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A structured review of upstream supply chain process in dairy industry

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Abstract

The dairy supply chain, as all other agri-businesses, is complex. Technically, the dairy chain starts with the raw milk production & ends when other processors, institutions & consumers utility products which are created in the value chain. As consumer's habits and decisions are not static, it imposes urgency for change in the supply chain in order to have consumers ever-changing needs met. However, this ever-changing demand has a direct effect on the people within the supply chain, they have to change (or) adjust accordingly. Supply chain is an integrated manufacturing process wherein raw materials are converted into final products, then delivered to customers. At its highest level, a supply chain is comprised of two basic integrated processes.

1. The production planning and inventory control.
2. The distribution and logistics process.

Dairy is considered as the important source of income whose agriculture depends upon monsoon. Indian dairy is recognized as one of the instruments for social & economic development. The countries milk supply comes from millions of small producers, dispersed throughout the rural areas. The major challenge for the dairy sector is undoubtedly to raise milk production to meet the increasing demand that arises from almost inevitable expansion of population & presumably growth of income.

Keywords: Dairy industry, supply chain, distribution, logistics, milk supply

Introduction

Farming is the main tradition of India since the time of Lord Krishna. Farming has been essential and non-separable in Indian culture, for hundreds of years. Milk and milk merchandise have forever been a necessary part of our consumption habits within the field of farming, the contribution of farming has been most noteworthy, in terms of employment additionally as financial gains. In post-independence Asian country, co-operative farming has been amongst our nice successes, having an excellent impact on socio-economic development of rural areas.

India gains the top most positions in world when it comes to milk production with a large share in world milk production. Milk has reached a singular standing in terms of its output price surpassing Rs. 1,00,000 large integers and has created a prompt stride each in terms of variety of milk producers and amount of milk made. In India, farming is one amongst the foremost vital subsidiary occupation in rural areas, next to the most occupation of agriculture. Stock sub-sector alone contributed for 22% of the whole price of value. The event of dairy farm business in Asian country is renowned everywhere the planet in concert of the foremost triple-crown development programs within the globe popularly referred to as white revolution. Husbandry is visualized by the farmers within the country as a part of Associate in Nursing combined agricultural system wherever dairy farm and agriculture complement each other.

The dairy farm business in Asian country has been on a gentle path of progression since Indian independence. It's full-grown from manufacturing seventeen million tons of milk in 1951 to manufacturing 127.3 million tons in 2012. Today, Asian country is one amongst the biggest milk manufacturing countries within the world. This solid progress is primarily because of structural Antecedent of dairy farm offering Chain Management Practices: An abstract Framework forty-nine change within the Indian dairy farm business led to by the appearance of dairy farm cooperatives. The Indian dairy farm business recorded a market size of USD 48.5 billion in FY2011.

With a Compound Annual rate (CAGR) of 16%, it's anticipated to achieve USD 118 billion in 2017. On the rear of an increase in income, let alone for the sturdy demand for dairy farm merchandise, the Indian dairy farm business is equipped to expertise high growth rates within the next five years. The consumption pattern of dairy farm merchandise in Asian country is kind of distinctive as compared to a number of the western countries. Consumption is primarily inclined towards ancient products; but, westernized merchandise area unit bit by bit gaining momentum within the urban areas. Curiously, buffalo milk accounts for the biggest share of the whole milk made within the country.

For the success of a dairy farm industry/firm economical provide chain management may be a necessity. Thus, the provision chain performance of the process units may be an important issue. Milk provides chains square measures additionally involved with dominant of milk quality and provide fluctuations that square measure exceptional to the current sector. Biodegradable product like milk invariably needs a time economical provide chain. This biodegradable issue will distress the milk supply chain. It will provide chain management which has seen a supply of achieving competitive advantage within the business world.

Due to pressures from enlarged competition ensuing from globalization of provide, process and distribution networks, high levels of service expectations and competitive rating, the provision chain management has become very necessary.

The Indian provide chain for milk merchandise is disturbed by abnormal wastage and poor handling. The wastage happens as a result of multiple points of handling. Shortage of cold storage facilities and cold transport instrumentation cause inadequacies in handling milk merchandise. There's a desirable demand for acceptable infrastructure for storage and transportation like temperature-controlled warehouses and vans. By active improved provide chain management practices, can be important decrement within the wastages of milk and milk merchandise that successively will profit each of the farmers furthermore because the customers suggest that of redoubled returns and reduce in worth severally. Given the fragmented nature of the milk provide chain, few firms have right of entry to capital and therefore the ability to speculate in provide chain.

Supply chain network includes numerous organizations, for instance, suppliers, makers, and therefore the retailers. The Indian dairy farm trade is especially recognized of twenty-two state milk federations, 110,000 dairy farm agreeable social orders as well as quite twelve million milk manufacturers. Milk may be a valuable gift of nature to all or any living beings underneath the sun. It nurtures our health and tones up the system of the body. It created largely in rural areas and is distributed to the end customers in urban areas through effective promoting system. The shoppers expect smart quality milk at a good worth frequently. The producers need to possess additional stipendiary worth for the milk they sell. The milk created within the rural areas totally on a tiny low scale and sold on to the shoppers or to the non-public milk traders or to the organizations (may be non-public agencies or co-operatives). They neither follow the promoting strategy nor the promoting combine that square measure followed for the finished or for the commercial merchandise. Milk being biodegradable in nature, created in several segments and its

sale depends upon various factors, chiefly is that the marketable surplus.

Earlier agriculture was a grounds enterprise in Bharat with only enough variety of animals to cater to the requirements of the family. But now, agriculture has become an ad enterprise in Bharat. A good vary of producers begin rearing of cows in each organized and unorganized sector, that provide milk and milk merchandise to the ever-increasing Indian population. Milk is a very important part within the daily diet of Indians. The table below shows the biological process elements gift in milk, that build it a full add food.

