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## **WEAK CAPABILITIES OF INDIAN DAIRY CHAIN: AN EXPLORATORY CASE STUDY THROUGH SAP-LAP APPROACH**

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### **ABSTRACT**

*Cold chain has become an integral part of the Supply Chain (SC) of perishable items to provide consumer with safe and wholesome products. Recent studies have shown an absence of a strong and dependable cold chain in India. About 30 percent of farm produce is being wasted every year only due to lack of such infrastructure. This paper sets out to discuss one of the cold supply chains in India, namely, Milk chain. Although India is the world's largest milk producer since 1995, not a single Indian dairy company featured in the list of global top 20 dairy companies. An attempt has been made in this paper to systematically explore the problem of weak capabilities of Indian dairy chain.*

*After structuring the problem, root causes for the weak capabilities of Indian dairy chain are identified, which is followed by Pareto analysis for finding the vital few. For an indepth insight a situation-actor-process (SAP)-learning-action-performance (LAP) general problem solving model has been applied to analyze the case of XYZ dairy. The situation represents the present scenario of the organization. Actors are the participants, influencing the situation to evolve different business processes. Based on SAP, Influence Diagram (ID) has been framed through which various learning issues have been analyzed which lead to suitable action followed by impact of SAP on the performance of the milk chain of the federation. This synthesis and prioritization done are based on extensive literature review as well as consultation with academicians and industrial professionals.*

*The milk chain is very complex, which includes raw material supplier, processing units, distributors as well as customers. Although, having abundant availability of raw material, about 85 per cent of milk produced is flowing into the unorganized sector, which results into many distribution channel inefficiencies. Various issues that need attentions are; quality and safety, IT enablement, technology up-gradation, customer awareness, milker and udder practices. Through Pareto analysis it has been interpreted that quality and safety in combine is one of the vital causes which needs further in-depth focus. SAP-LAP model of general problem solving came out with suggested suitable actions and expected performance followed by impact of SAP on the performance of the supply chain of the XYZ dairy. ID shows the influence relationship between the various actors, situation and processes.*

**Keywords:** Dairy chain, Perishable items, Quality and safety, SAP-LAP, Influence Diagram

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### **Introduction**

#### **Dairy Cold Chain**

Dairy development in India has been acknowledged as one of the most successful developmental programmes in the world. World milk production is estimated at 650 million tonnes for 2006-07

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and is growing at a compounded annual growth rate (CAGR) of 1.1 per cent. India ranks first in the world in terms of milk production with a total of 96.1 Million Tonnes (MT) for 2006-07 and records a CAGR of four per cent (Banerjee, 2006). It is further expected to increase to 98 MT in 2007-08, says a report from United States Department of Agriculture.(Goliath, 2007). Milk production in India is characterized by small rural producers scattered all over the country accounting for about 70 per cent of production. From a milk deficient country in the early 1960s, India has emerged as the world's largest producer of milk in year 1995. If we glimpse at the past of MMP, milk trade was traditionally a subsidiary occupation in rural areas where women folk generally used to take care of their cattle to supplement the family income. With the growing demands of urban areas, the middlemen started buying milk at a very nominal rate from rural areas and sold it in urban centers at overpriced rates. At the time when India gained independence the major problem faced by the Indian dairying was milk procurement from rural areas and its marketing in urban areas (Brouwers, 2006). There was no integration between milk production, processing and marketing. This all resulted Indian dairying at very disappointing low-level.(Banerjee, 2006). While Indian dairy development was at its lowest diminution, a unique dairy development model was developed, in Anand, Gujarat, which is popularly known as Anand Model of Cooperative Dairy Development as shown in Figure 1. It is a vertically integrated cooperative structure involving farmers, in which each village cooperative elects their executive committee members and they get federated at the district level by electing their representative as a member of the district level cooperative. Then the district level cooperatives affiliated themselves into a State level cooperative Federation (Gcmmf, 2007).

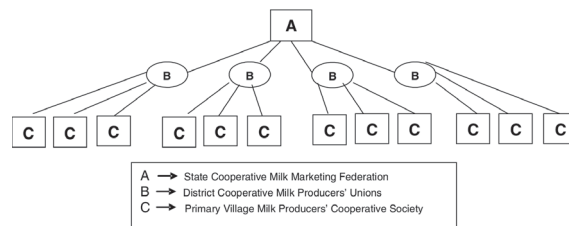


Figure 1 : Three Tier Cooperative Model

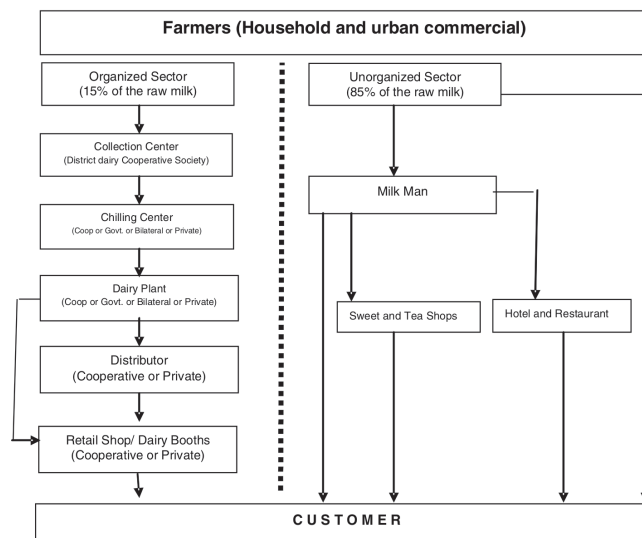


Figure 2: Organized and Unorganized Dairy Chain in India (adapted from Saha , 2005)

### Weak Capabilities of Indian Dairy Chain: An Exploratory Case Study Through Sap-lap Approach

In 1970 the Operation Flood was launched to get rid of middlemen, remove seasonal price variations and make it economically viable for farmers to undertake production and distribution of milk (Khanna, 2004). Operation Flood achieved phenomenal success, with trebling India's annual milk production from 21 Million Tonnes (MT) in 1960s at the rate of 7.8 percent to 74 million tonnes in 90s and maintained further at the rate of around 5 percent per annum to move further to 96 MT as shown in Figure 3.(Banerjee, 2007).

