the state cooperatives & federations to overcome the losses incurred during natural calamities and worse market conditions thus thereby enabling them to make timely payments for the dairy farmers. This fund should be utilized for providing stable market access to dairy farmers and making sure to pay them a reasonable price during the flush season. [17]

Dairy Infrastructure and Development Fund (DIDF)

Dairy Infrastructure and Development Fund is a corpus of Rs. 8004 crores which have been set up with the National Bank for Agriculture and Rural Development (NABARD). The main objective is to provide loan assistance to state dairy federations, milk producer companies, District milk unions, and NABARD subsidiaries to help them modernize their cold chain equipment, and chilling centres and upgrade their processing plants & machinery [18].

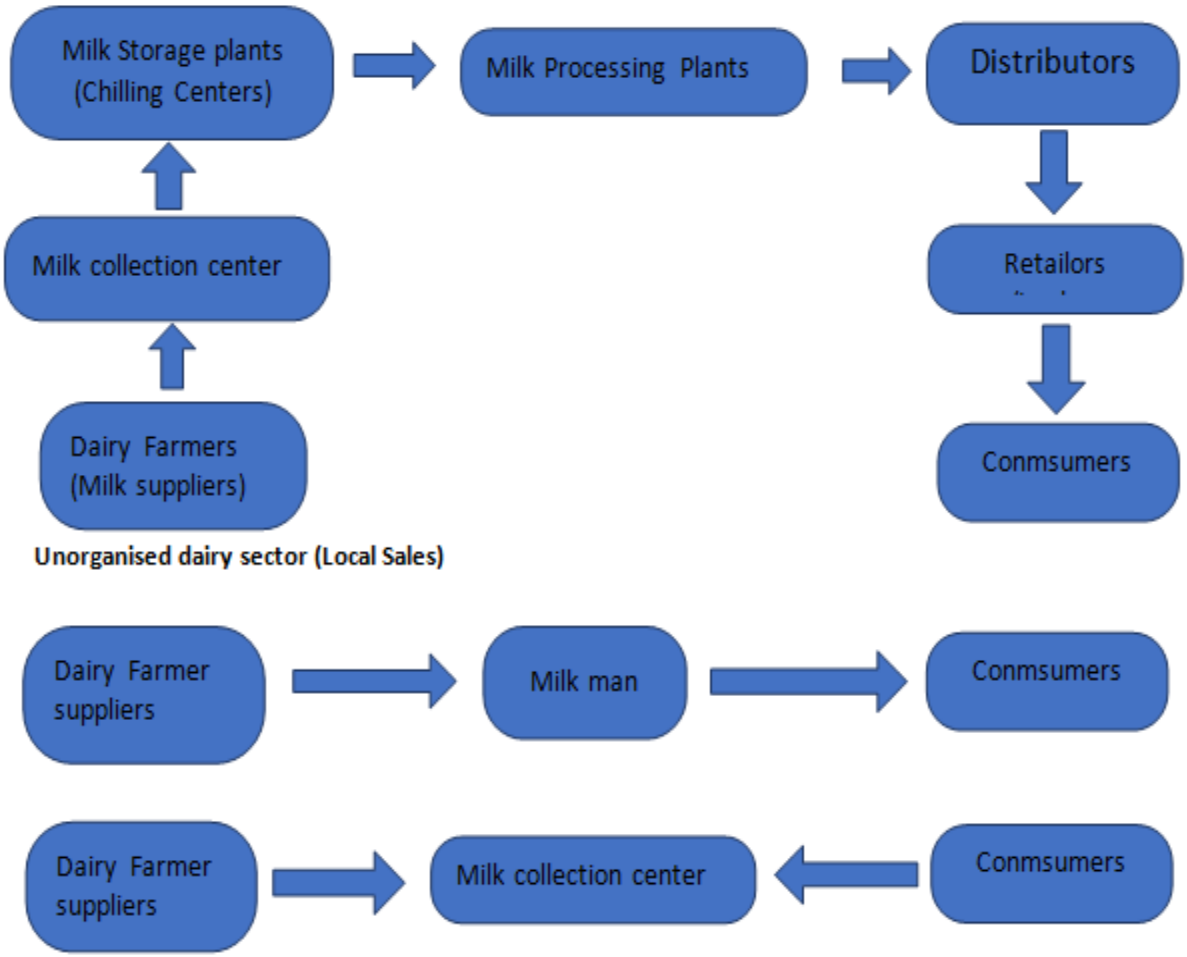
The main aim of these schemes is to create awareness among the dairy farmers regarding the best practices in the dairy sector and make them participate more in the organized dairy sector and thereby increasing the productivity of the dairy sector across the country