Table 1: Contents in milk of Cow and Buffalo

Sr. No.	Milk components (per 100ml)	A Cow	B Buffalo
1	Proteins (g)	3.3	4.2
2	Fat (g)	4.1	7.0
3	Carbohydrates (g)	4.5	5.1
4	Ash (g)	0.72	0.82
5	Calcium (mg)	120	210
6	Magnesium (mg)	10.6	16
7	Sodium (mg)	50.6	-
8	Potassium (mg)	145	-
9	Phosphorus (mg)	82	128

For centuries, milk from numerous animals like cow, buffalo and goat has been employed in the diets of individuals everywhere the globe. Milk has carbohydrates and therefore the milk fat is a prepared supply of energy. The milk production may be an advanced biological development controlled by variety of things. The humor animal's area unit biological machines that convert roughages and crude macromolecule into milk. The annual worth of India's milk production amounted to quite Rs. 34,927.9 billion in 2010-11.

India stands 1st in milk production all over the globe with a production of 121.7 million tons of liquid milk. Milk production contributes four-dimensional to the national GDP (NDDDB, 2010). Ethereal mammal contributes 22.2% to the GDP from agriculture and allied activities. Quite seventy million farmers in rural Republic of India area unit concerned in farming. Dairy farm cooperatives generate employment opportunities for concerning 15 million farm families (Pranab Mukherjee, 2011).

In last six decades there has been an enormous growth in milk production. In Republic of India milk production enhanced at a rate of 2.5 to 4 nada annually. From Fifties it's enhanced by 7.5 times, from 17 million tons in Fifties to 127 million tons in 2011-12. The demand for milk is undergoing a modification each in quantitative and qualitative terms. White Revolution wouldn't have been possible while not the farm cooperatives, implementation of operation flood programs and timely policies of the govt. However, work ought to be done towards enhancing production and productivity of milk and milk merchandiser to fulfill and ever-increasing demand because of increase in population, increase in disposal financial gain and accrued awareness among the customers. Within the last 2 years, the assembly in Asian nation accrued to three to 4.5 million tons a year, against the steady increase of half dozen million tons a year within the early years. The necessity of hour isn't solely to extend stock population concentration and productivity however conjointly on higher handling of milk in terms of acquisition, process and selling.

Objectives of the study

1. To find out the ways how milk industry is fulfilling demand.
2. To probe various strategies for driving customer values.
3. To understand how the milk farmers are building network resiliency and facilitate financial success.

Literature review

1. Mangla SK, Sharma YK, Patil PP, Yadav G, Xu J. Logistics and distribution challenges to managing operations for corporate sustainability: study on leading Indian dairy organizations. *Journal of Cleaner Production* 2019;238:117620.

Milk supply chains are more concerned with controlling of milk quality and supply fluctuations which are unique to this sector. Perishable goods like milk generally require a time efficient supply chain. This perishable factor can affect the milk supply chain. Supply chain management has considered as a source of gaining competitive advantage in the business world.

2. Mor RS, Bhardwaj A, Singh S. A structured-literature-review of the supply chain practices in dairy industry. *Journal of Operations and Supply Chain Management* 2018;11(1):14-25.

The comprehensive literature review suggests that though SCM is a more generic term related to all sectors, the characteristics like demand fluctuation, perishable nature of product, seasonality, traceability, small-scale production etc., are the major concerns that differentiate the dairy supply chain from other. Dairy industry currently calls for an effective and competitive supply chain strategies along with food safety and security to meet the standards of the export market.

3. Subbaiah KV, Narayana K, Nookesh RK. Supply chain management in a dairy industry—A case study 2009.

In this paper supply chain network is designed for a dairy industry. This network includes material purchase plan, production plan, inventory plan and transportation plan. From the results it is observed that the total cost of the supply chain is 9.8 percent lesser than the existing cost. This model can be extended to varying demand and costs. This can also be applied to fast moving consumer goods.

4. Sharma ML, Saxena R, Mahato T, Das D. Potential and Prospects of Dairy Business in Uttarakhand: A Case Study of Uttaranchal Cooperative Dairy Federation Limited. *Agricultural Economics Research Review* 2007;20(347-2016-16838):489-502.

Dairy farming is one of the important sources of income and providing occupation opportunities to the rural families and farmers in District Almora. Dairy co-operatives have played an important role in the dairy development. In the study area dairy farming is done mainly by the small, marginal farmers and land less laborers. Dairy development has resulted in the improvement of nutritional intake and milk products consumption. It has also increased the purchasing power and living standards in rural areas with socio-economic up gradation.

5. Chandra P, Tirupati D. Managing complex networks in emerging markets: the story of AMUL 2002.

In this paper, using the example of AMUL, we have presented a robust business model for operating in large

emerging economies characterized by underdeveloped markets, infrastructure and suppliers. To succeed in these markets, firms need to adopt a long-term perspective of the business and simultaneously develop supplier capabilities on the one hand while enhancing purchasing ability of potential customers. A network of firms appears to be the best way to operationalize the above requirements. Large entrants may have to develop such networks, while small firms may be best served by becoming niche players and join an existing network. Managing such distributed 22 networks would require effective supply chain coordination and capability building at each entity.

6. O'Callaghan S, O'Connor D, Goulding D. Distance optimisation of milk transportation from dairy farms to a processor over a national road network. *Agriculture and Food* 2018.

In this paper we have proposed and demonstrated a novel approach to the simulation of milk assembly based on the Irish road network. One of the major findings of the research presented, is that because of the seasonal supply of milk the monthly variation in truck load numbers and routes is striking, suggesting that at a minimum, routes should be revised monthly rather than what anecdotal evidence suggests of peak and shoulder, where for example 9 trucks could be replaced by 3 or 4. Another significant conclusion that can be drawn from the results of the simulations is that when farms are located near a processing plant it may make sense to employ short trips collecting a small number of farms near the plant.

7. Kazancoglu Y, Ozkan-Ozen YD, Ozbiltekin M. Minimizing losses in milk supply chain with sustainability: An example from an emerging economy. *Resources, Conservation and Recycling* 2018;139:270-279.