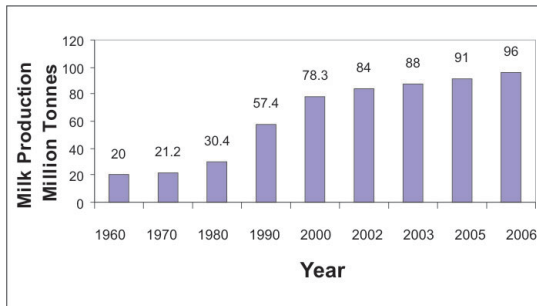


Figure 3: Milk Production per Year in India (Source : Annual report,06, DAHD, GoI)

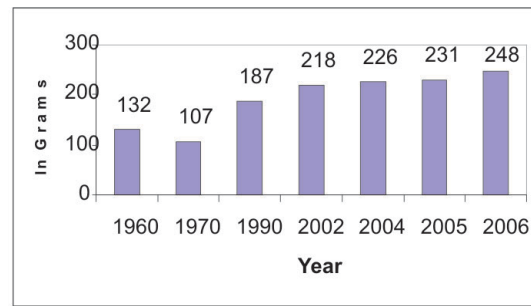


Figure 4: Per Capita Availability of Milk (Source : Annual report, 06, DAHD, GoI)

India became the largest milk producer in the world by the year 1995, by then it had exceeded the highest milk production of 75 million tonnes by the USA. The milk availability per capita was 132 gm in 1960, which declined to 107 gm in 1970 and subsequently risen to 248 (Dahd, 2006) as shown in Figure 4. Nearly 1.70 lac Dairy Coop Societies which cover around 1.30 lac villages in 326 districts began supplying hygienic and fair priced milk to 300 million consumers and earning revenues of Rs 64 billion in the process. There are 120 lac farmer members, out of them about 75% are landless and marginal and small and around 30 lac women members. Milk processing capacity is around 300 LLPD and milk drying capacity is 1167 MTPD in year 2006. There are basically two type of channels present in Indian milk chain i.e Organized and Unorganized. About 85% of raw milk reaches customer through unorganized sector and rest 15% come from organized channel based on Anand Model of Cooperative Dairy as shown in Figure 2(Mofpi,Icar, 2007). If we glimpse on the darker side, 85%, which is a far larger proportion of milk continues to be marketed by the unorganized sector - comprising innumerable vendors, small processors, merchants, manufacturers and retailers of indigenous milk products like khoa, paneer, dahi and milk based sweets, etc. However, the main problem in the unorganized sector is quality, which creates a serious threat to the health of consumers. Unsanitary local conditions, unhygienic containers, substandard processing equipment, poor handling methods, breaks in the cold chain etc. In this paper, firstly the problem statement is stated. In section 3 and 4 an exhaustive RCA is done to investigate various causes for weak capabilities of Indian dairy chain and poor quality of milk respectively. In section 5, a case has been analyzed through SAP-LAP general problem solving enquiry model, to get better insight of the current state of Quality and Safety (Q&S) issues in a particular state. Based on SAP, Influence Diagram (ID) has been framed through which various learning issues have been analyzed which lead to suitable action followed by impact of SAP on the performance of the milk chain of the case organization. Then finally the findings and managerial implication are discussed

#### Problem Statement

Although, India as a country became the world's largest milk producer in 1995, not a single

Indian dairy company featured in the list of global top 20 dairy companies (Robobank, 2004). Out of the total production, over 45 per cent of Indian milk is retained at rural sector, while another 40 per cent is handled by the unorganized sector (as shown in Figure 5). This means that in the organized sector just 15 per cent of the entire milk produced is put through a process where 'value' is formally added. Out of the 15% organized sector milk, around 75% is fresh pasteurized milk and the rest only 25 % of milk is used for other value added products. A poor quality standard of MMP is also a serious threat to economic growth where agri-products contribute to about 31% of the national GDP (Vishwanandam, 2006). Besides being a health hazard, contamination of milk can lead to huge economic losses. Hazard to quality and safety occurs at different levels along the dairy chain. The problem of weak capabilities of Indian dairy chain is quite complex and needs systematic exploration.

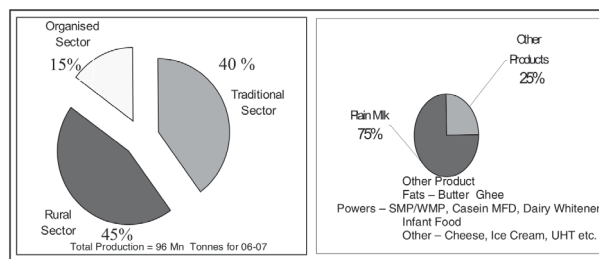


Figure 5: Milk Usage by Sector (2006-07)

### Methodology

After structuring the problem, root causes for the weak capabilities of Indian dairy chain are identified, which is followed by Pareto analysis for finding the vital few. The most significant issue is further categorically brainstormed and related causes and sub-causes are explored. For an indepth insight a situation-actor-process (SAP)-learning-action-performance (LAP) general problem solving model has been applied to analyze the case of XYZ diary. Based on SAP, Influence Diagram (ID) is framed through which various learning issues have been analyzed which lead to suitable actions followed by impact of SAP on the performance of the milk chain of the federation This synthesis and prioritization done are based on extensive literature review as well as consultation with academicians and industrial professionals. Then finally the findings and implication are discussed.

### Root Cause Analysis (RCA) for Weak Capabilities of Indian Dairy Chain

Root cause analysis (RCA) is a class of problem solving methods aimed at identifying the root causes of problems or events. The practice of RCA is predicated on the belief that problems are best solved by attempting to correct or eliminate root causes, as opposed to merely addressing the immediately obvious symptoms. Thus, RCA is often considered to be an iterative process, and is frequently viewed as a tool of continuous improvement. An extensive RCA for weak capabilities of Indian dairy chain is done as shown in Figure 6. Seven categories of causes are identified namely: Quality and Safety, Material, Method, Technology, measurement, environment, udder and man. This synthesis is done on the basis of brainstorming and consultation with academicians and industrial professionals and with extensive literature review.

