CHAPTER III
CONCEPTUAL FRAMEWORK

In this chapter supply chain management concepts with respect to dairy industry has been discussed. The supply chain risks, coordination and performance issues are discussed in the way they are stated in the objective section of the research. Though customers are not a part of the procurement, production and distribution related issues; still their behaviour towards the product or service matters a lot for the organisations to improve. In light of this, customer satisfaction is also being discussed so as to make the study comprehensive. At the end some of the dairy food supply chain models across the world are presented to compare and contrast with the Indian dairy food supply chain.

3.1 Concepts of Supply Chain Management

Supply chain management (SCM) encompasses all the activities relating to the cost minimisation and product customisation to the customer requirement working at various levels of the organisational hierarchy. SCM manages the product, fund and information flows between and among various stages in the supply chain to maximise total supply chain profitability. A typical supply chain consists of suppliers’ suppliers, suppliers, manufacturer, transporters, distributors, retailers and customers’ customer and the customers at large (Chopra & Meindl, 2003). In some cases under the vendor managed inventory (VMI) the manufacturer asks the suppliers to take care of the inventory and directly supply it to the distributors and retailers. This somewhat relaxes the job of the manufacturer in the whole distribution process. Similarly some manufacturers directly ship their products to the customers’ door step for final consumption and use. Companies like Dell Computers receives the orders from the customers directly, processes it and dispatch the computers and laptops etc. to them at the end. These days the supply chains are extended to countries other than the country of operation to enhance the scope through sub-contracting and outsourcing.

3.2 Supply Chain Cost and Profitability

The basic objective of a supply chain is to minimise cost and maximise profitability throughout so that every stakeholder will be satisfied and the demand be met without any breaks (Chopra & Meindl, 2003; Shapiro, 2001) The total cost may include all direct and indirect costs so that the merchandise is produced and delivered to the end users at right
time (Simchi-Levi et al., 2008). Purchasing-, production- and distribution related costs play major role in the total cost calculation of a supply chain. Purchasing plays a vital role in the survival of any supply chain. Cost reduction or improvement, improved material delivery, shorter cycle time, development cycle times, access to product and process technology and quality improvement etc. could be practiced with an efficient purchasing operation in the organisation.

It has been widely seen that manufacturers spend an average of 55 cents for procurement of materials out of every dollar of revenues on goods and services (Tiersten, 1989; Monczka et al., 2002). Various activities like supplier identification, evaluation, selection, management, development, and improvement are the key issues relating to procurement process in the organisation (Monczka et al., 2002). But in most of the cases due attention is not given to the above factors and hence the procurement process becomes sub-optimal and less value additive to the supply chain.

According to Reck and Long (1988) as cited in Cousins et al. (2008), “there are four different stages in the development of a purchasing function viz. passive, independent, supportive and integrative”. In case of an independent supply chain the primary focus is to reduce costs and maximise profits unlike a passive supply chain. In supportive and integrated supply chain the basic priority is on the purchasing strategy and is dealt with a strategic object unlike independent and passive supply chains.

The supply chain cost is the total cost incurred in the supply chain starting from the suppliers’ supplier to the customers. According to Supply Chain Operations Reference (www.supply-chain.org), supply chain cost is the total cost associated with the plan, source, make and deliver decisions. In this study also all the costs are taken into consideration except the cost of planning since this is not known. Hence the study will be discussing the costs related to procurement, production and distribution.

The dairy industry which is highly diverse and heterogeneous starts with a village level milk producer (supplier) and ends with the customers in the urban areas. The optimum level milk productions at the farmer level (Barman et al., 2008) can possibly decrease the cost of production (Prasad, 2005) as well as the total cost of the supply chain. Due to the lack of optimal production the milk producers are incurring losses and hence to some extent leaving the avocation. This not only brings down problems for them rather decreasing the gross domestic product (GDP) from agriculture over a period of time. So in
order to have a sustainable development in dairy industry (Khanna, 2005) it is highly essential to increase the farm level milk productions.

Moreover the non-remunerative price of the cooperative based dairying (Rajgopal, 1996; Kohl et al. 2002), the situation becoming terribly affected leading to low participation of the milk producers in the system. The lack of milk production also has serious repercussions at the downstream members of the supply chain. The cost of collections and the chilling (Rangasamy & Dhaka, 2007) respectively with the dairy cooperative societies and the bulk milk coolers keeps on rising due to low milk procurements. Sub-optimal level of procurement further increases the cost of transportation and processing (Rangasamy & Dhaka, 2008). That’s the reason why an efficient milk procurement system could minimise various supply chain costs.

3.3 Types of Supply Chain

Supply chain management is defined as the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole (Mentzer et al., 2001). Depending upon the nature of the products/services the supply chain is designed. There are five different types of supply chain discussed below.

- **Lean supply chain**: The lean supply chain is the supply chain which aims at reducing or eliminating the wastes by aligning automation and just-in-time approaches (Womack & Jones, 1996; Ohno, 1988). In 1988 the concept has been propounded by Ohno at Toyota Motors to eliminate or reduce wastes through value-added activities while making the product reach the end users at the right time and right location.

- **Agile supply chain**: The supply chain which responds the market rapidly when the demands are highly volatile and not known (Christopher & Towill, 2000). This type of supply chains are suitable for the dairy industry where the demand is sporadic and is based upon the availability. The profit margins are also comparatively higher.

- **Leagile supply chain**: This kind of supply chain is lean at the upstream while being agile to the downstream aiming respectively at cost effectiveness and high service level (Mason-Jones et al., 2000). For an instance hotel industry or dairy industry – the upstream side is lean while the downstream side is agile. In the former part the waste
reduction is the objective while in the latter part the service level to the customers are extremely important.

- **Resilient supply chain:** The supply chain which can operate in an uncertain business environment thus increasing its ability to cope up with the risk (Tang, 2006). The supply chain risks and uncertainties are quite common which disrupt the supply chain or reduce profit. In order to operate in a very risky or uncertain environment it is essential to increase the risk coping efficiency of the stakeholders.

- **Green supply chain:** This kind of supply chain aims at reducing the ecological risks being created by it while achieving the corporate profits and market share objectives (Zhu et al., 2008). Global warming, sporadic changes in the climate and environmental pollutions are compelling the organisations to take care of the environment as a whole by reducing carbon foot prints. The green supply chain though not specifically pertains to an industry still it is for all kinds of it to be followed on moral grounds as a corporate responsibility.

According to Mason-Jones et al. (2000) the basic distinctions between the lean and agile supply chains are as depicted below:

**Table 3.1: Lean vs. Agile supply chain**

<table>
<thead>
<tr>
<th>Distinguishing attributes</th>
<th>Lean supply chain</th>
<th>Agile supply chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical products</td>
<td>Commodities</td>
<td>Fashion goods</td>
</tr>
<tr>
<td>Marketplace demand</td>
<td>Predictable</td>
<td>Volatile</td>
</tr>
<tr>
<td>Product variety</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Product life cycle</td>
<td>Long</td>
<td>Short</td>
</tr>
<tr>
<td>Customer drivers</td>
<td>Cost</td>
<td>Availability</td>
</tr>
<tr>
<td>Profit margins</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Dominant costs</td>
<td>Physical costs</td>
<td>Marketability costs</td>
</tr>
<tr>
<td>Stock-out penalties</td>
<td>Long-term contractual</td>
<td>Immediate and volatile</td>
</tr>
<tr>
<td>Purchasing policy</td>
<td>Buy goods</td>
<td>Assign capacity</td>
</tr>
<tr>
<td>Information enrichment</td>
<td>High desirable</td>
<td>Obligatory</td>
</tr>
<tr>
<td>Forecasting mechanism</td>
<td>Algorithmic</td>
<td>Consultative</td>
</tr>
</tbody>
</table>

Source: Mason-Jones et al. (2000)

The choice of supply chain depends upon the nature of the product. If the product is durable or semi-durable and the demand is predictable then probably a lean approach
could be the solution but when the product or the raw material is perishable and the demand is highly unpredictable and supply is a constraint then an agile approach is the solution to perform better. The above table depicts the practices to be made in case of both the supply chain types. For an instance for a dairy product the demand is very high then procurement should be based on the assignment of capacity to the suppliers and forecasting should be done with due consultation with the stakeholders in the system (Mason-Jones et al., 2000). It is seen that for this case demand is highly unpredictable and the supply is comparatively lesser than the demand. Other distinguishable differences have been depicted in the table above which fits for the products depending upon their nature and market conditions.