In this paper, the study Grey Method is used to predict potential milk losses and managerial implications are given based on the proposed sustainable collection center model with its TBL based advantages. Social and economic advantages can be summarized as training and education opportunities for farmers, increase in product quality, new job opportunities for society, increase in profits, and improve the balance between demand and supply.

8. Guarnaschelli A, Salomone HE, Mendez CA. A Stochastic Approach for Integrated Production and Distribution Planning in Dairy Supply Chains. *Computers & Chemical Engineering* 2020, P106966.

This paper addresses production and distribution planning for a real-world dairy supply chain. The planning model accounts for the production and distribution of Cheese, Yogurt, Powdered Milk and UHT (Ultra high temperature) milk products across a two-echelon Supply Chain. This task is undermined by the inherent variability of raw materials and finished products demand. The integrated production and distribution planning methodology introduced is based on a two-stage stochastic mixed integer linear programming formulation. In real-world settings the number of scenarios grows substantially; thus, a scenario reduction strategy based on clustering techniques is given.

9. Sonesson U, Berlin J. Environmental impact of future

milk supply chains in Sweden: a scenario study. *Journal of Cleaner Production* 2003;11(3):253-266.

In this research scenario technique was chosen because scenarios can yield information about the environmental consequences of certain lines of action or developments in a system. To quantify the effects of future systems, a mathematical model of the milk supply chain was constructed and used to simulate possible scenarios. The model was based mainly on life cycle assessment (LCA) methodology. The results show that any consideration of the environmental effects of the milk supply chain must consider the entire chain. The amount of packaging materials used is an important factor, as is the transportation of the dairy products to households.

10. Lingling X. Applying grey relation clustering and PCA to performance evaluation of vendors in fresh milk supply chain. In 2010 International Conference on Logistics Systems and Intelligent Management (ICLSIM). IEEE 2010;2:932-935.

The complexity and limited data samples in performance evaluation of vendors in fresh milk supply chain are an obstacle for traditional evaluation method. This paper studied the performance evaluation methods for vendors in fresh milk supply chain by grey relation clustering and principal components analysis. Three major fresh milk supply vendor and typical evaluation indexes of fresh milk supply chain were selected to illustrate this evaluation. The result shows that principal components analysis is suitable for complex indexes in fresh milk supply chain and grey relation clustering can be a valuable method to determine the best vendor under limited data samples conditions.

11. Okano MT, Vendrametto O, Dos Santos OS. Organizing the dairy chain through productivity indicators for a sustainable supply chain. In 2010 International Conference on Chemistry and Chemical Engineering. IEEE 2010, P258-260.

In this paper they analyzed the main prevailing aspects of the production chain, as referenced in the literature and confronted with the reality encountered in field research. We were able to prepare the development of better practices for producers in the classification table and help improve the organization of the estates composing the dairy chain. We understand to have hereby generated a relatively simple model - one that can be implemented in steps, depending on the producer competency and culture, and that serves as a facilitator to induce changes, innovation and economic growth of small businesses in the industry of bovine milk, both at the individual as well as the collective levels.

Status of dairy sector in India

India is endowed with an oversized population of 128 million buffaloes in keeping with the All Asian country outline Reports of seventeenth ethereal mammal census, Asian country holds the most important ethereal mammal population within the world when Brazil. It accounts for Sixteen Personality Factor Questionnaire of the kind population, fifty-seven of the buffalo population and twenty seventh of cow population of the globe. Buffaloes typically contribute additional to the milk pool with regarding 61.6 million tons (55%) of milk followed by endemic cows with

eighteen.30 million tons (27%), cross breed cows with thirteen. 5 million tons (16%) and goats with regarding 4.2 million tons (5%).

Indian dairy farm business may be divided into 2 components of enterprises that are; liquid milk and milk merchandise. Within the acquisition and promoting of liquid milk, there's a powerful presence of co-operatives and ancient non-public channels but the unionized non-public sector enterprises additionally exist.

Dairy co-operatives contribute for the main share of processed liquid milk within the country. Presently, the dairy farm cooperative network includes 177 milk unions, operational over 346 districts covering regarding 1, 44,246 village level societies (approximately about close to just regarding some roughly more or less around or so that area unit closely-held by about fifteen million farmer members of that over four million area unit ladies. Over seventy million farmers within the rural Asian country area unit concerned in dairying. Through Co-operative approach, economy of scale is also introduced within the handling of milk. But, majority of plants area unit handling milk a lot of below their put in capability and facing cut throat competition from the vendors, contractors and different players that area unit handling milk acquisition. Thanks to their high idle capability, total operation value enlarged vastly within the price addition chain.

In approx., five hundredth of the entire milk made within the country is consumed as liquid milk, whereas the remaining is employed to provide the merchandise like dry milk, curd, butter, khoa, paneer, butter milk and frozen dessert. Although milk is made in villages, the consumption pockets area unit principally in cities and cities. Generally, in winter (flush) milk production is far over the consumption. This milk surplus is being regenerated into dry milk that is being employed in summer to keep up the assembly and consumption gap. Close to about eleven liters of milk area unit being employed to provide one kilogram of dry milk.

Procurement a major function in dairy industry

In general, the success of farming depends on four parts namely production, acquisition, process and distribution of milk and its merchandise. Among these four parts, milk acquisition plays an important role. The economic potency of milk acquisition principally depends on the operations particularly developing a network for assortment, transportation and chilling of milk. Completely different dairy farm plants have different systems of milk acquisition that are contractor system, Co-operative system or their own assortment network. The milk acquisition by co-operative system has been pondered as a perfect system beneath the prevailing conditions of milk production.

Earlier half-hour of the entire milk created in Asian nation is consumed at the producer level and remaining seventieth was directly marketed at the door steps of the buyer. Over the year's folks began to use branded milk and cooperative societies compete a serious role during this amendment. During this gift state of affairs, it's projected that 15 August 1945 of the entire milk created in Asian nation is consumed and therefore the producer level and remaining is marketed through numerous cooperatives, non-public dairies and vendors. The dairy farm farmers who are manufacturing milk in line with the prescribed quality standards are able to sell their manufacture to co-operatives. People who are

manufacturing milk that isn't meeting the standards to choose to sell on to the shoppers. Hence, the most important downside with the acquisition of milk by cooperative societies is that at any purpose on a median solely 500 of registered dairy farm farmers were supplies to cooperatives, attributable to that, dairy farm plants are finding it terribly tough to forecast the milk acquisition.