### Pareto Analysis

#### Udder and Man

Next step was to identify those causes which impart significant effect on the problem using

pareto analysis. Pareto analysis is a statistical technique in decision making that is used for selection of a limited number of tasks that produce significant overall effect. It uses the Pareto principle - the idea that by doing 20% of work one can generate 80% of the advantage of doing the entire job. Or in terms of quality improvement, a large majority of problems (80%) are produced by a few key causes (20%). An interview based survey was used for Pareto analysis result. In this survey, 18 experts were presented with the RCA daigram and asked to rank seven listed broad causes. The Pareto analysis interpreted that Quality And Safety (Q&S) in combine is one of the vital causes with a major share. 14 experts rated Q&S as top cause and four experts put it in second position. This gave an insight that Q&S is an issue which needs further in-depth focus.

### **RCA for Quality and Safety in Dairy Chain**

An extensive RCA for poor Q&S of milk chain in India, is done as shown in Figure 7. Few insights from the RCA are briefed as follows. Milk is a highly nutritious food, but it is also an excellent growth medium for bacteria. Raw milk has the potential to transfer zoonotic diseases and milk-handling procedures must minimize associated health risks. When the milk is secreted from the udder, it is almost sterile. But the moment milk comes in contact with environment bacteria grow exponentially. With in optimal condition, bacteria divide in every 20 minutes and within 8 hours under optimal temperature conditions and where the medium is of optimal composition, one bacterium will have generated over 16 million descendants (Halm, 2004). This confirms that temperature is a fundamental factor enabling the control of microbial risks. To reduce the time interval between milking and bulk storing early refrigeration is quite significant. This makes it possible to reduce water loss and to prevent multiplication of micro-organisms. Contamination is another major problem to dealt with. Contamination occurs at different levels: at farm level, during collection and storage, and at processing centers. Adulteration is also one of the major issues. Milk is adulterated when there is a short supply in the market, the purchasing power of the consumer is low and now days to earn profit. The Prevention of Food Adulteration (PFA) act says: milk should be free from any addition or extraction, but water, lime, caustic soda, urea, starch, cane sugar and salt are routine used to adulterate milk. The consumer blindly consumes the adulterated milk with the impression that it is a good source of all the nutrients (Terpstra, 2005). High microbial activity and increased activity in high atmospheric temperature causes milk to spoil quickly. Milk producers try to prolong its life by adding preservatives like salicylic acid, hydrogen peroxide, hypochlorite and formaldehyde, which all are harmful to health. PFA does indicate that milk should be free from these preservatives. Synthetic milk is one of the major problems in India, It contains 60% water, 10% urea, 5% refined oil, 5% salt, 10% glucose and 10% fat free milk. Moreover, in order to emulsify water, detergent is added to compensate for solid not fat (SNF) content, sugar, glucose and urea. Consumers are paying the value of pure milk but are getting only 10% of milk and other harmful chemical whose long term intake can be fatal (Mahmood et al., 2005). Some time Titanium dioxide is also added to give white colour to the solution, which has an adverse impact on liver. In spite of advancement in the chemistry and technology of milk, with lack of suitable and sure, handy and inexpensive tests, it has not been possible to provide the consumers to determine the nature and extent of adulteration (Agricoop, Icar, Mofpi 2007).

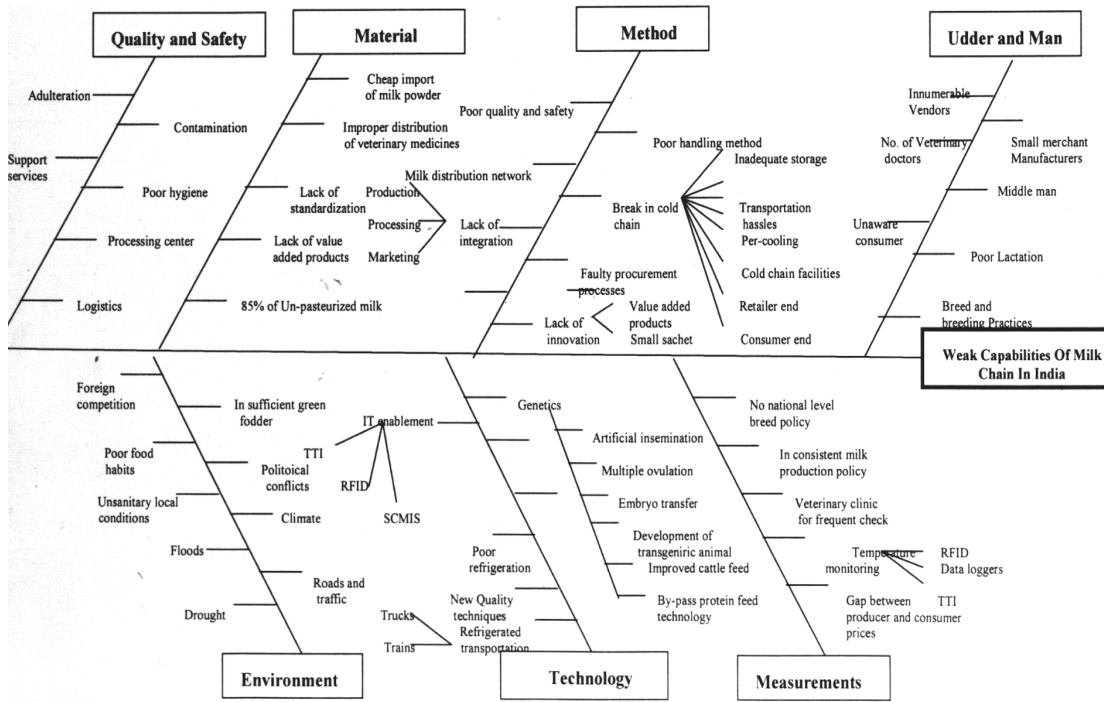


Figure 6: Root Cause Analysis for Weak Capabilities of Milk Supply Chain in India