3.3.1 The relationship between supply chain types and attributes

Table 3.2: LARG versus synergies and divergences

<table>
<thead>
<tr>
<th>Supply chain attributes</th>
<th>Paradigms</th>
<th>Lean (L)</th>
<th>Agile (A)</th>
<th>Resilient (R)</th>
<th>Green (G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information frequency</td>
<td></td>
<td>↑</td>
<td>↑</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Integration level</td>
<td></td>
<td>↑</td>
<td>↑</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Production lead time</td>
<td></td>
<td></td>
<td>↓</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Transportation lead time</td>
<td></td>
<td></td>
<td>↓</td>
<td></td>
<td>↓</td>
</tr>
<tr>
<td>Capacity surplus</td>
<td></td>
<td></td>
<td></td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Inventory level</td>
<td></td>
<td></td>
<td></td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Replenishment frequency</td>
<td></td>
<td>↑</td>
<td>↑</td>
<td></td>
<td>↓</td>
</tr>
</tbody>
</table>

Legend: ↑ increase; ↓ decrease; - without consequence;

Source: Carvalho and Cruz-Machado (2008)

Information frequency and level of integration increase in all the above supply chain types. In other words it can be said that information frequency and level of integration are required to be higher irrespective of nature of the supply chain. Production and transportation lead times are also decreased in all the supply chains which are the basic functions of supply chains irrespective of their nature. In lean and green supply chain the capacity surplus decreases or is required to be less whereas in the agile and resilient supply chains this is required to be higher and hence increases. Except the resilient supply chain in all other kinds the inventory level decreases and in the similar way except for the
green supply chain the replenishment frequency increases to fulfil the demand and maintaining a high fill rate.

3.4 Role of Purchasing in Supply Chain

Purchasing plays a vital role in any supply chain operations. The higher is the purchasing the higher is the role of a purchasing manager and higher is the amount money invested to procure material from various sources. The history of purchasing could be as old as 200 years old and sourced from the Railroad companies in the US (table 3.3). The evolution of purchasing over this period has been mentioned in the table below till it is being treated as a strategic function than a clerical one.

“There may not be one best way to source; one should investigate the nature of business environments before making strategy decisions.”

Murray, Kotabe and Wildt (1995)

### Table 3.3: History of purchasing

<table>
<thead>
<tr>
<th>Period</th>
<th>Duration</th>
<th>Evolution stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>The early years</td>
<td>Early 1800 - 1900</td>
<td>Railroad companies in the US treated purchasing a major function and gave it a separate department status.</td>
</tr>
<tr>
<td>The purchasing procedure refining years</td>
<td>1900 - 1914</td>
<td>Purchasing procedures were refined and considered as a clerical activity.</td>
</tr>
<tr>
<td>The war years (WW I-WW II)</td>
<td>1914 - 1945</td>
<td>Importance of purchasing increased due to the requirement of war materials. Mass production by Ford made it an important function.</td>
</tr>
<tr>
<td>The quiet years</td>
<td>Late 1940’s - mid 1960’s</td>
<td>Purchasing function became better refined as the number of trained professionals increased.</td>
</tr>
<tr>
<td>The age of material management</td>
<td>Mid 1960’s - early 1980’s</td>
<td>MRP introduced which later on evolved to MRP II and JIT emphasising on supplier relationships. Purchasing evolves to procurement during this period.</td>
</tr>
<tr>
<td>The age of integrated supply chain management</td>
<td>2000 and beyond</td>
<td>Increasing integration with supply network and information technology.</td>
</tr>
</tbody>
</table>

Source: Li (2007)
3.4.1 Stages of Purchasing

It has been experienced that more than half of the supply chain cost is incurred towards purchasing various items/materials (Tiersten, 1989; Monczka, 2002) in the industry. Hence these days many organisations are linking their purchasing to strategic decisions. According to Reck and Long (1988) as cited in Cousins et al. (2008) there are four different stages in the development of a purchasing function viz. passive, independent, supportive and integrative.

Stage I: Passive: In this case the purchasing function has no strategic direction and primarily reacts to the request from the other functions. In this stage the corresponding department does not have much contribution except performing the regular activities in the firm. The purchasing managers mostly deal with the supply related problems. The basic characteristics of the purchasing department at this stage are:

- High proportion of time spent on quick fix routine operations
- Purchasing function and individual performance based efficiency measures
- Little inter-functional communication due to low visibility of purchasing in the organisation
- Supplier selection based on price and availability

Stage II: Independent: Purchasing function here adopts the latest purchasing techniques and practices but its strategic direction is independent of firm competitive strategy. At this stage the primary focus of the firm is to work with greater efficiency. The main characteristics of the purchasing function are:

- Performance is primarily based on the cost reduction and efficiency measures
- Coordination links between purchasing and technical disciplines are established
- Top management recognises the importance of professional development
- Top management recognises the opportunities in purchasing for contributing to profitability

Stage III: Supportive: In this stage the purchasing function supports the firm’s competitive strategy by adopting purchasing techniques and products, which strengthen the firm’s competitive position. Top management deals the department as an essential
business function to the firm. The department provides necessary support and information to all other departments to deal with pricing and material related problems. The characteristics of supportive stage are as mentioned hereunder:

- Purchasers are included in sales proposal teams
- Suppliers are considered a resource, which is carefully selected and motivated
- People are considered a resource, with emphasis on experience, motivation and attitude
- Markets, products and suppliers are continuously monitored and analysed

**Stage IV: Integrative:** Purchasing strategy is fully integrated into the firm’s competitive strategy and constitutes part of an integrated effort among functional peers to formulate and implement a strategic plan. At this stage, the purchasing department works proactively which minimises the potential threats. The basic characteristics in this case are:

- Cross-functional training of purchasing professionals and executives is made available
- Permanent lines of communication with other functional areas are established
- Professional development focuses on strategic elements of the competitive strategy
- Purchasing performance is measured in terms of contribution to the firms’ success

**3.5 Concepts of Logistics**

The word logistics derived from the Greek word “Logistikos” and the Latin word “Logisticus”, which means the science of computing and calculating. It was first used by the French army during 17th century. After the World War II, the US army officially used the term “logistics” which is defines the physical distribution of materials and finished goods from one place to another.

The American Council of Logistics Management defines logistics as, “the process of planning, implementing and controlling the physical flows of materials and finished goods from point of origin to point of use to meet the customer’s need at a profit”. It covers various functions like order processing, inventory management, warehousing, transportation, material handling and storage, packaging etc. under a proper information sharing base.
As said in the below given table 3.4 the distribution related cost is almost two third of the total logistics costs and hence is highly crucial for the entire system. The prudential planning of the transportation functions and travelling-salesman related issues should be undertaken and implemented in the supply chain to curb the logistics costs. For a typical dairy farm the distribution of milk to the retailers and industrial customers like hotels and restaurants are judiciously carried out so that the perishability in the process can be curbed and while minimising the distances travelled en-route.

**Table 3.4: Logistics costs breakup**

<table>
<thead>
<tr>
<th>Stages</th>
<th>Cost items</th>
<th>Share in logistics cost (percent)</th>
<th>Cumulative share of stages (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-bound logistics</td>
<td>Transportation</td>
<td>12.0</td>
<td>28.0</td>
</tr>
<tr>
<td></td>
<td>Storage</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inventory</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>Process logistics</td>
<td>Transportation</td>
<td>2.0</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>Storage</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Out-bound logistics</td>
<td>Transportation</td>
<td>33.0</td>
<td>65.0</td>
</tr>
<tr>
<td></td>
<td>Storage</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inventory</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Order processing</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Sople (2004)

Sometimes injudicious planning of the routes brings harm to the products and leads to customer dissatisfaction. In-bound logistics constitute 28 percent or almost less than one third of the logistics costs. It is noted here that for a perishable product like liquid milk inventory is maintained to be very high unless it is UHT milk which can be stored for 2-6 months without damage. But for pasteurised milk and other susceptible dairy products to damage are not much stored and hence produced according to the tentative demand (agile supply chain behaviour).