Another major downside with acquisition of milk is minimizing the spoiling and curdling probabilities, as spoilt milk can produce losses within the milk offer chain. Therefore, sterilization of cans, vans, chilling of milk and on-time delivery of milk at the plants play an important role in acquisition perform of milk.

Distribution of milk in the dairy industry

Existing scenario

Presently, around eightieth of the overall milk created is distributed through the extremely fragmented unorganized sector, which incorporates native milk vendors, wholesalers, retailers, and therefore the producers themselves. On the opposite hand, the organized farm trade distributes the remaining two hundredth of the overall milk that's created. Asian nation presently represents itself the world's biggest marketplace for milk and milk product. In light-weight of its growing population, higher incomes and growing health consciousness, the demand for milk is steady increasing within the country and it'll grow within the future additionally in keeping with IMARC Group's new report titled, "Dairy trade in India: Market Size, Growth, Prices, Segments, Cooperatives, non-public Dairies, procurement and Distribution", the overall production and consumption of milk throughout 2014-15 reached 147 Million Metric Tons and 138 Million Metric Tons, severally.

Factors that help in deciding the mode of distribution of milk are as follows

1. Keeping quality and kind of milk.
2. Perishable nature of milk and its products.
3. Possible contamination.
4. Proper supervision and control in distribution.
5. Cost of distribution/delivery of milk.

Distribution of raw milk

In places of temperate climate and in sub-temperate conditions milk is distributed on to the customers. This can't be recommended in space apart from temperate regions. Wherever the assembly of milk is rigorously supervised and a brief amount lapses between production and consumption, the milk could also be distributed provided the temperature of milk doesn't transcend 10 °C at delivery. Milk consumption might in all probability continue in geographical region however strict healthful management is needed to examine that milk is of excellent quality or not.

Factors affecting pattern of its distribution to public

1. Building's density in particular locality.
2. Topography of the area.
3. Number of customers.

Analysis

The main players in the milk supply chain in India are milk producers (farmers), cooperatives and dairy manufacturers. Even though there are also other performers such as domestic input suppliers, global suppliers, final retailers

who also have essential roles in this industry. Based on Karim (2011) ^[40], over 100 thousand of milk producers in India usually operate some of three to five heads of milk-cows per farmer. Until the last year, India had approximately 500 thousand of heads of cows and successfully produced 930 thousand tons of raw milk per year. Having a low economy of scale in the farm operations compared to other developing countries, it can be observed that the population of dairy cows is slightly decreasing overtime.

Cooperatives and manufacturers play a vital role in the marketing channel for the milk produced by farmers. From the past two year, there were at least 95 registered cooperatives, but it is believed that only a few of them are still in full operation. In general, almost all domestic farmers are a member of a cooperative in their corresponding area. Cooperatives are considered as an organization that has a strategic position in the supply chain of milk. It plays a role as a single provider of farm inputs - essentially complementary feed - and the sole channel for distributing - or selling - milk produced by farmers to manufacturers.

All of the domestic raw milk is absorbed by dairy manufacturers as the main buyer in the milk supply chain. Although there are over 30 manufacturers in India, only the largest six of them absorb about 85 percent of the available raw milk (Morey 2011)^[41]. In fact, the domestic raw milk supply cannot meet the manufacturers' actual demand. As most manufacturers are a trans- national corporation, the lack of raw milk is then supplied by their affiliated overseas manufacturers in the form of WMP (whole milk powder). In relation to final consumers, the consumption of milk products has reached approximately 870 thousand tons per year. As for the final products, it can be observed that milk products are mostly in the form of powdered milk (enriched milk) and sweet condensed milk. There are no clear evidences to show how much fresh (raw) milk is consumed by the final consumers.

The milk supply chain in the study area

Farmers turn out milk. Usually, the dimensions of milk farming operations are relatively low. Given its natural legacies and therefore the convenience of family resources, 3 to 5 Cows area unit common in ancient milk farming operations. In keeping with the report provided by IDA (Indian Dairy Association), the own productivity is just ten liters per day. It means farmers who keep 3 producing- cows will turn out around thirty liters of milk per day. It's thought of to be comparatively low compared with the opposite milk-producing areas in West India. From the farmer's purpose of read, thus, their current low production will be determined by their unnatural access to smart quality animals and feed throughout the year.

Raw milk made by farmers is then collected by IDA. IDA provides basic infrastructure to hold out the assembling activities through "milk collection points" (MCPs) settled around farmers' home block. There's a complete of seven MCPs during this study space. These MCPs change farmers to deliver milk straight off when the Cows area unit is being milked doubly daily. In MCPs, IDA can do many milk-quality tests to see the standard of the milk delivered by farmers. These take a look to embrace the "test of milk solid-contents and microorganism" test (known because the "Total Plate Count test"). These tests function a basis for scheming the value that may be received by farmers.

Handling and immediate delivering need to be done by farmers to avoid the deterioration of milk (known as spoilage). In associate degree open space while not cooling, milk can solely sustain for 3 hours before it begins to decompose because of microorganism activities. Indeed, handling milk may be a vital key because it has one thing to try and do with the value that the farmers can receive.

From all of MCPs, IDA then bulks the milk within the "cooling storage" in hand by IDA. This unit can preserve the milk till its amount reaches a bound level, and within the next day, the milk is transported to makers' mistreatment special vehicles. Currently, there are units to makers that absorb massive shares of milk made here, hence; they function fervent emptor. A tiny low quantity of milk is oversubscribed directly by IDA. Mostly, the native food retailers purchase a tiny low quantity of milk from IDA for being resold to final customers.