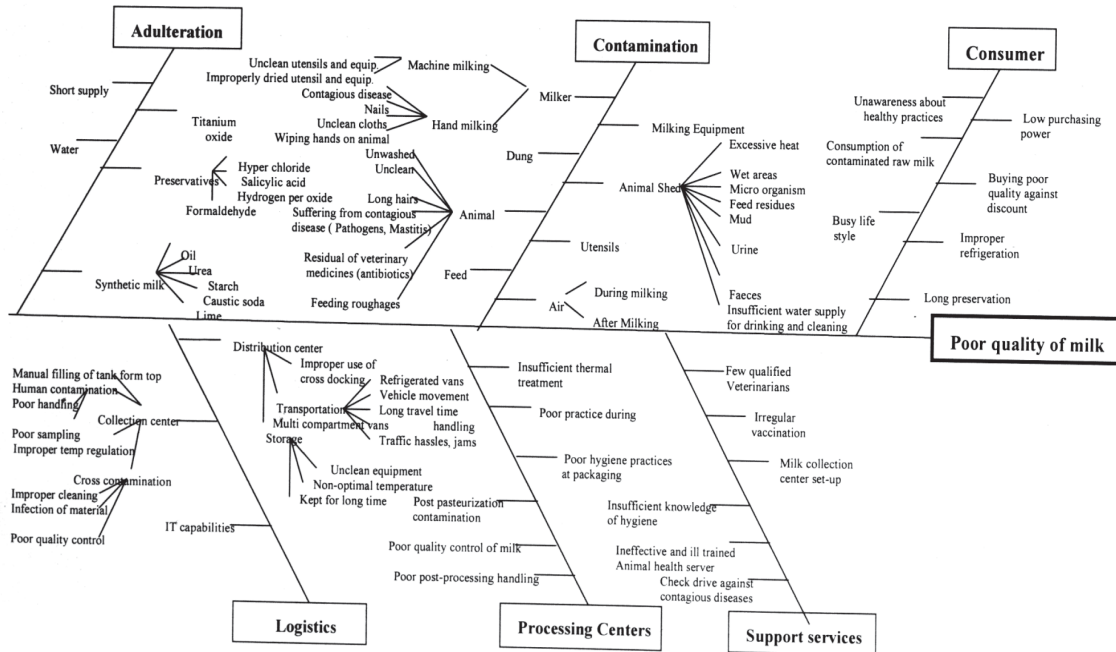


Figure 7: Root Cause Analysis for Poor Quality of Milk



- As compared to year 2007, 11% more have been paid as milk payments to the producers.
- 57 new PDCS, 70 milk parlors, 1100 dairy booths allotments to women only are targeted till the end of year 2008.
- For the benefit of diabetic patient packed camel milk is proposed to be sold for the first time in there state

**SAP-LAP Model of Enquiry**

A situation-actor-process (SAP)-learning-action-performance (LAP) model of enquiry is proposed by Sushil (2000). For the systemic inquiry of quality and safety issues in MMP chain the SAP-LAP framework can be used. The respective terms in SAP-LAP are: The “situation” represents the present status, environment of an organization, and the driving forces for good performance of an organization. The “actors” are the individual participants, or group of members, which influence the situation and define an organization culture to evolve business processes. The “process” is an overall transformation process that converts a set of inputs into outputs to recreate the situation (Sushil, 2001). The interplay and synthesis of SAP leads to LAP in which various learning issues are brought out regarding SAP as shown in Figure 9. Based on the learnings, action is to be taken on the front of SAP or the interface. The impact of the action on the performance can be analyzed for the improved performance of actors or processes and situational parameters

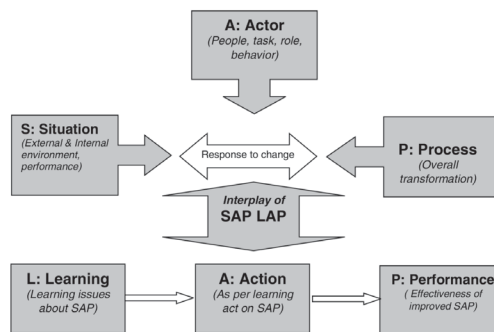


Figure 9: SAP-LAP Model of Enquiry

The SAP-LAP model is used in the context of quality and safety issues in MMP chain. The actors might have different perceptions of Q&S, as the actors in MMP chain are not restricted to one organization only. The actors belong to different organizations of same chain and they perform different activities and processes. The SAP-LAP model gives better insights about the status of the case problem, expectations from that case problem and how to change those expectations into reality than the traditional models of environmental scan like SWOT, TOWS matrix, and PEST analysis. These traditional models are static in nature, which deals only with the internal and external environment of an organization. On the other hand, the enquiry model of SAP-LAP along with internal and external environment also considers the impact of dynamic environment on inter-organizational systems and intra-organizational systems. It seems that the traditional models are not able to capture the overall gamut of MMP chain activities in a holistic manner. The proposed model not only discusses the issues of Q&S only but also explains how to work on the issues, potential lie for some changes, the impact of change and the extent of change. SAP-LAP model has been used by a number of researchers (Sushil, 2001) in a variety of situations through case studies in automobile and pharmaceutical industry. These case studies have analyzed the issues regarding financial health of companies, core competencies, strategy

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formulations, and role of flexibility in strategy formulation. The SAP-LAP model in these case studies is used in a very holistic manner, which helps in the understanding various issues that make an organization different from its competitors.

A case study is presented to understand the Q&S issues in a Cooperative Federation, XYZ state, India. The interviews were conducted with the Managing Director heading XYZ federation after Chairman who is of IAS (Indian Administrative Services) cadre, three formal Managing directors of the processing center situated at capital, and seven Managers of processing units of XYZ and 15 retailers at booth centers, on the basis of SAP-LAP model of inquiry (as in Figure 9). While interviewing, a structured set of queries was given as shown in Table I, to bring out the issues related to Q&S in MMP chain.

Table 1: A Template for Queries about SAP of XYZ with reference to Quality and Safety in Milk Chain.