**3.5.1 Transportation**

It is the process of moving objects from one place to the other; being most important factor of logistics. There are several modes of transportation viz. road, rail, sea, air and
pipelines. Out of all these, road medium is the most advantageous method of transportation because of its high reachability and flexibility. Currently in India there are 25 million trucks operating in the logistic sector with average distance coverage per day is 250-300 kms against 550-600 kms in the developed countries. The average operating cost of an Indian truck is Rs. 15 per km (Sople, 2004). Various factors, that affect the operating/freight costs are:

- Volume (sub-optimal lot size, under optimal unit leads to higher per unit cost)
- Distance (the more the distance the more the cost)
- Product density (wt/volume, low density products brings up cost e.g. wool, cotton)
- Product shape (irregular shape needs careful driving and leads to more fuel burn)
- Product handling (needs crane, forklift trucks, earth movers, which increase the unit cost)
- Product type (perishable products like milk need conditioned transportation)
- Market dynamics (sometimes the freight charges are fixed by the associations)

Vijayaraghavan (2001) as said in Sople (2004), 84.3 percent of firms have been using outsourced transportation where as the rest 15.7 percent use in-house mode of it. The logistics function in the organisations is one of the key function areas which require expertise in the field. But it is found that most of the organisations do not have the proper skill to deal with the function that’s the reason why the activity has been outsourced to other parties which have the expertise in it. Some of the advantages of the outsourced logistics are:

- Cost reduction
- Wide coverage
- Resource optimisation
- Optimising customer satisfaction
- Enhancing core competencies

3.6 Major Supply Chain Challenges

Had it been changing demand pattern or competition in the market place, there exist challenges for the supply chain. These challenges could be:
3.6.1 Increasingly demanding customers

The demands are more rampant and dismantled in case of manufacturer as a customer of raw materials and components or the end users of a final product. Whereas manufacturer demands improvement in delivery lead time, cost and product performance from the suppliers; the end users demand low price, better quality and faster delivery etc. from the manufacturer. If the suppliers won’t work up to the expectations of the manufacturer then the contract with the earlier suppliers are broken and new suppliers are searched and contracted. On the contrary, keeping view to the end users product proliferation is very common practice today. It gives rise to shorter Product Life Cycles (PLC) of many products which in turn incurs heavy costs affecting the responsiveness within the supply chain.

3.6.2 Fragmentation of supply chain ownership

Off-shoring, outsourcing and sub-contracting of many non core activities has been a very common practice in the manufacturing industry. Wherever this has brought a tremendous change in the sector for getting globalised but at the same time the companies are losing control over the supply chain. The whole supply chain is fragmented with many owners who work with their own policies and interest giving rise to conflicts in many occasions and decrease in the overall supply chain profits and revenue.

3.6.3 Globalisation

Globalisation has given rise to steep competition among the various players in the market. Since more and more companies are interested in the global marketing so the supply chains are becoming larger but it is extremely difficult to coordinate. Globalisation and free trade has brought sea changes in the business where distance is not perceived as a problem rather it is used to the fullest capacity in anticipation of low price material/product/labour and timely delivery of the same.

3.6.4 Difficulty in executing new strategies

Strategies are easy to formulate than to execute. Whether it is related to the product customisation, outsourcing or supplier autonomy, high risk is intact everywhere and companies are finding it hard to execute though not impossible. Further there are several stakeholders for the supply chain and keeping track of every stakeholder and coordinate them accordingly is found to be difficult. Vested interest of the stakeholders in the system
also brings harm in a guise way. For an instance in dairy industry the milk producers in the rural areas try to sell their produce themselves in the nearby markets but when they become failure in the process resort to the cooperative societies in anticipation of selling with other guise motives – difficult to know. Moreover a strategy undertaken might not be advantageous to all the stakeholders which sometimes bring up conflicts.

3.7 Supply Chain Risk Concepts

Supply chain management is gaining overwhelming response from across the world irrespective of the type of industry and supply chain (Li et al, 2006) and so is supply chain risk management (Faisal et al, 2006b; Tang, 2006a). It is the most comprehensive approach which entangles all the stakeholders in the system to make the product or the service available at least cost and with maximum customer satisfaction. But in order to have an efficient and effective supply chain in the long run, it is highly essential to identify and mitigate the risks and uncertainties. Risk and uncertainty, though used interchangeably in various studies, are not same. Wherever in case of risk the probability is known, it is not known for the uncertainty (Siegel, 2005). Risk and uncertainty has always been an important issue in supply chain management and is wide-spread. Under the purview of supply chain management there is a little scope for the stakeholders to get rid of these issues. Every stakeholder in the system has its own working environment where the vulnerabilities are quite common and frequently come into being by disrupting the dyadic links.

Earlier the risks and uncertainties in the supply chain were dealt as company-specific tasks (Juttner, 2005) but later on it was realised that, since the supply chain is a complex bonding of several stakeholders, distortion at one of the components distorts the entire system by varying degrees. For an instance, in case of organised dairy food supply chain, “non-remunerative price to the producers” at the producer-cooperative society dyad brings down the procurement of milk at plant level which in turn increases the price of the products. The producer, who gets a non-remunerative price for the produce shows dissatisfaction and gradually losses his/her confidence on the performance of the chain. If this happens to be a case for a long time he/she sells out his cattle and gets abstinent from producing milk anymore. If a few producers in the system do the same, it may not necessarily affect the flow of the chain. But if followed by thousands of the producers then it definitely brings down the procurement throughout the upstream supply chain.
The low procurement of the material at the production plant seriously affects the production processes. Since the products are not produced at optimum level and distributed to the retailers on time, both the retailers and the customers get dissatisfied. This not only hampers the flow of the chain but also snatches the avocation of the poor milk producers creating serious problems in the society. Clearly, if a single component of the chain gets violated, it affects the entire supply chain’s flow. Though the supply chain risks and uncertainties are quite rampant still in many cases a proper risk redressal mechanism seems to be lacking. Of late, the research and development in this respect is gaining its momentum and has become a top agenda for both researchers and practitioners (Vanany, Zailani, & Pujawan, 2009; Thun & Hoenig, 2009).

3.7.1 Risk management

“When our world was created, nobody remembered to include certainty” (Bernstein, n.d).

The famous quote by Bernstein indicates the uncertainties and risks in the worldly phenomena. Risks and uncertainties are inevitable no matter how strong is the individual or institution in making decisions. These often come into the picture with some sort of unpleasant results with them. It is not only difficult to predict the outcomes of the events rather it is also difficult to avoid them in many real life situations. So a clear-cut risk redressal mechanism is the call for the day to minimise the impact irrespective of the organisation. In this connection the supply chain of farms are no deviations. The supply chain makes the products or services available at the market place with least cost and maximum stakeholder satisfaction. Redressing/managing risk is essentially a major task for the smooth functioning of any supply chain.

Every supply chain, irrespective of its type, invariably attached to the risks and uncertainties. The risks could be of different types depending upon its impact on the supply chain. They are viz. high risks, medium risks and low risks etc. A “high risk” affects the supply chain drastically and obstructs its efficiency unlike medium and low risks. Though all medium and low level risks can’t be fully ruled out from the hierarchy of risks still some organisations have the flexibility to overlook them. On the contrary, the highly efficient supply chains have either lower risks or more capability at their disposal to handle the risks and uncertainties (Nicholas, 2001). The high degree of efficiency in detecting and mitigating risks could be attributed to the experience gained from past years and the coordination among the supply chain stakeholders.
Managing the supply chain greatly depends upon the risk management efficiency of the firm. Today in the era of globalisation, organisations not only face stiff competitions in the market place rather confront whole lot of difficulties aroused from the operation - may be related to supplier management, production management or logistics management. Each part of the supply chain is vital and needs diversified expertise. The problems being evoked from all sort functions in the organisation may be brought under the purview of risk management. Of late organisation come to realise that the risk management is a part of the operations management and hence has been viewed seriously these days. Various authors have described risk management in one way or the other but the most comprehensive definition have been suggested by the Australian Standard 4360 (1995).