Recently, makers absorb most of the milk offered by IDA. There is no written agreement relationship between these makers and IDA. IDA delivers the milk to the makers primarily based on their own order. In their orders, makers cannot place a quota for the milk delivered, however some degrees of quality standards area unit applied. The chances for the makers to reject the milk from IDA are connected solely to the milk quality. Supported the data from IDA, the milk from IDA solely serves ten pack of the full raw materials employed by makers. However, it is necessary for these makers to have contemporary raw milk from domestic farmers as a result of most of the foreign raw materials is within the type of milk. For makers to provide liquid merchandise (i.e., Bottled milk or milk in bag packaging), contemporary milk is incredibly essential.

The main sources of risks in the milk supply chain

This section describes many sources of risks that, to some extent, might have an effect on the operations of the milk offer chain. However, in discussing these risks, the most stress is on the phase of suppliers, particularly farmers and IDA. Additionally, we have a tendency to solely choose many most important risks among several different risks unconcealed throughout the interviews.

Quality of the milking animal

The low amount of milk production may be a major downside in ancient milk farming. During this study space, it is found that the common amount of milk production is as several as ten liters per cow per day, though some farmers owning higher quality cows are ready to manufacture concerning fifteen to eighteen liters per day. During this case, genetic factors will have an effect on the number of the milk a cow will manufacture. Thus, cows with top quality genetic factors are so the foremost valuable input for milk farming. However, top quality cows are scarce these days owing to the absence of a structured or formal input market. Recently, it is not common for farmers to lift heifers (young cow) on their own because of further long-run production prices. By the time they need to switch their previous cows, they will trust heavily on external sources – in the main from different farmers in several areas or from informal markets – to induce the heifers.

This condition is taken into account as a supply of risks within the milk production for two reasons. First, farmers don't have any future data concerning the provision of heifers – as replacement stocks – because of missing

markets. There is an opportunity that in a very sure state of affairs, the heifers won't be pronto offered. Even though they're pronto offered, the value typically exceeds the farmers' ability to pay. The second reason has one thing to try is to with the genetic quality. In the absence of formal markets, there'll be no comfortable data on the heifers' genetic quality. Supported our observation, we tend to found that several farmers strove to keep "low-milk-producing" cows because of unfavorable genetic quality of the heifers bought within the past. This condition consequently constraints them to provide an economically acceptable amount of milk.

Feed availability

Similar to the genetic quality, feed is additionally the foremost decisive think about milk production, each in terms of amount and quality. Recently, the provision of feed remains a tangle in milk farming. Thanks to seasonality, there will be extensive put in the wet season and, on the contrary, feed shortages within the time of year subsequently. The amount and quality of milk made by farmers correspond directly with this seasonal condition. Once the feed is comparatively on the market, the amount of the milk made tends to extend. However, the standard of the milk won't solely be determined by the amount of on the market feed, however conjointly by the standard of the feed itself. In short, notwithstanding the feed is accessible, the milk quality can stay low if the feed quality is poor. Supported our observation, the entire solid (TS) content of milk made by farmers is 10-11% on the average. It is probable that this low TS content is also resulted from the animals' biological response to the inferiority feed.

Actually, TS is that the main criteria for makers in procuring the milk from farmers and setting the milk worth. If the amount of TS is far not up to the desired level, then makers will actually reject the milk provided by farmers (through IDA), whereas if it's still tolerable, the milk worth are going to be adjusted comparatively to the desired level of TS. Because the level of milk production, each in terms of the amount or quality, is generally determined by feed handiness (also in terms of feed amount and quality), then there is an occasion that in an exceedingly bound season lower milk amount and quality are going to be tough by farmers. Feed handiness becomes one supply of risks within the milk production chain.

Milk handling practices

Handling practices or another issue that determines the standard of milk, in term of its microorganism load. Initially, milk created by healthy cows is nearly freed from contaminants, however forthwith when it's been exposed to outside, the contamination begins to occur. Though such microbes don't seem to be essentially unsafe for human consumption, they really injury the milk properties. Throughout the assembly chain, several activities and possibilities which permit milk to be contaminated. As an example, farmers' practices in handling the milk when it's been milked from cows, and once it's delivered from farmers' place to the milk assortment points (MCPs). It's conjointly doable for the contamination to occur once the milk is being bulked in MCPs or within the cooling storage operated by IDA. What is more, the transporting follow performed by IDA once delivering the bulked milk from the cooling storage to makers also has an equivalent likelihood

of being contaminated. Overall, thanks to poor healthful infrastructure used for milk handling, largely within the farmer section, it's evident from the study space that the lower quality milk, to some extent, is set by these practices. In fact, the microorganism contamination in milk conjointly is a basis for the milk worth came upon by the makers. Makers run a microorganism take a look at (called "Total Plate Count") each time the bulked milk is received from IDA. It is customary that a typical standard, the milk's TPC mustn't exceed one hundred thousand cfu/ml. Thus, the upper the TPC of the milk delivered by IDA, the lower the value the makers compensate.

Milk bulking practices

Other than contamination, bulking practices performed by IDA area unit conjointly possible to bring effects on the decreasing milk quality. Again, thanks to poor infrastructure permanently handling practices, IDA incorporates a restricted capability to handle numerous qualities of milk made by farmers. It's not stunning to possess numerous qualities of milk since IDA has got to receive it from thousand farmers, and every farmer so employs numerous ways in manufacturing milk. Thus, current bulking practices could result in free-rider issues caused by combining totally different milk qualities in one storage. Considering an easy example, supposed that one farmer is in a position to supply milk that contains 12% of TS. At the same time, another farmer produces milk that contains solely 10% of TS. If IDA mixes these two totally different milk qualities, then we are able to be sure that the TS will merely be corrected to the amount of 11%. For the primary example, it implies

that the makers pay just for the actual percent of TS. Though IDA has established value differentiation for every quality level of milk made by farmers, however actually, makers can solely acquire one single value based mostly on the bulked milk received from IDA.

This situation will become the supply of risks particularly for IDA in running its operations, because it receives the common value for milk delivered to makers, some farmers UN agency will turn out milk with higher quality than the common one ought to be paid at a better value supported their milk quality. During this case, IDA should incur extra expenditure. Additionally, milk- bulking practices can even result in distrust among farmers since higher quality milk ought to "subsidize" the poor one.