<p><b>SITUATION</b></p> <p>How this organization is different from the competitors and the other players in the MMP industry?          What are the driving forces of this organization's success?          What are the core competencies of the organization?          Are the employees aware of quality and safety issues in milk chain?          How many members are involved in the milk chain?          What is the nature of raw milk suppliers, retailers and consumers?          What initiatives they have adopted to detect contamination and adulteration?          What is the basis for the accessing quality and safety at farm level?          How they are accessing customer's refrigeration practices and behaviors?          What efforts are made for awareness of quality and safety in whole milk chain?          What sort of awareness and help about veterinary drugs &amp; antibiotics are given to the farmers?</p>
<p><b>ACTOR</b></p> <p>How much importance is given to the 3<sup>rd</sup> party logistics and refrigeration support providers?          How many refrigerated vehicle drivers are aware of the criticality of cold chain as far as quality and safety is concerned?          What are the various initiatives taken at the level of State Cooperative Milk Marketing Federation, District Cooperative Milk Producers' Unions, Primary Village Milk Producers' Cooperative Society?          How many customer awareness campaigns are conducted related to safety and quality issues?          What are the areas where organisation is lacking in technical expertise, machine and equipments?          Is there is any enzyme used for increasing keeping quality of milk like Nisin etc?          Is there any political pressure against banning the sale of unpasteurized milk?          Is there any reference laboratory of world class where this organisation is associated with?          Are there any incentives to the farmers for production of quality milk for encouraging clean milk production?          How about the technical skills to implement new technologies?          What are the barriers they observed in maintenance of cold chain from producer to customer?</p>
<p><b>PROCESS</b></p> <p>Are you aware of breaks in your MMP cold chain?          How the problem of unsanitary local conditions, unhygienic container, and substandard equipments at farm level is dealt with?          What processing is done at village level for raw milk?          Is there any use of non-conventional energy sources for primary processing at village level?          How many dairy venture fund schemes are initiated since last five years?          What are the efforts made to identify faulty procurement and distribution practices?          What are the research efforts done in obtaining value added products from sour whey?          What is the basis of payment system at village level (Fat, SNF, bacterial count)?          How is the contaminated milk is separated form good one from a lot at village level?          Is the information system able to coordinate quality issues in three tiers modal?          What about the compatibility of information systems at each level of milk chain?</p>

**SAP-LAP Model**

Hygienic MMP can be achieved by the joint efforts of inter-dependent members of milk chain. It requires efforts at individual level, organizational level, and at inter-organizational level. SAP-LAP model is very effective tool to analyze the case study to explore the present situation of Q&S in XYZ. This tool will also help in consolidating various perspectives and efforts required by various actors of milk chain, and different processes, which enhances Q&S at whole milk chain. The SAP leads to various learning issues about the success factors, core competencies, coordination mechanisms, difficulties in achieving coordination, and flexibility required to adopt the concept of coordination. Based on these learning issues, corrective actions are suggested to improve the milk chain Q&S in XYZ.

### Situation

- Dairy development in XYZ state is based upon the principles of world famous “Anand Model of Cooperative Dairy Development”.
- Milk leaves the udder at a temperature of about 37°C and requires immediate chilling to 4°C. Fresh milk from a healthy cattle is practically free from bacteria, but required be protected against infection as soon as it leaves the udder. Micro-organisms capable of spoiling the milk are everywhere - on the udder, on the milker’s hands, on air-borne dust particles and water droplets, on straw and chaff, on the cow’s hair and in the soil.
- Careful attention is paid to hygiene in order to produce milk of high bacteriological quality. However, despite all precautions, it is impossible to completely exclude bacteria from milk. Milk is in fact an excellent growth medium for bacteria - it contains all the nutrients they need.
- Milker are advised to adapt clean practices
- The payments to the primary producers are made on the basis of Fat and SNF content.
- Various tests which could be done at quality control lab is : Raw milk grading, raw milk sampling and testing, Controlling the skimming efficiency of cream separator, controlling acidity, temperature and stability, butter and ghee analysis, softness of water etc.
- In former times milk was delivered to the dairy twice a day, morning and evening. In those days the dairy was close to the farm. But as dairies became larger and fewer, their catchments areas grew wider and the average distance from farm to dairy increased. This meant longer intervals between collections. Collection on alternate days or every three or even four days is now common practice.
- Perishability and relative scarcity of MMP, gave the milk vendors leverage which they used for their advantage.
- Contamination is another major problem to deal with. Contamination occurs at different levels: at farm level, during collection and storage, and at processing centers. Labs at various processing centers are installed to care of contamination.
- Adulteration is also one of the major issues. Milk is adulterated when there is a short supply in the market, the purchasing power of the consumer is low and middle man tries to earn profit.
- There is an absence of a strong and dependable cold chain system.
- Poor raw milk handling result in downgrade in terms of physico-chemical and microbiological attributes of the milk collected.
- Packaged curd and curd products – such as lassi, buttermilk, chhas, set dahi, mishti doi, etc. – are new products and are witnessing a rapid pace of growth still in terms of volumes this just comprises 5 per cent of dairy products
- Traditional products, such as paneer, mithai, khoa and khoa-based sweets, which are available in the unorganized market, is a huge segment. The XYZ has not tapped into the potential that this sub-category offers. Also Flavoured Milk ,Diet Milk, Fortified Milk and other such niche categories are yet to be grown to their real potential.
- The XYZ accounts for only 12 per cent of the total milk produced in the state and a far larger proportion of milk continues to be marketed by the unorganized sector - comprising innumerable vendors, small processors, merchants, manufacturers and retailers of indigenous

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milk products like khoa, paneer, dahi and milk based sweets, etc. However, the main problem in the unorganized sector is quality, which creates a serious threat to the health of consumers. Unsanitary local conditions, unhygienic containers, substandard processing equipment, poor handling methods, breaks in the cold chain etc

- Out of the 12% organized sector milk around 75% is fresh pasteurized milk and the rest only 25 % of milk is used for other value added products.
- Customer Unawareness about possible contamination or adulteration. Twice a year awareness camps are organized by XYZ, but very low percentage of people are turning up to check the exact status of milk they are receiving from the unorganized channel.
- Customers' refrigeration practices are very poor. They are not aware to keep milk continuously below 4°C before boiling.