Australian Standard 4360 (1995), as said in Frost et al. (2002) has defined risk management and risk in the following ways which has been considered by ISO as a basis for an international standard:

The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood. Risks are uncertain future events which could influence the achievement of the organisation’s objectives, including strategic, operational, financial and compliance objectives. (2002, p.27)

3.7.2 Types of risk

There are basically four types of risks. They are operational, strategic, compliance and financial risk. Operational risks are the risks related to the production and operation function in the organisation like problems related with production process, distribution and logistics related hazards etc. whereas strategic risks are the risks experienced at the higher level like competition in the market place, technology, collaboration related difficulties etc. Further changing government rules and regulations, political hindrances etc. can be attributed to the compliance risks and exchange rate fluctuations, credit risks and lack of profitability etc. come under the financial risks. In this research focus is basically concentrated on the operational and financial risk issues. The various problems discussed in the introduction chapter are further modified to define the risks and uncertainties at each level of the supply chain. Starting from the milk producers in the rural areas to the consumers in the urban areas the detailed discussion upon this issue has been made. There are several reasons for the risk management process to be undertaken in the organisation of which some of the major reasons could be:
Rapid globalisation
- Internal competition
- Increased risk awareness
- Increased regulation
- Demand unpredictability
- Enhanced consumer awareness
- Scarce resources and so on t name a few

3.7.3 Benefits of risk management

Benefits of risk management are manifold as it can help the organisation to take new opportunities by optimising the risk and the return. Moreover it helps the organisation to avoid cost, disruption and unhappiness (Sadgrove, 2005). However the benefits among others could be but not limited to:

- Enhanced overall growth
- Higher profit margin
- Improved cash flow
- Decreased loss due to depreciation
- Increased stakeholder satisfaction
- Reduction of causalities
- Enhanced supplier efficiency

3.7.4 Risk management process

The risks management process starts with a problem definition and ends with the action. The various steps of the risk management process are discussed hereafter (figure 3.1).

Step I: Define risks

A “risk” is nothing but an event with known probability which brings out an unpleasant result. It could be a potential damage or loss to the farm which affects the supply chain negatively. The British Standards Institute defines, “risk as a combination of probability or frequency of occurrence of a defined hazard and magnitude of the occurrence” (BS 4778, 1991, as stated in Schoenherr et al., 2008, p. 101).
Figure 3.1: Flow chart of risk management process

The two if unaddressed for a long time might defunct or break down the links in the supply chain. But a major task here is to define the risks and uncertainties for the entire supply chain, which is though not impossible still not an easy affair to deal with. It requires a great deal of past experience in the industry concerned and a team with high expertise in the field. According to the opinions of the experts and the past history of the supply chain – risks and uncertainties could be defined in an organised manner. The risks and uncertainties for various supply chains may be perceived differently. A risk or uncertainty for a particular supply chain in any industry may not be necessarily the same for other supply chains always. It all depends upon the organisational set up and it’s working environment.
Step II: Identify risks

Risk and uncertainties are inevitable for any type of supply chain. But it is imperative for the chain to identify the risks and take action to control them successfully. Some of the risks are easy to detect and some are not. The identification process could start in many ways. It could be a survey where the stakeholders’ opinions are taken and assessed, brainstorming, checklist or work breakdown structure (WBS) at the organisation level etc. to generate exhaustive list of the problem areas.

The risks are of two types—namely; internal risks and external risks. Internal risks arise from the organisation itself whereas the external risks are attributed to the outside world of the organisation. The internal risks could be namely; financial risks, technical risks, supply risks and logistical risks etc. whereas market risks, political risks, hazard risks and natural calamities etc. are some of the external risks. While identifying the various risks, both internal and external risks should be considered logically.

Step III: Analyse risks

Any risk or uncertainty is basically related to two major factors viz. likelihood and the severity (Mulacahy, 2003). Likelihood is nothing but the chance or the probability that the event occurs whereas severity is attributed the degree to which it causes damage to the supply chain. These two different entities contribute to the impact of the risk on the supply chain. Undoubtedly, the higher degrees of all these factors cause a major damage leading to supply chain breakdown. Though it may be difficult to generalise the correlations among the variables still there is no hesitation to say that, any event with higher probability and severity might bring in supply chain failure and disruption. So risk is treated to be varying over probability and severity. Mathematically:

\[
\text{Risk} = f (\text{Likelihood}, \text{Severity});
\]

If, Likelihood (Probability) = P, Severity = S then Impact (I) = P * S;

P: 1 = very low (0.0-0.2), 2 = low (0.2-0.4), 3 = medium (0.4-0.6), 4 = high (0.6-0.8), 5 = very high (0.8-1.0);

S: 1 = insignificant, 2 = minor, 3 = neither serious nor minor, 4 = serious, 5 = catastrophic;

I: 1 = very low (1-5), 2 = low (5-10), 3 = medium (10-15), 4 = high (15-20), 5 = very high (20-25).
It is clear that the risk impact values range from 1 through 25 under a five point Likert scale. Whereas “1” indicates a very low risk, the value “25” indicates high risk pertaining to a particular event. In this case, there can be 25 such permutations out of which the extreme left and the right values indicate “very low” and very “high risks” respectively. The values ranging from 1 through 25 could be further scaled down to put in the five point rating scale as mentioned in the table. Keeping view to the likelihood and the severity of the various risks – the risks can be with the following symptoms:

(i) High probability and high severity;
(ii) High probability and low severity;
(iii) Low probability and high severity and
(iv) Low probability and low severity.

**Step IV: Assess risks**

The risks in order of the descending “impact” values could be arranged in a list so as to identify the high risks, medium risks and the low risks etc. in the supply chain. Undoubtedly the high risks are the most prioritised areas where decisions need to be taken as early as possible in the supply chain so as to minimise their intensity or to stop the supply chain breakdown. For similar kind of high risk activities or events the organisations have to decide the case where to take action first, when and how? This is usually based upon the stand of the organisation in dealing with the particular risk in the yester years. Brainstorming in this regard is also a technique which usually addresses these impasses. The decisions are taken based on the available resources of the organisation concerned.

**Step V: Create a feasible action plan**

The action plan meant to find a tentative solution for the risks and uncertainties. While creating the action plan feasibility conditions of the same should be considered. There are risks with high, medium or low impacts based upon their impact values. The impact variability is quite subjective in nature and based upon the risk tolerance of the concerned organisation. The above values in the table are based upon the field-expert opinion and the survey conducted by the researcher in this case. The values and the ranges depicted might vary with respect to the industry concerned. Based on these impact values, the risks and uncertainties are given importance in the supply chain to be addressed. The organisation
has to decide which of the risks are to be transferred to other parties and which are not. Can a particular risk be simply avoided or ruled out for the entire chain? Can a particular risk be reduced or mitigated so as to minimise the impact of it on the chain?

**Step VI: Take action**

Decisions are implemented to mitigate or reduce the risks and uncertainties. But all the decisions implemented might not work as expected indicating flaws thereto. In this case the process needs to be thoroughly monitored and controlled and a suitable strategy again formulated to address the problems. Decision making in this case will be easier when it is consulted with other stakeholders in the system. Sometimes in a supply chain decisions or strategies taken without the consultations with the concerned stakeholders lead to discontentment and conflict. Hence it is important to take the decision and action against a risk or problem with due consultations with the stakeholders. In this way a collaborative working environment can also be developed and risks could be minimised.

**3.8 Supply Chain Coordination**

Supply chain coordination is the mechanism by which the stakeholders take action together so as to enhance the overall supply chain profits (Chopra & Meindl, 2003). The supply chain which is the combination of several stakeholders in the system consider the actions taken at each individual interfaces so that the conflicts arising out of it can be resolved. It has been seen many a times that the stakeholders keep interest in their own operation and won’t consider its impact upon the other stages of the supply chain. This not only decreases the overall profit rather invites the bullwhip effects in the supply chain which might worsen the relationships among the supply chain partners.