Milk transportation

To deliver high spoilable merchandise that area unit terribly sensitive to contamination and temperature changes, IDA so needs special instrumentality like vehicles equipped with a cooling system. Though IDA seldom experiences issues in delivering milk to makers, a little chance of failure on the transport-related instrumentality or machines continually exists. IDA disclosed that it had practiced a minimum of 2 cases of transport failure. One in all them came about in 2010 once the vehicle encountered damages in its cooling system whereas delivering 8000 liters of milk. It in real time caused the total milk to deteriorate, and so rejected by makers. This case has so burdened IDA for a substantial loss.

Graphical analysis

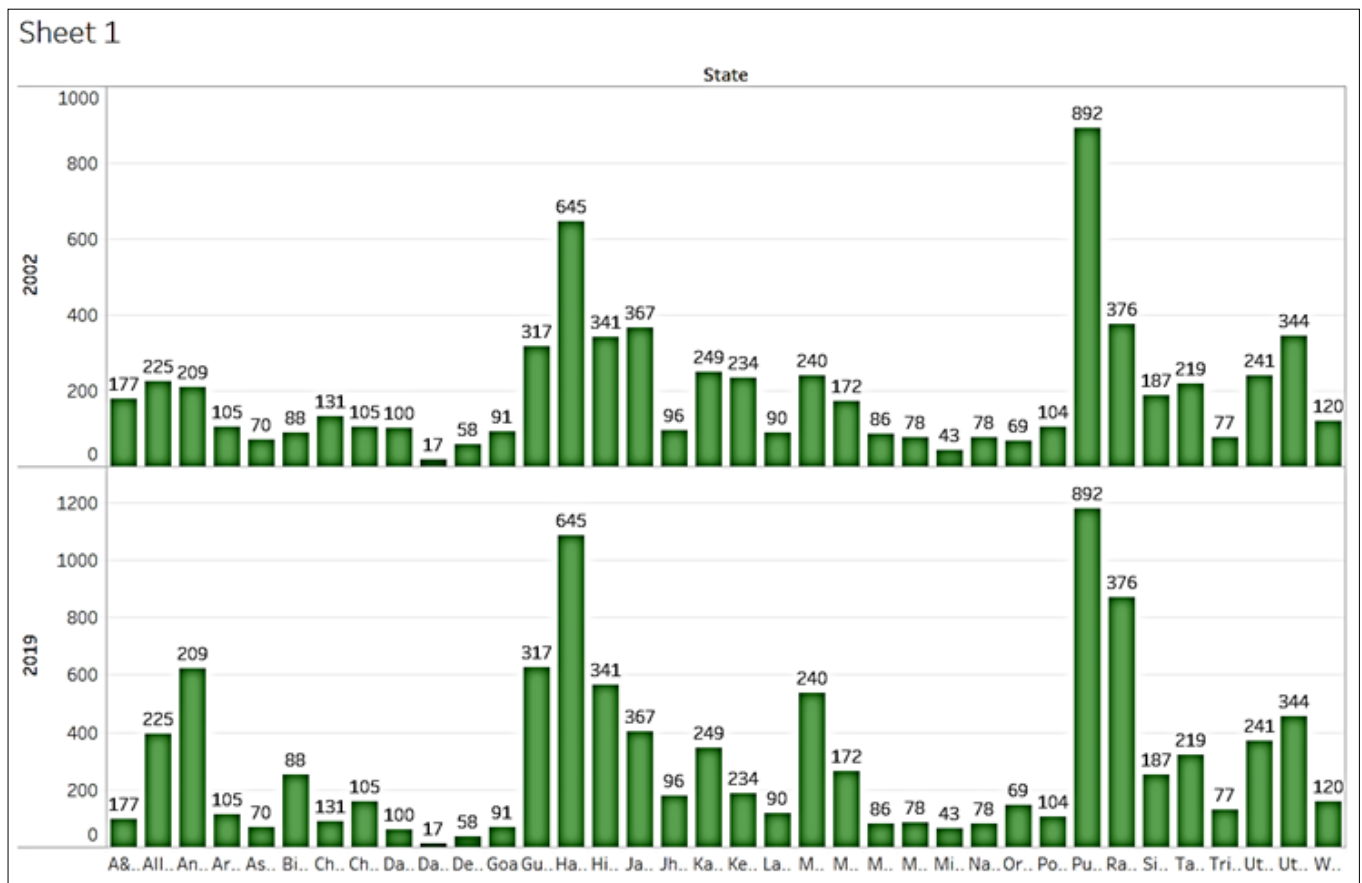
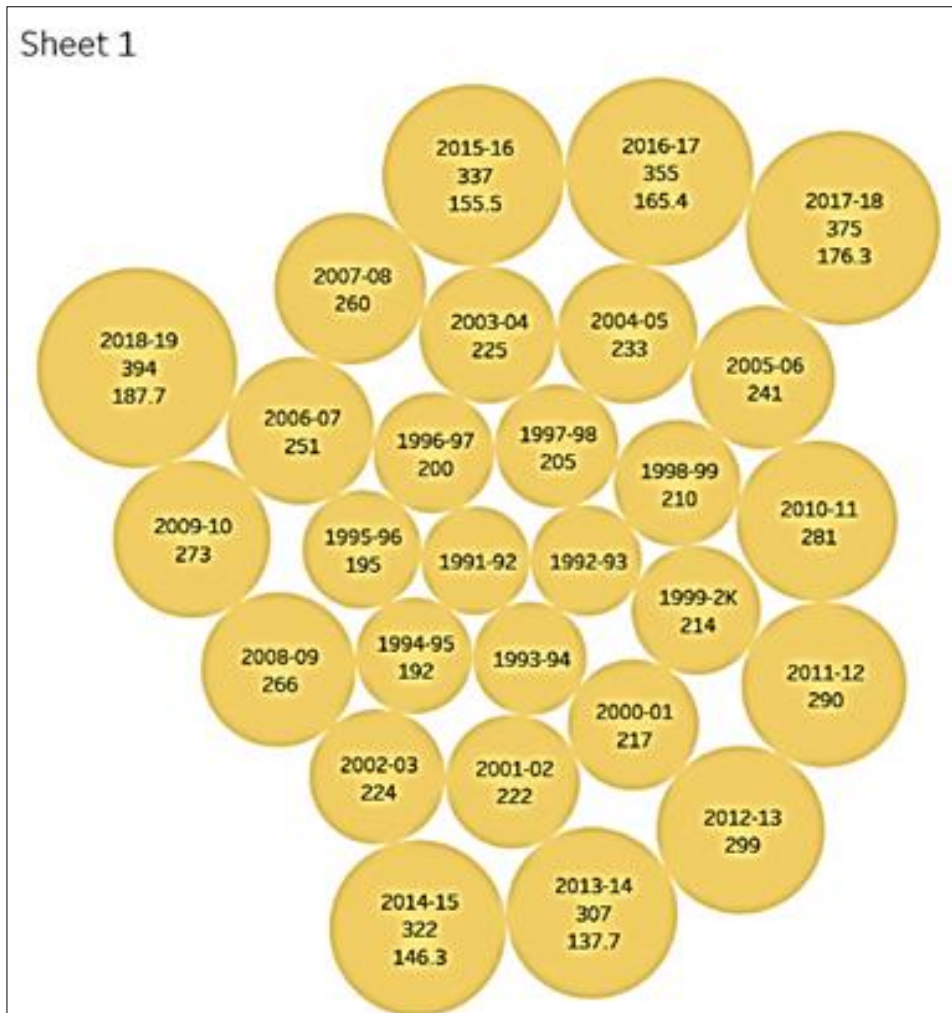