**Actor**

- Milker
- Pre-cooling centers
- Primary cooperative dairy society
- District milk producers cooperative society
- State level dairy federation
- Co-operative milk collecting centers: Under certain circumstances, e.g. when water and/or electricity is not available on the farm or when the quantity of milk is too small to justify the investment needed on the farm, co-operative milk collecting centers are established
- Farm cooling equipments
- Processing center
- Cold chain
- The tanker drivers
- Retailers
- Govt. regulations
- Customers

**Process**

The Quality and Safety of MMP depend upon the whole milk chain. These dependencies can be seen at various stages of chain like, milking practices at farm level, operational efficiencies at processing level, proper storage and transportation at distribution level, refrigeration practices at customer level, and finally optimum temperature control at each level. To manage these dependencies XYZ work in close relationship with people at various levels. The efforts put in by XYZ at different levels are explained below.

- **Milking:** Milking is a process to extract milk from the udder. At the time of leaving udder milk is very pure and free from any bacteria. There are many treatments which are done at farm level done before and after milking.
- **Contamination:** At the time of leaving udder milk is a clean milk that is safe for human consumption and free from disease producing microorganisms but as it comes into contact with nearby environment the is a potential danger of contamination, like from dung, water, utensils, soil, feed, air, milking equipment, the animal and the milker her/himself. Contamination

of milk occurs at Animal shed and environment, The Animal, Milker and milking routine, Milking equipment, Storage and transport.

- Pre-cooling: Temperature is a fundamental factor enabling the control of microbial risks. To reduce the time interval between milking and bulk storing early refrigeration or the pre-cooling at milking site is quite significant.
- Bulk storage: Bulk storage is done at PDCS. There is a common tank with spray or immersion cooling mechanisms. Now common tanks are hired up to reduce the tanker circuit.
- Payment system: Payments to the PDCS members are on the basis of Fat and SNF content at the primary milk receiving site. Small milk sample is taken and simultaneously the weight is measured. A slip is given to the member having details of fats, SNF, weight and respective amount printed. That amount can be encased from the next counter on the same day.
- Logistics: Logistics includes distribution, transportation and inventory management. The refrigerated transportation through out the chain is hired to 3<sup>rd</sup> party tankers, whereas, the inventory management and distribution is done from the processing centers of DDCU.
- Processing of milk: 75% of the milk is processed into pasteurized milk and rest 25% is processed into products like Butter, Ghee, Powers – SMP/WMP, Casein MFD, Dairy Whitener, Infant Food, Other – Cheese, Ice Cream, UHT etc.
- Quality control: XYZ possesses a specialized central quality control laboratory which monitors adherence to quality standards through random sampling of milk, milk products, cattle feed, packing material etc. Each dairy plant has its own laboratory to which XYZ staff provides advise and technical support. Central Quality Control Laboratory in XYZ is engaged in monitoring the quality standards of milk and milk products, packaging material, cattle feed and effluent treatment so as to ensure their conformance with laid down respective standards of P.F.A., B.I.S., Ag-mark and Pollution Control Board, by programme such as clean milk production, ISO-9002 and HACCP-15000 certification.
- Packaging : Every processing center has a packaging unit which take care of packaging liquid milk in ½ ,1,5 liters sachet. Tatra-pack for ultra high temperature milk, ghee tin and sachet, ice-cream bricks etc.
- Refrigeration at retailer's and customers' end: Refrigeration facilities at the retailer end are inspected before giving permit to sell dairy products. Separate booths (temporary stalls) are also installed with required freezing facilities which are dedicated to only this brand product. Customers are advised through package printing to keep the products in controlled temperature.

### **Interplay of SAP LAP**

An interplay of situation, actor, and process (SAP) leads to learning, action, and performance (LAP). Rather than the traditional management syndrome of planning, organizing, and controlling the flexible systems management works through a dynamic interplay of learning, action, and performance. Figure 8, shows an Influence Diagram (ID), which shows the influence of one element on other. In any managerial inquiry the insight or learning is gained about the situation, actor, and the process. The learning obtained would direct the possible actions to be taken for handling the impending situation, which will result into the performance of the system. The feedback from the performance will on the one hand provide additional learning, whereas on the other hand it will identify the control actions that need to be taken. With the new learning and actions the situation, actor, and process might change to a new level. Such a dynamic interplay of SAP and LAP will act as the basis of ongoing managerial inquiry. On one hand, it takes into

consideration optimization of processes, whereas at the same time it incorporates multiple perspectives of various participating actors in a managerial process and thus offers a learning and interpretive framework of inquiry.

### **Learning**

#### **Issues Related to Situation**

- Potential sources of contamination of milk are dung, water, utensils, soil, feed, air, milking equipment, the animal and the milker her/himself. Contamination of milk can occur at the following levels like Animal shed and environment, The Animal, Milker and milking routine, Milking equipment, Storage and transport.
- There is no well defined disease prevention strategy. Lowest priority is given to udder health and longevity production.
- Mostly udders are fed on dry fodder.
- The days difference between milking and processing is not specified on package.
- With an increasing time between milking and consumption, hygienic measures are insufficient.
- Unless the milk is chilled, it will be quickly spoiled by micro-organisms. Milk should therefore be chilled quickly to about 4°C immediately after it leaves the udder. At this temperature the level of activity of micro-organisms is very low. But the bacteria will start to multiply again if the temperature is allowed to rise during storage. It is therefore important to keep the milk well chilled (Amjadi, 2005).
- Poor operational efficiencies result in lower yields, increased waste, and maximized fat/protein losses during processing.