**3.8.1 Causes of lack of supply chain coordination**

There are so many issues of supply chain coordination failure. The critical issues in this case are:

- Lack of trust
- Lack of infrastructure
- Lack of information sharing
- Non-involvement in the decision making
• Low profit

3.8.2 Patterns of collaboration

Collaboration in a supply chain can be practiced in so many ways – may be outsourcing of decision making or capacity sharing etc. The various types of collaboration along with their practices have been depicted in the table 3.5:

Tables 3.5: Patterns of collaboration

<table>
<thead>
<tr>
<th>Type</th>
<th>Practice</th>
<th>Examples of practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outsourced local decision making</td>
<td>Increase the level of responsibility of suppliers</td>
<td>Vendor managed inventory, supplier quality programme, early supplier involvement (component design)</td>
</tr>
<tr>
<td>Improved local decision making</td>
<td>Enhance and align local decision making</td>
<td>Information sharing, shared POS data, joint capacity management and joint inventory management</td>
</tr>
<tr>
<td>Decision objective alignment</td>
<td>Joint objective planning and objective alignment</td>
<td>Collaborative forecasting, collaborative promotion planning, early supplier involvement and category management</td>
</tr>
<tr>
<td>Pooled resource and capacity sharing</td>
<td>Resource pooling and sharing and joint decision investment</td>
<td>Shared pallets, joint trailers, 3PL (mediated resource sharing), joint facility and R&amp;D investment, shared prototyping facility</td>
</tr>
<tr>
<td>Process and information system integration</td>
<td>Business process and information system integration</td>
<td>JIT supplier (such as Toyota), CPFR standards adoption, B2B market place, E-business standards compliant</td>
</tr>
<tr>
<td>Supply chain process reengineering</td>
<td>Internal business process redesign and alignment</td>
<td>Joint cycle time reduction, supply chain event management, suppliers training and evaluation, process postponement, performance metrics</td>
</tr>
</tbody>
</table>


Arshinder, Kanda and Deshmukh (2008) have suggested that, stakeholders in the supply chain should work towards a unified system and coordinate with each other in order to face challenges. According to them integration, cooperation and collaboration are all part of supply chain coordination and complementary to each other. Based on the gaps from the literature they have proposed the below given model to quantify the supply chain coordination index (SCCI). Supply chain contracts, information technology, information sharing and joint decision making play key roles in the overall supply chain coordination.
The overall performance of the supply chain coordination can be measured on the basis of weightage given to these indicators along with their values as opined by the stakeholders.

Supply chain relationships should be viewed from both buyers’ and suppliers’ perspectives while considering collaborative relationships. The collaborating relationship depends upon long term relationship (Krause, 1997), information sharing (Pyke et al., 2000; Monczka et al., 2002; Nyaga, Whipple & Lynch, 2010) and team work.

The work done by various researchers indicates that collaborative activities such as information sharing, joint relationship effort (Ellinger, Daugherty, & Keller, 2000; Nyaga

Figure 3.2: Measuring supply chain coordination (Source: Arshinder et al. (2008))
et al., 2010) and dedicated investments (Rinehart, Eckert, Handfield, Page, & Atkin, 2004; Nyaga et al., 2010) lead to trust and commitment (Moberg & Speh, 2003) which further lead to improved satisfaction and performance (Dahlstrom, McNeilly, & Speh, 1996; Knemeyer, Corsi, & Murphy, 2003; Kauser & Shaw, 2004; Johnston, McCutcheon, Stuart, & Kerwood, 2004). While buyers focus on relationship outcomes, suppliers found to safeguard their transaction specific investments through information sharing and joint relationship effort.

3.9 Supply Chain Performance

Determining the variables for measuring performance of the key stakeholders of a typical dairy food supply chain has been extremely difficult. Some of the measures studied from the existing literature (Beamon, 1999a; SCOR, 2000; Gunasekaran et al., 2004; Aramyan, 2007) have broadly used indicators like efficiency, flexibility, responsiveness, innovativeness, product quality and process quality with varying degrees. More or less all the authors or institutions have focused on cost, quality, time and innovativeness which are later brought under the purview of the above indicators. After coming across through a series of studies and research papers, three broad indicators have been considered in the study to make it more precise and appropriate. They are namely;

- Supply chain indicators
- Customer satisfaction index
- Risk coping efficiency of partners

The below mentioned discussions are all about the supply chain indicators namely efficiency, flexibility, responsiveness, product quality and process quality. Even though product quality depends upon the process quality to some extent still it is considered to demonstrate the dimensions according to the scale developed by Aramyan (2007).

3.9.1 Efficiency - in terms of cost and profit

Efficiency of a firm is measured in terms of cost and profit. If the cost is higher than the sales then there is no scope for profit and hence the return on investment is negative or low. Under the efficiency head facility cost, transportation/transaction cost, inventory cost and the return on investment (ROI) are considered by giving due weightage to their suitability to a particular component. At the milk producer level the facility costs are
measured in terms of cost of milk production where the fixed and variable costs are taken into consideration to calculate how much money is put in the process to produce one litre of milk. Since the milk producers stay within 2 kms radius of the dairy cooperative society (DCS) the scope for incurring transportation cost is ruled out. The preferred mode of transportation in their case is either walking or cycling. Inventory cost is also not an applicable parameter because the milk produced by them is delivered in specified time to the cooperative societies.

For the DCS and BMC the facility costs are treated to be respectively the collection and chilling costs where the fixed and the variable costs are considered. Sometimes in the spreadsheets the depreciation of fixed assets has been taken into consideration. Here in both cases there is no scope for the inventory - due to very nature of perishability of milk it is hardly kept preserved at a certain stage. Even though it is stored for sometime at the BMCs after chilling it is insignificant except emergency cases. Both the in-bound and the out-bound transportations are taken care by the union on behalf of BMCs is found to be a significant cost. This is the apex organisation which is responsible for the procurement process.

For the production plant, the facility cost includes the various costs associated with procurement, “production and processing” and distribution. At this stage the inventory cost has been taken into consideration even though cost incurred on finished goods inventory is lower than the raw material inventory. Among the raw materials poly packs, SMP, sugar, chemicals and other durable/semi-durable articles/materials are crucial and the inventory cost is basically calculated on them. Except the cost of processing of milk no other product costing is shared with the researcher. Based upon some literature and evidences from the cost of processing milk the items are concluded. According to the officials the costing is a susceptible issue and is basically not shared with outsiders. With great difficulty the costing of milk processing template has been obtained and made inferences thereto.

Transporting agencies both fixed and the variable costs are taken into consideration where the basic investments are on the vehicles and costs incurred towards making the vehicles insulated/air conditioned to deliver the products without damage to the retail outlets. In their fixed costs, are like one time investment and the variables costs are the operating and trip related costs.
For the retailers various costs which are incurred to make the sales possible are undertaken. Inventory and transportation related costs are found insignificant in their case. The ROI factor has been carried forward to measure financial performance of every stakeholder. Since the ROI is equal to the profit made throughout the year upon the investment in the business so in order to avoid redundancy only former is kept on roll.

3.9.2 Flexibility - the ability to change under a certain circumstance

In this aspect, customer satisfaction, delivery flexibility, volume flexibility, fill rate, back order and lost sales are taken into consideration. While customer satisfaction has got its usual meaning, delivery flexibility refers to the ability to change the delivery dates/times according to the requirement of the downstream and upstream members in the supply change.

In contrast, the volume flexibility refers to the level of production/procurement/supply according to the need of the other members in the supply chain. In some cases while delivery flexibility has more importance in other cases volume flexibility is very useful even though both the concepts important. Back orders and lost sales are concepts which occur during the stock out situations. Back order is nothing but the amount of material which is not delivered as per the order of the customers but promised to be delivered when stock is available. Lost sales is the stock-out situation which refer to the market lost or demand lost during this period and there is no scope to fulfil the demand some other point of time.

In this particular discussion the whole procurement chain is out of scope of customer satisfaction as the downstream members are bound to purchase their produce or procurement. But for the production plant, retailers and the transporters it is vitally important since the concerned purchasing member has got a choice to shift for other avenues.

The production of milk almost inflexible in the quantity and hence the volume is largely fixed which flows downstream. But the delivery system is bit flexible and hence the members do not hesitate to be abided by the change in delivery timings. For the retail outlets, production plant and the transport agencies it is extremely important to assess the quantity of products they can handle to manage the distribution chain.
production plant and the retail outlets back orders and the lost sales are immaterial for others since there is no scope of stock-ins and stock-outs.

### 3.9.3 Responsiveness – the ability to react to a certain circumstance

Fill rates, lead time, customer response time and customer complaints are the parameters used to measure the responsiveness in the supply chain. Fill rate is a crucial factor which is mostly used for measuring the demand filling rate - has been more or less referred by every component in this study even though there is no target fulfilment rate.