Fig 1: Per capita availability of milk by states/UTs of India (2002 and 2019)



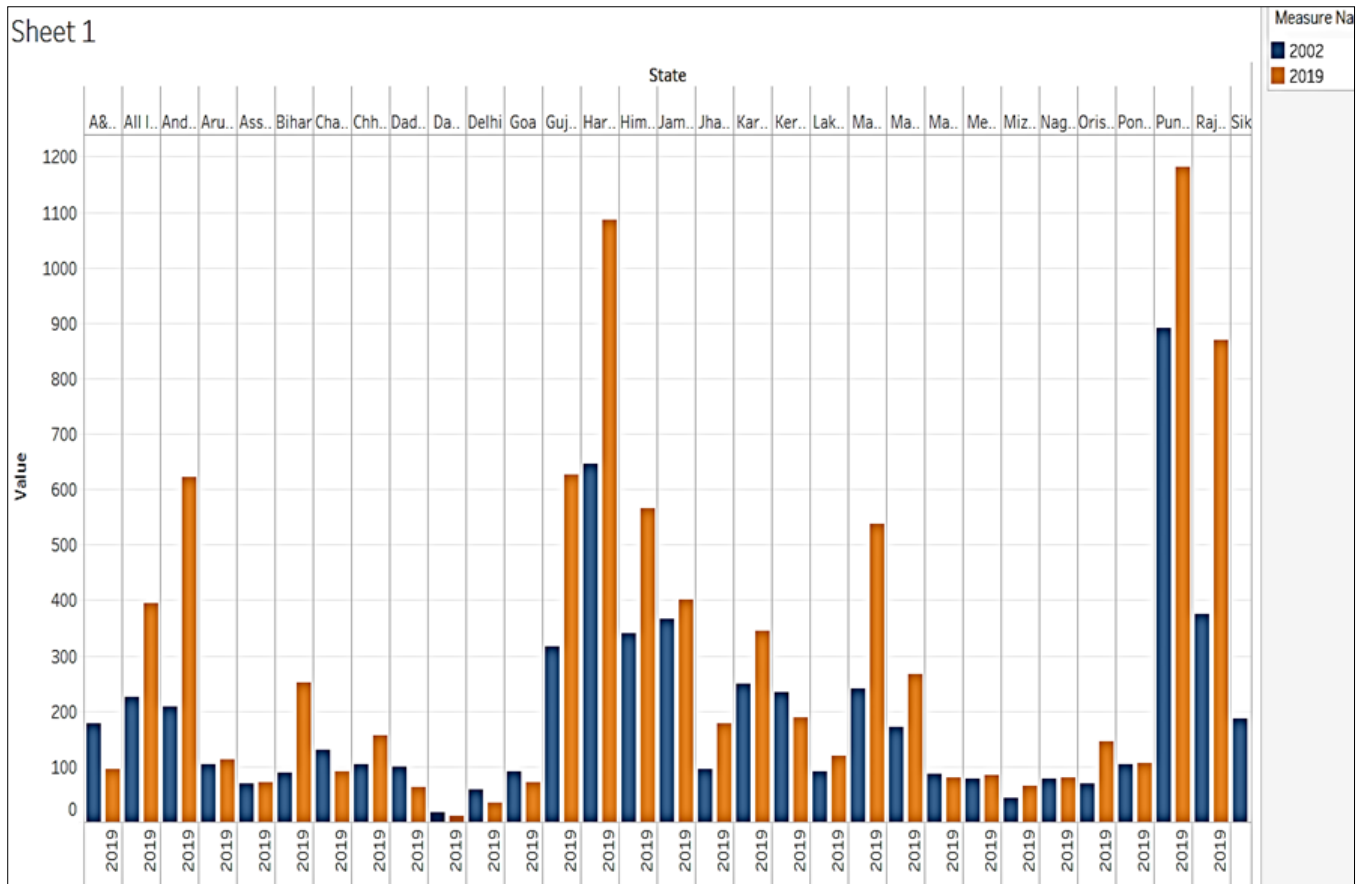


Fig 4: Bar graph representing milk production and per capita availability of milk in India

Interpretation

The first two graphs are related to per capita availability of milk in states/UTS and remaining all are related to availability in India in different years.

As we can interpret from the graph that the availability has increased year by year because of the demand for milk in the country. But it can be analyzed that the demand is not equal to the supply of milk, reason could be the increase in the population.