#### **Issues Related to Actor**

- Dirty milking equipment is one of the main sources of infection of milk.
- There is a lack of an effective and well trained animal health service at farm level at all times to look after the health of animals, and to arrange for regular vaccination and checking against contagious diseases by the qualified veterinarians.
- Milk collecting centers are not found near the vicinity of producers which result in spoilage and contamination.
- People attached to milk chain have often not sufficient knowledge of hygiene. Education especially in village women members are hardly reached out.
- Milk tank drivers constitute the profile with the most critical skill gap in the road freight segment. The profession attracts largely illiterate people with no formal training. Most of them graduated from working as helper or driving small vehicles. They do not know the criticality of maintaining optimum temperature during the transit. XYZ is hiring 3<sup>rd</sup> party service without proper information about the driver's skill (Arcelus et al, 2003).
- Farmers are not putting careful attention to hygiene in order to produce milk of high bacterial quality.
- The payments are made to producers on the basis of fat and SNF content, where as the bacterial content is missing. Latest packaging technology are not effectively implemented which can help retain nutritive value of packaged products and extend their shelf-life. For proper storage and transportation, cold chain needs to be strengthened.

#### **Issues Related to Process**

- The feed storage facilities are not kept clean and tidy. The humidity and temperature control are not given due importance.

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- After milking usually no treatment to teats are done. The milking area is also not thoroughly cleaned after each milking.
- Before storage, the milk is filtered by a in order to remove large particles that might have entered the milk. The cloth hygiene is usually not kept into account.
- Milk collection in alternate days is now common in practice. The newest milk is not separated from that of the previous day, at the farm and in the truck.
- People in the milk chain are not aware of processes like homogenization, centrifugation, reconstitution, pasteurization etc.
- In the case of hand milking, the danger of contamination coming from the milker is higher as compared with machine milking.
- Quality control and quality measurements information exchanged at each level of milk chain but farmers and end customers are least benefited.
- Contamination is another major problem to deal with. Contamination occurs at different levels: at farm level, during collection and storage, and at processing centers
- Sometime primary producer are adulterating milk by adding vegetable oil for fat and titanium for whiteness etc., is traced at latter stage, which result contamination of other fresh milk in the same container.
- Potential sources of contamination of milk are dung, water, utensils, soil, feed, air, milking equipment, the animal and the milker her/himself. Contamination of milk can occur at the following levels like Animal shed and environment, the Animal, Milker and milking routine, Milking equipment, Storage and transport
- Spray or immersion coolers are used on farms which deliver milk to the dairy in cans. In the spray cooler, circulating chilled water is sprayed on the outsides of the cans to keep the milk cool. The immersion cooler consists of a coil which is lowered into the can. Chilled water is circulated through the coil to keep the milk at the required temperature.

### **Suggested Actions**

#### **Related to Situation**

- Use a defined strategy of best practice for disease prevention, adapted to the climatic conditions and breed. Higher priority should be given to udder health, longevity and lifetime production than to annual yield, when devising production plans and selecting mothers for replacement stock.
- Contamination of milk should be checked at the following levels like Animal shed and environment, The Animal, Milker and milking routine, Milking equipment, Storage and transport. Special care should be taken for potential sources of contamination of milk like dung, water, utensils, soil, feed, air, milking equipment, the animal and the milker her/himself.
- Use of grass, fresh or as silage should be there as much as possible, preferably with a high content of aromatic herbs
- Date of milking or that the milk was processed and packaged on the day of milking, or that it took no more than x days from milking to packaging should be specified.
- Define clearly which processes have been applied to the milk, including homogenization, centrifugation, reconstitution, pasteurization etc., even if this information is not formally required. Explain complex terms

**Related to Actor**

- Dirty milking equipment is one of the main sources of infection of milk. About 15 minutes before milking, milking equipment should be rinsed with a sanitizing solution. In this way, dust and contamination will be removed.
- All equipment coming into contact with milk must be cleaned and disinfected.
- In India, knowledge of hygiene is often not sufficient. One of the most important support-services regarding clean milk production is “Extension-Education”. These services should be organized at the village level and main thrust should be given to empower the women members
- Where milking machines are used, the milk is collected in special farm tanks. These come in a variety of sizes with built-in cooling equipment designed to guarantee chilling to a specified temperature within a specified time. These tanks should be equipped for automatic cleaning to ensure a uniformly high standard of hygiene (Berger, 2007).
- Drivers must follow regular routines to transport milk from the farm to the dairy as follows (Hsu et al, 2007):
  - Wear uniform and keep good personal hygiene.
  - Agitate the milk before taking the sample.
  - Record the temperature of milk to be loaded.
  - Make the alcohol test before loading.
  - Take the sample.
  - Fill out the transport receipt.
  - Return to the farmer the dairy plant reports on the test results of his milk.

**Related to Process**

- The feed storage facilities should be kept clean, tidy and rodent free, a good control of humidity and temperature should be ensured, even during adverse weather conditions.
- After milking, the teats can be dipped or sprayed with a gentle antiseptic solution. The milking area should be thoroughly cleaned after each milking.
- Before storage, it is best to filter the milk with a clean cloth in order to remove large particles that might have entered the milk. The cloth should be thoroughly cleaned after use and left to dry in the sun.
- Collect milk daily, or keep the newest milk separate from that from the previous day, at the farm and in the truck. Use only the freshest milk for fresh consumption, older milk for yoghurt, cheese etc. If it possible, milk from different farmers should be kept separately.
- In the case of hand milking as the danger of contamination is more. The milker should therefore be free from contagious diseases. Nails should be well trimmed; she/he should wear clean clothes and should wash her/his hands with soap and water before milking, then dry with a clean towel.
- If milk is boiled before use and consumed within hours of production, high capital investments to improve hygiene may not be an economic necessity.
- With an increasing time between milking and consumption, hygienic measures should improve. At the same time, with an increasing scale of farming, there is more room for investments in hygienic practices. The cost of clean milk production should not exceed the benefit of

the farmers. Milk payments should be an incentive to improve the hygiene, and clean milk production should be financially rewarded.