The fill rate is not a concern for the transporting agencies while it is a concern for all other stakeholders in the supply chain. Lead time is the difference between the ordering date and the delivery date which influences the supply chain performance positively if shorter and negatively if longer. Customer response time and complaints are with their usual meaning and affect the supply chain depending upon their intensity – the lower the better.

As stated earlier the fill rate of the procurement chain (e.g. MP, DCS and BMC) is the quantity delivered to the next phase from a particular phase. It may be noted here that there is no target given to this stakeholders. Production plant uses all the concepts of the responsiveness while some varying degrees of the same are being used by other stakeholders to know their degree of responsiveness to the market place.

### 3.9.4 Product quality – the ability to provide superior products

Under the quality manufacturing head appearance, taste, shelf life, safety and reliability of the product are some of the extremely useful terminologies as the very nature of the raw material as well as the products are perishable which may be fatal if consumed in the damaged form. So the dairy food supply chain keeps into account all these parameters at every stage and due care is taken for production, processing and distribution of the same for delivering it fresh and safe. All the terminologies are quite clear in their literal meaning while the reliability of the products says about the deviations between the promised and the actual. Higher the deviations lower the reliability which brings up discontentment irrespective of the situations and stakeholders.

Among all the components the production plant is entangled with these parameters while delivering the safety produce (milk) is an important criterion for the procurement chain members. It is seen that awareness of quality and safe milk production among the producer members are lacking which not only reducing their ROI due to lower price rather
decreasing the food value requirement of the milk causing serious problems for the production plant for further processing.

It is expected that the transporting agencies deliver the raw and processed milk (products) to the concerned stakeholders in the right state so that customer complaints of delivery of damaged products could be minimised. Retailers do not have any role to affect the quality of the products since they are meant to sell only delivered products from the production plant.

3.9.5 Process quality – the ability to follow standard operating procedure

Traceability, ”storage and transporting conditions”, working condition, chemical use, energy use, sales promotion, display in the shops/parlours and customer service are some of the important parameters considered for measuring the process quality under which a specific stakeholder operates. If the process quality is superior then the product quality will be superior under some specific conditions like superior raw materials, skilled manpower etc.

Traceability is one of the most important criteria for having superior processing since the pre-requisite information and the whereabouts of the products can be known by this parameter. This is facilitated by the use of various information tools like barcodes, radio frequency identification (RFID) and global positioning systems (GPS). Though in this case the RFID and GPS are not being prevailed still the use of barcodes on the products are quite common to convey the desired information of the manufacturer. To keep track of the logistics this is also quite important and the use of cell phones facilitates the process.

For the procurement part of the supply chain it is extremely important to have good working, storing and transporting conditions else the possibility of perishability can’t be avoided. For the BMC and production plant the use of chemicals as preservatives are important to keep them out of damage but using it above the optimal level could be dangerous and might increase the processing/production costs too.

Store display, sales promotions and customer service are some of the important criteria at the customer sales interface especially at the level of retailers. Sales promotions and the customer service to the retailers and the industrial customers these are also some major parameters at the production plant level. Other stakeholders do not have anything to do with these parameters since they are not directly involved with the end users.
3.10 Supply Chain Operational Issues in Dairy Industry

A typical dairy food supply chain involves seven stakeholders e.g. milk producers, dairy cooperative societies, bulk milk coolers, production plant, transporters, retail outlets and customers. In the forward direction the material/product of the supply chain flows while in the reverse direction the finance flows. In either way the information and knowledge flow occur in order to expedite various operational processes. In this case, milk producers and dairy cooperative societies are the supplier’s (bulk milk cooler) suppliers of the system and customers at the end are the customers’ (retailers) customers.

The whole distribution is taken care by the third party logistics (TPL) providers while the in-bound logistics is a part of the union (BMC) function. It is already seen that the transportation part is largely taken care by the TPLs (84 percent as said in Sople (2004) and hence the dairy industry is no deviation in this case. The basic aim of the supply chain is to make the products reach the end point without damage while obeying the basic management principles like right time, right place and right person. In this way while cost is the factor to be minimised, profit and customer satisfaction (overall value) is to be maximised. The following discussion will be on the basic functions of the supply chain with respect to cost and customer satisfaction.

3.10.1 Milk producers vs. milk production

Dairying is basically a women centric activity found in the villages or in the suburban areas. Basically people from the below poverty line chose animal husbandry and dairying as one of their professions. While the male-earners in these families take care of the cultivation and agricultural related activities; females rear cattle or buffaloes in the sheds to produce milk and to have extra income for the family.

The cost of milk production at the farmers’ houses is one of the major issues in the supply chain. Higher is the cost of production lower is the overall supply chain profit. If due weightage is not given to this and farmers’ are underpaid for their produce then discontentment among them might rise and lead to lower farmer involvement in the cooperative based supply chain.

Japan is expending the highest (Rs.43.65/lt) for the milk production followed by European Economic Community (EEC) and Canada. India is expending the least for milk production (Rs.9.24/lt) which is being proceeded by New Zealand (Rs.9.72/lt). The cost of milk
production in India is quite competitive in the world and so is New Zealand, though it produces one fifth of India’s milk production.

![Figure 3.3: Country-wise cost of milk production](image)

Source: Compiled from ICAR (2002) and Nataraj (2005)

While India is the greatest milk producer, New Zealand is the greatest exporter of the dairy products in the world. The cost of production over a period of years is increasing by at least 10 percent due to the inflation on fodder items which is responsible for almost 60 percent of the cost of milk production. Some of the major countries’ cost of milk production per litre is depicted in the table to compare by bringing a contrast to India’s cost of production. In all the cases due to the inflation on feed and fodder items, there is an increasing trend in the cost of production experienced by all the countries.

### 3.10.2 Factors of milk production

Venkatadri, Rani and Reddy (2008) have evaluated the cost of milk production at the farm gate in Chittoor district of Andhra Pradesh. The details of the various heads of expense have been mentioned in the table below. In the recent study the cost of milk production has also been calculated and compared with the study made by the researchers mentioned here. The table is depicted here to analyse the various cost factors of milk production and the same to be used for evaluating the cost of milk production for the ongoing study.
Table 3.6: Calculating cost of milk production

<table>
<thead>
<tr>
<th>Cost heads</th>
<th>Description</th>
<th>Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed costs</td>
<td>Cost of animals</td>
<td>25,000</td>
</tr>
<tr>
<td></td>
<td>2 cows @ Rs.12,500 per cow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transportation to home</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>@ Rs. 350 per cow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equipments</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>Total Rs. 600 for 2 cows</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost of shed</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>Total Rs.1,000 for 2 cows</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total fixed costs</td>
<td>27,300</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Variable costs</td>
<td>Grazing expenses</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>Rs.200 per annum per cow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry fodder expenses</td>
<td>6,000</td>
</tr>
<tr>
<td></td>
<td>Rs.3,000 per annum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depreciation</td>
<td>4,550</td>
</tr>
<tr>
<td></td>
<td>Fixed costs distributed over 6 yrs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Labour charges</td>
<td>20,075</td>
</tr>
<tr>
<td></td>
<td>@ Rs.55 for 8 hrs/day for 365 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insurance premium</td>
<td>643</td>
</tr>
<tr>
<td></td>
<td>@ 5% per cow’s cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health &amp; medicine exp.</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>@ Rs. 250.00 per cow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concentrates</td>
<td>11,680</td>
</tr>
<tr>
<td></td>
<td>@ Rs. 8/kg @ 2 kg/day/cow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interest/opportunity costs</td>
<td>2,184</td>
</tr>
<tr>
<td></td>
<td>@ 8% per annum on fixed assets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total variable costs</td>
<td>46,032</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Source: Compiled from NIRD report (2008)

Annual milk production from two cows = 2,400 litres

Cost of milk production/litre = 46,032.00/2,400 = Rs.19.18

Cost of milk production/litre (excluding interest and depreciation) = 32,298/2,400 = Rs.16.37

After coming across all the necessary factors like fixed and variable costs, the milk production cost per litre is found to be Rs.19.18 per litre. The cost of production will decrease by 15 percent to make it to Rs.16.37 per litre, if depreciations and interests are not considered. It may be noted here that if number of cows are increased at a constant milk production rate the cost will be more than expected. In the similar way if the average production per cow per day reduces, the cost of milk production will go up. The details will be further discussed in the analysis section of the milk production in the study. So it’s better to have less number of cows with high milk production rate. But in most of the cases it is seen that a typical milk producer owns 1-5 cattle in his/her shed (ICAR, 2002).
3.10.3 Dairy cooperative societies vs. collection of milk

Dairy cooperative societies play a vital role in employment generation to the rural people (Jithendra Kumar & Shankara Murthy, 1992). Irrespective of the seasons it provides a perennial source of income unlike any other agricultural professions. The dairy cooperative societies play a vital role in procuring milk from the milk producers and deliver that at the chilling centres for chilling as a treatment of post harvesting process. They collect milk from their members twice a day and send it to the specified BMC through their head loaders. The head loaders not only carry the collection to the BMC rather help the secretary of the DCS in other activities too. In absence of the secretaries, the presidents and the head loaders operate the society and collect milk from the milk producers. There are three basic functions rendered by the cooperative society namely managerial, operational and input services.