RESEARCH METHODOLOGY

The study was conducted in the Vijayawada, Andhra Pradesh region. Interviews and direct interaction with some of the dairy industry experts and various stakeholders in the dairy supply chain and made the below process flow model as per the results of the discussion

Dairy Chain Work Flow Model in India (Generalised Model)

Organised Dairy Sector



There are two workflows in the Unorganized Sector. In the former, the local milkman will collect the milk from their farm and will do a direct door delivery to the consumer. But in the latter one dairy farmer will sell their milk in a nearby milk collection centre and the consumers have to go directly to the centre to collect it. It's actually a benefit to the Dairy farmer whenever there is surplus milk produced during the flush seasons & animal post-delivery period then he can directly sell the excess to milk collection centres and make profits.

In India, it is estimated about 48% of milk produced is consumed at produced level or sold to non-producers in local areas, and the remaining 52 % is available for sale in urban areas, and out of this only 40 % of produced milk is handled by organized sector (Dairy Cooperatives & Private dairies) and remaining 60 % of the milk production is distributed through Unorganised dairy sector [12]. Since the informal market does not include processing milk charges and packaging and transportation charges on their products so obviously many choose to prefer buying directly from milk suppliers in tier 2 and tier 3 cities In the organized sector the dairy farmers (Milk suppliers) directly sell to the end consumers and in another case, they will sell to the Milk collection centre people who will analyze the dairy farmers samples and finalize the payments and from milk collection centres people will procure milk directly or they will get them from retailers.

We all know that the supply chain consists of three fundamental flows

a) Material flow b) Finance flow c) Information flow

Material flow

In an Organized dairy sector, Dairy farmers (Milk suppliers) will take their milk cans to nearby Milk collection centres (Village level dairy milk societies), and a sample of milk from each milk can is taken and tested for its quality, and the payment is done based on the percentage of milk fat and SNF's levels (which is a nutritious portion of the milk excluding fat and water)

As the milk is a perishable item so once all the milk cans are collected, they it is transferred to Milk container trucks and will be sent to Milk storage plants commonly called chilling centres where milk is cooled to a certain temperature to increase its shelf life Later these temperature-controlled container trucks move to Milk processing plants

and they will test again for adulteration and fats and SNF levels and go through a further processing and converted into different grades like whole fat milk, Reduced fat milk, low-fat milk & skimmed milk and prices will be fixed accordingly. Milk products like Milk powder, curd, cheese, ice cream, butter, etc. Trucks from factories will distribute it to all the retailers in the city and consumers purchases from retailers. This is famously called Milk van operations as the truck will take one round trip covering all the retailer's outlets and distribute their required products and returns to the factory.

Finance Flow

For Lucrative returns pricing policy is designed in a such a way that it should satisfy both milk suppliers and end consumers considering the economic benefits of the plants as well hence milk prices are determined by demand & supply forces and price policy i.e., Milk surplus states will have fewer prices and milk deficit states usually have more. In India, we usually follow a two-axis price policy that is considering both % fat and SNF's (Solid, not fat) levels and decide the final procurement price.

In Organized flow Usually for a smooth transition of the payment process, payment is done in 10 days interval so each dairy farmer's record is maintained in a separate book and based on their milk fat and SNF value they will be paid accordingly, Similarly, the Milk unions and milk processing plants companies pay the amount to milk collection centres in 10 days interval based on the avg fat and SNF's values they receive in the milk container and payment is wired to chilling centre's agents account and he is distributing the amount to each milk collection centres people as per their contribution. In the Unorganized sector, the determination of milk price mostly depends on the quality of the milk, local demand & presence of the organized buyers in that region. Many people from rural and semi-urban regions are preferring to get milk from local dairy farmers to avoid paying extra costs for processing and packaging milk.[10]

Information Flow

Dairy milk is collected from milk suppliers during both morning and evening shifts. Information regarding the quality of the samples is tabulated & recorded on a daily basis at the collection centres. Usually, milk unions & and private dairy players have separate software tools and frameworks to do precise calculations and finalize the price for that container of milk-based on % fat and SNF values. The average values of the milk samples collected from different milk collection centres of different villages should be approximately equal to the actual average of % fat and SNF values of the container milk. This information is critical for us to ensure the quality of the milk being transported and on top of this, they cross-check the weights of the containers reached in the plant with the recorded data to ensure the correct quantity of milk procured.