- An effective and well trained animal health service should be available at all times to look after the health of animals, arrangements should be made for regular vaccination and checking against contagious diseases by the qualified veterinarians. Veterinary first aid should be readily available around the clock at village level.
- To avoid spoilage, milk collection centres should be set up at locations that are easily accessible to the producers. Milk producers' organisations should have their own arrangements for milk processing, manufacturing of by-products and marketing to maximize returns to the producer.
- Information about the quality control and quality measurements should be exchanged with the companies and persons in charge of the other parts of the chain. Formal or informal collaboration agreements can ensure that quality and safety is controlled at every step of the supply chain, and that the costs of this are shared fairly among the participants.
- Safety and quality assurance programmes for milk and dairy products must cover the whole dairy chain from farm to table. Processing and proper subsequent handling are the most critical steps to ensure safety of products. The emphasis in quality assurance and risk management has shifted from end product testing to certification of process in approaches such as HACCP
- Quality problems may arise if the intervals between collections are too long. Certain types of micro-organisms, known as psychrotrophic, can grow and reproduce below +7°C. They occur mainly in soil and water, so it is important that water used for cleaning is of high bacteriological quality. After an acclimatisation period of 48-72 hours, growth goes into an intense logarithmic phase. This result in breakdown of both fat and protein, giving the milk off-flavours that may jeopardize the quality of products made from it ( Valeeva et al, 2007). This phenomenon must be allowed for in planning of collection schedules. If long intervals cannot be avoided, it is advisable to chill the milk to 2-3°C.
- Safety and quality assurance programmes for milk and dairy products must cover the whole dairy chain from farm to table. Processing and proper subsequent handling are the most critical steps to ensure safety of products. The emphasis in quality assurance and risk management has shifted from end product testing to certification of process in approaches such as HACCP (Hazard Analysis and Critical Control Point)(Sperberg, 2005).

### **Expected Performance**

The success of an enterprise, whether at an individual or corporate or national level would much depend on the establishment of an appropriate institutional structure for it and how best it is being managed in fostering the growth of the enterprise. The growth of disposable incomes, change in family structures, more women joining the work force and focus on healthy-nutritious and quality products are likely to result in demand for a shift towards dairy products that are not just functional and convenient but also meet the consumers' inspirational needs. XYZ has the potential and flexibility to adopt the suggested actions as the top management is too committed and XYZ is equipped with latest technology. To promote effective Q&S issues the following four factors may be given importance: Check contamination at farm level, early quality control at PDCS, DDCU level, effective cold chain, an aware customer. Clean milk production results in milk that is safe for human consumption and free from disease producing microorganisms, has a high keeping quality, has a high commercial value, can be transported over long distances, is a high quality base product for processing, resulting in high quality

products. Better the Q&S issues are dealt with more be the improvement in the performance of the XYZ. The SAP-LAP methodology applied in a case study of XYZ helps to identify important Q&S issues. The inquiry model of SAPLAP in conjunction with its present situation and capabilities of XYZ result in various factors of learning. These factors are expected to improve the milk chain performance of XYZ.

### **Managerial Implications**

The case study of XYZ is presented with the help of a SAP-LAP enquiry Model. SAP-LAP is used to explain soft and hard issues of milk chain Q&S in the managerial context. This study has following managerial implications:

- The framework helps in identifying different Q&S issues based on the relative importance in milk chain.
- The utility of SAP-LAP model can be appreciated from studying the present situation of Q&S, which may motivate the actors who may initiate the steps to improve processes.
- The interplay of situation, actor, and process presents a dynamic scenario in which these three entities depend on each other. The change in one of the entity may lead to change in other two entities in a dynamic manner.
- There is a need to view the concept of milk chain Q&S from a holistic perspective. It requires critical analysis of milk chain situation, milk chain members, and supply chain activities.
- The SAP-LAP model is useful in understanding milk chain Q&S perspective. Situation, actor, and processes are different parameters even though inseparable, and LAP helps to synthesize SAP. This makes SAP-LAP a whole system. Milk chain is comprised different organization but because there is dependency between them, they may perform well when they consider themselves to be a part of one whole system.

### **Conclusion**

In developing countries like India, various factors combine to compromise the hygienic quality of milk products viz the organization of milk supply chains themselves, dysfunction of the support systems, improper check to contamination and adulteration, sub standard processing centers and poor customer awareness. The problem is compounded by local climatic conditions, where both heat and, at times, humidity do not favor the preservation of the product in optimal conditions when the cold chain cannot be maintained. The contamination of milk whether accidental or deliberate can have far-reaching consequences. The primary goal of this paper was to explore the reasons to poor quality& safety standard of dairy in India. Contamination and inadequate cold chain are found to be the most critical cause categories to ensure quality safety of MMP. The SAP LAP model is used for better understanding of the problem and for this a case of XYZ federation is taken. The list of various learning gives a bright insight upon the problem. These trends have provided insights into the experience of milk chain in India. These findings could help future adoption and implementation of milk safety and quality management systems in the food industry. The limitation on this part is that the sample size for Perato analysis is too small and the members of PDSC are not directly interviewed.

Note: For technical reasons, the name of the organisation is concealed.

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- Agricoop, Department of Agriculture and Co-operation, <http://www.nic.in/agricoop>
  - Da, Dairy Australia [www.dairy.com.au](http://www.dairy.com.au)
  - Dahd, Department of Animal Husbandry and Dairying, <http://www.nic.in/dahd>
  - Ddb, Danish Dairy Board, Denmark , <http://www.mejeri.dk>
  - Fao, Food and Agriculture Organization [www.fao.org/ag/againfo/projects/en/pplpi/home.htm](http://www.fao.org/ag/againfo/projects/en/pplpi/home.htm)



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- Gcmmf, Gujarat Cooperative Milk Marketing Federation Ltd <http://www.amul.com/>
- Goliath, [http://goliath.ecnext.com/coms2/gi\\_0199-5905968/india-s-milk-production-to.html](http://goliath.ecnext.com/coms2/gi_0199-5905968/india-s-milk-production-to.html)
- Hddcf, Haryana Dairy Development Cooperative Federation Ltd <http://www.vitaindia.com/>
- Icar, Department of Agriculture and Research <http://www.nic.in/icar>
- Ida, Indian Dairy Association <http://www.indiandairyassociation.com/>
- Mofpi, Department of Food Processing Industries <http://www.nic.in/mofpi>
- Ndcc, National Dairy Council of Canada, <http://www.dairy.ca/>
- Pmf, Punjab Milk Federation, Punjab <http://www.nic.in/milkfed>
- Usda, United States Department. of Agriculture, [www.usda.gov/services.htm](http://www.usda.gov/services.htm)