In the managerial purview the set up of a new society by the endeavour of the supervisor of the union and managing the same by involving milk producers as members. Each member is asked to pay a nominal fee of Rs.11 towards the membership charges of which Rs.10 is towards purchasing a share of the cooperative and the rest is towards the entrance fee. The cooperative societies are managed by forming a governing body of nine members through an electoral process. The secretary of the society is the in-charge of the overall functions and maintains the records, makes payment to the producers for their sales and distributes the incentives/bonus on behalf of the dairy federation/union. Among the operational activities are the receiving the milk from the producers twice a day, testing it for fat and SNF and dispatch the same to the bulk milk coolers through the head loaders. Apart from this at the society level local milk sale, organisation of the milk producers into these societies is also being taken care.

On behalf of the union/federation the secretary and head loaders of these societies undertake various other activities like sales of feeds, medicines and organising health camps for the cattle and artificial insemination programmes (AI) at their locality. This facilitates sound milk production culture among the producer members and motivates other milk producers from unorganised sector to join societies.

But most of the times it is seen that milk producers do not stick to the system even if they produce milk on continual basis. They resort to some other means for selling their produce.
in anticipation of higher price. This leads to serious procurement problems in system and
decreases ultimately the production level at the plant.

A statistics provided by the DairyCo (2009) says that more than 13 percent of the farmers
leave the industry within two years of their joining. Almost two third maintain the same
level of productions over a period of years and others increase their production. So the
attrition is quite common in the field of milk production and its sale to the societies. This
is a case in corporate farming so the case of Indian milk farming could be realised from
this. It may be mentioned here that all most all the developing countries follow same kind
of supply chain where the produce (milk) directly enters the plant by removing the
components (society and chilling centre) unlike Indian cooperative based dairy supply
chains.

3.10.4 Bulk milk coolers vs. chilling & transportation

The milk union, being one of the major constituent parts of the Anand pattern dairying,
plays a vital role in the procurement of milk from the producers through the cooperative
societies and chill it at the BMCs. There are several projects of the state/central
governments under which these BMCs are set up in the sub-urban/urban areas. Clean Milk
Production Programme, Intensive Dairy Development Programme (IDDP), Rashtriya
Krishi Vikash Yojana (RKVY) etc. are some of the major projects which facilitate the
process.

BMCs or the chilling centres chill milk collected from the DCSs at around 4°C
temperature and subsequently send it to the production plant for further processing. Once
in a day, the milk is collected by the tankers from the respective BMCs as per the route
assigned to them. The tankers are maintained at around 25°C -30°C temperature in order to
transport the content without damage till it reaches the production plant. Before chilling
the procured milk is tested for the fat and SNF level and recorded and sent to the plant for
payment. Sometimes the mismatch of the fat and SNF level at the BMC and production
plant brings up discontentment among the stakeholders and deviations in it lead to
problems. If the fat and SNF (total milk solids) is more than that is recorded in the list then
there is no complaints and payment is made accordingly otherwise deductions from the
payment is made. However, the milk is tested for fat and SNF through either Gerber
method (manually) or Milko tester where the latter is an easier process to conduct.
3.10.4A: Gerber method/Milko tester

Solution of 10 ml milk + 5 ml H₂SO₄ (Sulphuric acid) + 2.5 ml C₂H₅OH (Amyl alcohol) put in the butyrometer and rotated in the centrifugal machine (1, 200 rotations per minute) for three minutes (manually) in order to detect the fat level and once the fat is detected the SNF can be calculated using the following formula. Now-a-days it is determined with the help of milko-tester (A Danish invention with the help of NDDB). Calculation of solid-not-fat (SNF) and total milk solids (TMS) is done by using the formulae:

SNF = (CLR/4) + 0.21F + 0.36
TMS = Fat + SNF = (CLR/4) + 1.21F + 0.36

Where CLR = Corrected Lactometer Reading and F = Fat content of milk (percent)

In order to detect the price of milk per kg of milk excepting the end points of the supply chain the following methods are used. It may be noted here that the pricing policy for the milk is a policy decision and varies from state to state in the cooperative based dairying system. NDDB, federation authorities, policy makers and milk union authorities usually formulate the pricing strategies. So keeping view to the situations the price varies and is probably not uniform across the country. However the following rules prevail across the country in pricing and payment system upon delivery.

- Due to higher specific gravity 1.0 litre of milk weighs 1.03 kg (1.0 kg = 0.97 lt) and varies with the temperature from 1.02 to 1.04 (ICAR, 2002)
- At milk producer-society level and retailer-customer level unit of measurement is “litre (lt)” whereas at all other levels it is kilogram (kg)
- Price/kg = Quantity*(Fat percent*Fat price/kg + SNF percent*SNF price/kg)
- Milk producers won’t purchase and federation won’t sell raw milk

3.10.5 Production plant and processing

The milk is delivered by the bulk milk coolers at the production plant for further processing. The processing plants preserve the milk in the silos (with storing capacity of minimum 25,000 litre) and test it for adulterants. The tests are basically carried out to detect extraneous particles in milk like water, starch, gelatine, sugar, sodium chloride, urea, formalin etc. Once the milk is tested and given clearance for processing, it is
rendered through several steps to produce packaged milk and other derivates. The main steps in producing pasteurised packaged milk are:

- **Clarification:** extracting foreign particles from milk
- **Separation:** separating fat and skim milk
- **Standardisation:** increasing/decreasing of fat and SNF as per requirements
- **Bactofugation:** separating micro-organisms from milk through “Bactofuge” machines
- **Homogenisation:** unvarying the fat globule size to “one micron or less” for more taste and uniformity in the content
- **Thermal processing:** pasteurisation (63°C for 30 minutes and 72°C for 15-20 seconds)
- **Chilling:** cooling by chilled water/glycol solution to maintain temperature at 4°C
- **Packaging:** packing milk through poly pack machines

These days, to enhance the longevity of milk Ultra High Temperature (UHT) treatment is also being performed (the heating is done at 135-150°C for 1-6 seconds and packed in multi-layer packets after chilling). The UHT treated milk can be store for a period of 2-6 months by maintaining room temperature. This helps in perishability both at the producer (plant) and consumer level while maintaining the same food values during production. Several other processes followed for the converting milk into products but production and consumption in liquid form is almost half of the total production/consumption of the dairy products (ICAR, 2002).

### 3.11 Transporters as Third Party Logistics Providers

While some of the dairy federations have their own transport facility in some cases they do not have and resort to the third parties through bidding process of selection. The process starts with the open applications through sealed tenders and selection is made upon the lowest bids. However once a partly is selected for the process he or she is entitled to serve the federation/plant for a stipulated time with due notice period. The party is also supposed to keep security deposit with the plant/federation as per the rules and regulations. The transporters also help the plant in disbursing some other activities apart from usual distribution. However their basic objective is to serve the retailers on time with fresh and damage-free products.
3.12 Retail Outlets and Sales of Products

Retailers play a vital role in distributing the products like milk and its derivatives to the end users. Since the products are highly perishable in nature, the smart distribution and consumption of the same is essential to get rid of damage and storing costs. In some cases the federations are opening of their parlours to facilitate sales of various dairy products still the selection of the agents (retailers) in various localities matters a lot for greater coverage of markets and increase in market share. In most of the urban areas they have been delivered products twice a day viz. early morning and afternoon while in some other areas once in a day the products are delivered.