Adulteration

Adulteration is a process of intentionally adding foreign substances to the milk to increase the quantity (& degrade the quality) with the sole purpose of making profits. Eg Addition of Urea, sugar, starch etc. Usually, it's added to increase the quantity and also has higher SNF values. The minimum SNF values to get considered by milk collection centres are 8.5 % for cow's milk and 9 % for the buffalo's milk [10]. The milk collection centres themselves have adulteration testing equipment so if any sample is found to be adulated, then straight away, they will reject their milk cans and more once the container truck reaches the factory It is tested for adulteration again If it comes positive then the whole container milk is disposed of as per rules and traces the source of adulteration.

Bullwhip Effect

Unlike the other industries, Bullwhip effect is not observed in the dairy supply chain because no return policy is strictly followed by all the stakeholders across the chain that is they have to sell it or use it on their own and mostly under no circumstances the milk products are not taken back to the plant. hence no retailers or distributors will not create artificial demand and order the exact products required as per the demand in their area.

Demand and Supply Gap

Generally During the spring seasons and also when the cows and buffalos conceives, more milk is produced during this time. Most of the times companies keeps the surplus milk in buffer stock and unlike other industries, there will be no severe demand fluctuations in the dairy sector but there will be a little surge during festivals seasons in India. Hence Most dairies try to meet the demand with their buffer stock stored in their plants and stop making milk products like cheese butter, curd etc and fully concentrate on processing liquid milk alone and distributing them.

The Challenges of the Dairy Supply Chain.

- Even though we have the highest milk production in the world still milk productivity per animal in the country is less than the global average.
- Majority of the dairy sector is still Unorganized

- Information gaps exits between the stakeholders in the chain.
- Lack of proper cold chain transport system resulting in spoilage of the milk before reaching its destination.

CONCLUSION

Milk is an essential basic commodity to all the sections of the people out there and despite the pandemic, the dairy sector business is booming continuously in the country & making new production records every year. Even though we are the top producers of milk in the world we don't export them much as we are the major consumers of it. The Realization of middle men's scam in making more money and paying the least amounts to milk producers led to the origin of Dairy cooperative societies, started in Gujarat and later adopted by all the other states. During this period the percentage of milk distributed in the organized sector is very less. With the help of the operation flood programme famously called the White revolution of India programme over the years finally, we became the top milk producer in the world in 1998 and maintained the legacy till now. Even though we have the highest milk production in the world still milk productivity per animal in the country is less than the global average. So, to address this Government of India has introduced many welfare schemes to encourage the dairy farmers to invest in the formal dairy sector by providing fodder and getting animals vaccinated & geo-tagging and also sanctioning them the loans at less interest rates for the development of their dairy farms. Due to the perishable nature of milk, we must strengthen our existing cold chain infrastructure in the country or we couldn't able to utilize the full potential benefits of our dairy sector. Lack of proper cold supply chain infrastructure to store the perishable items like milk, milk products, meat etc. In 2020, Dr S Rawat, secretary of ASSOCHAM (The Associated Chambers of Commerce of India) revealed that their study states there are 6300 cold storages in India which can handle only 11% of countries total perishable goods and 60% of spread across Uttar Pradesh, West Bengal, Gujarat and Punjab [20]. This is very high time that we need to concentrate on strengthening our cold chain infrastructure in order to ensure the maximum utilization of our true dairy sector potential.

SCOPE OF FUTURE STUDY

This study is limited to Vijayawada region of Andhra Pradesh covering one dairy cooperative union. But future scope of study can be extended to the Inter district study on multiple dairy cooperative unions of various districts and we can include the private dairies as well and proceed with the comparative study discussing the material, financial and Information flows along with best practices of dairy chain of the two sectors.

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