Every year we can see the increase in the demand for milk as it has become the necessity.

Whereas, dairy farmers are now collaborating with big companies for the supply of the milk. Good packaging is also making it easy for the customers to buy or drink it wherever they want to. So, the overall interpretation is that as of now there is a massive availability of milk in the country.

Issues and challenges

The entire dairy Industry in India has its base in the small holders and marginal farmers. These prime stakeholders of the entire value chain of milk are deprived of minimum resources of land, labor, capital etc. The other constraints at the grass root levels are:

- Inadequate feeding of animals: With burgeoning human population there is an increasing pressure on the land resources for cultivation of food crops and fodder crops are not preferred. This apart the small holders are not able to feed the animals with balanced diet of concentrates and roughages due to lack of financial support.
- More disease incidence: Small holders who are not members of cooperative societies often get deprived of

good animal health care facilities in terms of routine vaccination and prophylactic disease prevention measures. Financial constraints generally inhibit these farmers’ access to the organized veterinary services and they still rely on the quacks and conventional treatment methods.

- Low genetic potential of animals: The stocks of animals even if cross-bred have less percentage of exotic genes which lowers their milk production. There is indiscriminate artificial insemination without proper record keeping which leads to repeated inbreeding and decreased production potential of the animals.
- Lack of chilling capacities: The farmers having high yielding varieties of the cattle and buffalo have a different issue all together. These farmers milk their animals 2-3 times in the day and every time they have to carry this milk to the distant collection centers where there is a cooling facility or else the milk goes waste if there is delay.
- Exploitation of farmers. Those farmers who do not conform to any of the cooperative societies get exploited at the hands of the contractors of the private dairies with regard to payment of exact dues as per the fat content of the milk.
- High production costs: Compared to the amount of efforts and maintenance costs being involved in the production of milk, the farmers do not get remunerative prices due to low market prices and lack of elasticity in the prices of milk.
- Delayed payment of dues: The farmers are not only paid less according to the quality of milk but also their payment gets delayed from time to time. This comes in line with the sick and non-performing milk cooperative

unions which pass on the perils of mismanagement and marketing losses to these poor farmers.

- Lack of trained and skilled workers: There is lack of trained and skilled workers who can handle the milk processing operations hygienically and safely.

Issues and challenges at the storage and logistics level

- Lack of cold storage facilities: Milk being a highly perishable product requires be processing or cooling as soon as possible after milking, so as to prevent spoilage and contamination. However, to ensure this there is a need of refrigerated milk silos for storage which are not present at the village levels.
- Gap in the cold chain and transport facilities: There are long distances to be covered to reach bulk milk coolers from the collection center. There is a shortage of refrigerated vans and insulated tankers for ferrying the chilled milk to the processing plants.

Issues and challenges at the co-operative level

- Less number of member farmers: The cooperative model though successful has not been able to include all the farmers into the fold. There are still many potential farmers who use the informal channel of milk sale and delivery.
- Lower participation in the decision-making process: There is huge govt. Interference in many of the co-operative federation activities which leads to lesser say of the farmers in any crucial issues.
- Losses: Poor management of the some of the village cooperatives have led to huge losses in the trade due to which farmers have lost faith in these entities.
- Low prices of milk: The co-operatives declare low prices for procuring milk from the farmers which benchmarks the prices and forces other players to sell milk at the same prices.
- Inefficient services: The cooperatives have also failed in many parts of the country in providing the basic inputs in terms of quality feed, exotic germ plasm and veterinary services.
- Insufficient Infrastructure: Some of the co-operatives are lacking the cooling and milk testing facility at the village level collection centers.

Issues and challenges for marketing

- Majority of the Market is still unorganized: The milk market in India still faces the challenge of getting organized. The unorganized market makes it competes with the organized market in relation to prices.
- Acceptability of the Consumer base: A large fraction of the consumer base in India is yet to accept the clean and supple milk from organized dairies due higher costs. The mindset of buying fresh whole milk from the milkman is still prevalent in the Indian consumers.
- Less penetration to the rural Market: Most of the milk produced by the dairy co-operatives goes to the urban market. The rural consumers are still dependent on the informal and unorganized market channels.
- Lack of transparent milk pricing System: There is no specific minimum support price of the milk in the system which makes it unremunerative for the farmers.

Conclusion

In previous decades the most important and crucial stages of

the availability chain like procurement, production and distribution appear to own been dominantly managed severally. However, the accessibility of excess inventories, intense competition, and market globalization were forcing companies to reinforce their provide chain capabilities that may promptly reply to client preferences. To cope up and endure during a business atmosphere wherever competition is high, companies ought to decrease the flow of interruption inside upstream and downstream provide chain activities. This sort of endurance in such a business atmosphere will solely be achieved by suggests that of effective provide chain management. In recent years, the realm of provide chain management has become very talked-about. This can be proved by marked will increase in professional and tutorial publications, conferences, skilled development programs. Moreover, provide chain management attracts most companies, principally those in operation businesses severally. Its one thing that each firm desire for managing mutually beneficial supplying activities so as to mitigate demand variability and surplus inventories. Provide chain management has relevancy in things wherever there's quite one autonomous player within the production and distribution of products and services. Variety of students additionally agrees that offer chain integrates key business processes of a company. In alternative words, it integrates everybody concerned that vary from finish users through original suppliers of product, services and data actor on the availability chain adds price for purchasers and alternative stakeholders. Milk provides chains area unit additional involved with dominant of milk quality and provide fluctuations that area unit distinctive to the present sector. Perishable merchandise like milk need a time economical provide chain. This perishable issue will have an effect on the milk provide chain.

Supply chain management has seen as a supply of gaining competitive advantage within the business world. Thanks to pressures from augmented competition ensuing from globalization of provide, process and distribution networks, high levels of service expectations and competitive valuation, the availability chain management has become additional vital in recent years.

For the success of a dairy farm industry/firm economical provide chain management may be a pre-requisite. Thus, we have got to focus to beat the problems and challenges before of Indian dairy farm business.

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