There is a further scope for the production plant to select agents in the sub-urban/rural areas to open sales counters. The agents are basically endorsed for one year and renewed in the successive years upon meeting a certain level of performance. Since they are the representatives of the plant and work as an interface between the distribution and customers, it is instructed that they should sell fresh dairy products by asking a requisite price. Customer complaints against them is viewed seriously which might lead to “penalty or cancellation of authorisation.”

3.13 Customers and Customer Satisfaction

Customers are the epicentre of the whole process. The survival and improvement of the supply chain greatly depend upon the customer satisfaction on the products or service of the federation above all. In order to see that customers are happy on the system a regular market research is needed to be carried out to upgrade the system. In the context of this customer satisfaction issues have been discussed here.

“A dissatisfied customer will tell seven to twenty people about his negative experience. A satisfied customer will only tell three to five people about his positive experience.”

Kan (1995)

According to the Engel et al. (1995) as cited in Mont and Plepys (2003) the customer decision-making process comprises a need-satisfying behaviour and a wide range of motivating and influencing factors. Consumer decision making process has the following steps:

- **Need recognition:** This is a process where the consumer realises the difference between desired situation and the current situation which in turn serves as a trigger for
the entire consumption process. Variables like changed circumstances, time, money, new product purchase and consumption influence the process at varying degrees.

- **Search for information:** The consumer searches for the relevant data or information both internally and externally. The internal resources could be his/her memory and past experiences with the product or service. The external searches could be through the advertising, brands, in-store information, information received from sales people, or social contacts etc. The extent of the information search depends on the degree of importance of the purchasing decision to the customer.

- **Pre-purchase alternative evaluation:** This is an assessment of available choices that can fulfill the need of the consumers. In this case the number of alternatives are evaluated and one (several) is (are) chosen as per the requirement of the consumers. Product or service attributes or particular dimensions of their delivery etc. are some of the criteria used for the evaluation process.

- **Purchase:** This is the acquirement of the chosen product or service. In certain cases at this stage the customers might change because of the various circumstances like new information available to them or the non-availability of the desired alternatives. So at this stage the final decision could be fully planned, partially planned or totally unplanned.

- **Consumption:** The utilisation of the procured product or enjoying a particular service. Once the product is purchased it can be consumed over a period of time or can be consumed at a time.

- **Post-purchase alternative evaluation:** In this case the consumer assesses the degree of satisfaction. Satisfaction is the result of a post-consumption evaluation if a chosen alternative met or exceeded expectations of the customer. According to expectation-disconfirmation model, consumers have three levels of expectations about the product or service performance. They are namely equitable performance (what the customer has to receive in return for money and effort spent), expected performance and ideal performance (Oliver 1980).

- **Divestment:** This is the disposal of the unconsumed product or its remnants. Recently the environmental impact of the disposals and wastes of the products are gaining
momentum among the customers. So re-use, re-marketing and reverse logistics etc. are becoming part of the consumer buying behaviour.

![Figure 3.4: Kano’s model of customer satisfaction](Source: Kano et al. (1996))

According to the model suggested by Kano et al. (1996) there are three types of product attributes which are needed for bringing customer satisfaction at varying degrees. They are namely:

- Basic or expected attributes
- Performance or spoken attributes
- Surprise and delight attributes

From the above figure it is clear that, higher is the degree of achievement of the requirements higher is the customer satisfaction. In order to have a higher level of customer satisfaction, a company should identify the requirements of the customers and their lookouts in a particular product or service. These lookouts (attributes) of a product can be further imposed into the product at the designing stage through a quality function deployment (QFD) process. The basic objective of this process is to ensure product development process either meets or exceeds customer need and demands. Not only this, QFD process minimises errors and maximises product quality.
Customers are becoming overwhelmingly quality conscious these days due to increase in the disposable income. Though price matters while purchasing still comparing to the quality of the product it is seemed to be an inferior concern. According to Juran (1988) quality is defined as fitness for use – may be a product or service. This could be a relative concept for individuals or organisations as a whole but it is gaining momentum these days to fight with the competition and maximising customer satisfaction.

The unprecedented competition has forced the companies to improve their quality of products and services in order to have survival in the market. A decade ago the scenario was completely different due to less competition. Just after the globalisation the conditions have been drastically changed with too many competitors’ existence in the market place. Had it been goods or services, the quality is now-a-days has been a key attribute for satisfying the customers’ requirements. The customers do not just buy the products or services rather the bundle of satisfaction within which they want many attributes of varying degrees. These attributes depend upon the products to products and services to services.

In almost all cases the attributes like tangibles, reliability, responsiveness, assurance and empathy play important role in customers’ satisfaction level. These are called as the five basic dimensions moulding the customers’ expectations and perceptions. If any one of the dimensions lacks he/she gets dissatisfied up to a certain degree. Continuation of the same leads to the distraction towards products or services over a period of time.

Parasuraman, Zeithaml, and Berry (1985) have mentioned about these attributes which are responsible for lessening the gaps in the service quality (SERVQUAL). In this model the expected service describes customers’ expectations about what the service firm should provide and perceived service reveals their feelings of the service they actually receive from the firm. If there is a mismatch in the expectations and perceptions then gaps are found which lead to customer dissatisfaction.

The study by LeBoeuf (1987) explains the reasons why a customer quits certain company:

- Only 3.0 percent quit without any reason
- 5.0 percent develop other company relationship
- 9.0 percent leave for competitive reasons
- 14.0 percent dissatisfied with the products/services (tangibles)
- 69.0 percent quit because of indifferent attitude of the company towards customers

In order to measure the customer satisfaction in the dairy marketing there are three major indicators namely product attributes, retailer behaviour and company attitude towards the customers are discussed elaborately in the analysis section.

3.14 Dairy Food Supply Chain Models

In most of the dairy food supply chain across the world, it is seen that either milk collection centres or milk producers themselves deliver milk at the production plant. This is usually practiced in case of developed countries like USA and Europe. But in developing or under-developed countries like India, China, Ethiopia, Nepal etc. the traditional dairy food supply chain comes into picture. Some of the typical dairy food supply chains have been discussed hereunder to bring a contrast among them.

![Dairy Food Supply Chain Model](source)

Figure 3.5: Moldova (Russia) dairy food supply chain (Source: Gorton et al. (2006))

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Figure 3.6: Australian dairy food supply chain (Source: Issar (2004))
Figure 3.7: Ethiopian dairy food supply chain (Source: Yigrem et al. (2008))
The longer is the supply chain the higher is the cost, lower is the profit and difficult to coordinate. That’s the reason why the developed countries follow comparatively shorter supply chain in dairy industry. Moreover keeping in view the dairy farming at the milk producer level, it is seen that at least 50 high yielding cows are reared. In contrast a farmer in India upkeeps only 1-5 cattle (ICAR, 2002) and produces around 700 kgs (ICAR, 2009) of milk per cow per year. Eventually, the method of collection and processing is entirely different and hence so many phases of supply chain come into existence. Still then there is a scope further to look into the system and upgrade in order to enhance the profit level of the supply chain. Contract farming is one such kind which might help the process since procurement is found to be a serious concern for developing/underdeveloped countries’ dairy food supply chains.

Hobbs and Young (2001) highlights some of the major issues of the contract farming issues. It has been seen that the procurement is the most difficult part of the system where the contract farming model could work definitely better while improving the various other parts of it. Furthermore it is another suitable model to improve the sector where the inputs to the dairy farmers are provided to produce and deliver desired quality/quantity milk to the contracting dairy plants. This is where the unions of the federations take the pivotal
role to make it convenient to provide all necessary inputs to the dairy producers (especially loans and financial help with tie-ups from banks) under the contract farming agreement. On the contrary the dairy producers or the stakeholders under the shed should not expect too much out of the contract and help the processors to make profits out of it so that a win-win situation can be built up.

3.15 Conclusion

The typical dairy food supply chains of underdeveloped or developing countries like India are sometimes not meeting the expectations of its stakeholders. Keeping view to the longer supply chains it is inferred that, the cost is comparatively higher leading them to operate at a sub-optimal level. If one or two components can be removed from the system it will definitely lead to more profits. Moreover without doing the same if contract farming will be adopted in mass scale then the situation can be improved. Contract farming can be practiced together with the aforesaid models so that procurement level will go up and production/processing could be performed at a higher level.

3.16 References


