CHAPTER II
REVIEW OF LITERATURE

Starting from the ancient stone era human has had tried to make his living easy and subtle by removing uncertainties and minimising risks. Today’s business is also no deviation. Keeping view to the enormous competition in the market place and the excessive political & bureaucratic interventions the organisations are striving hard to overcome uncertainties and risks which are leading to shorter product life cycles and a great deal of customer distraction towards the product or service. That’s the reason why the organisations are formulating and implementing various strategies (Mintzberg, 1980) to overcome these barriers. In this regard, the supply chain and logistics have emerged as most sought after strategies in the organisations. To support the argument - views of some of the theoreticians and the practitioners have been hereunder mentioned under different heads pertaining to supply chain management and its usefulness to dairy industry.

2.1 Introduction to Supply Chain Management

A supply chain consists of all parties involved directly or indirectly in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers but also transporters, warehouses, retailers and customer themselves (Chopra & Meindl, 2003). In contrast to this supply chain management (SCM) is a set of approaches utilised to efficiently integrate suppliers, manufacturers, warehouses and stores so that the merchandise is produced and distributed at the right quantities, to the right locations and at the right time. The basic objective of the SCM is to minimise system wide costs while satisfying service level requirements. While designing the strategies it is essential to involve all the stakeholders in the system to reach at an optimal one and if designed autocratically then the cost could be higher by incurring losses (D. Simchi-Levi, Kaminsky, E. Simchi-Levi., & Shankar, 2008).

Most of the supply chains are found incapable to minimise the overall cost due to various reasons. Lee (2006) expresses concern over the deterioration of supply chain over time even if it is highly focused on cost minimisation and responsiveness. After fifteen years of studying more than sixty companies he has reached at the conclusion that supply chain should be agile, adaptable and aligned in order to survive for a longer period of time. To
add value to the argument of agility instead of cost cutting, a famous quotation by “Warren Buffet” is presented below. It says,

“…..Whenever I read about some company undertaking a cost-cutting program, I know it’s not a company that really knows what costs are about. The really good manager does not wake up in the morning and say 'This is the day I'm going to cut costs', any more than he wakes up and decides to practice breathing.”

According to this, instead of giving too much emphasis on cost cutting it is rather required to improve the overall value of the supply chain. Another important objective of the supply chain is to maximise the customer satisfaction. Kotler (2008) defines customer satisfaction as the consumer's feelings of pleasure or disappointment resulting from a comparison between the perceived performance of the goods or services and the prior expectations. Happy customers are those who get what they expect – or more. According to him the customer satisfaction can be defined by the formula:

Perception – Expectation = Satisfaction

If perception is greater than the expectations then the customer satisfaction is positive and hence the product or the service performs better than what it is expected. In the similar way, if the result is negative then the customer satisfaction is found to be negative which requires further attention of the company to improve the former. Customer satisfaction greatly influences by the quality of the product or service and price-quality match (Juran, 1988; Teng & Jaramillo, 2005; Ramaiah, 2008). Higher is the customer satisfaction higher is the performance of the supply chain and hence should be viewed seriously in order to improve the performance level of it (Kano, Seraku, Takahashi, & Tsuji, 1996).

2.1.1 Flows and drivers of a supply chain

The various flows and drivers of a supply chain are depicted in the figure 2.1. In context to this some of the views of researchers are cited.

According to Ayer (2001) there are four flows of a supply chain namely physical-, information-, financial- and knowledge flows. The physical flow of the supply chain depends upon three basic drivers namely facilities, inventory and transportation. Facilities are the places where the items are manufactured and stored - basically the production and storage sites; inventory constitutes all raw materials procured from the suppliers or by own, semi-finished and finished items. It exists in the supply chain because of the demand
fluctuation situations. And the inbound and outbound logistics entangles the flow of materials to the plants and flow of items to the end users through the proper mode of transportation (Cox, Ireland, Lonsdale, Sanderson & Watson, 2001). Finance flows encompasses the series of financial relationships that start with the customer buying the product or service at a given price and ultimately the revenue generated out of it is allocated to the various stakeholders of the supply chain (Cox, 1997). Today’s markets are changing at an alarming speed.

In order to keep track of the market places better, rapid gathering and disseminating of information is inevitable. In this context the information flow in the supply chain includes the market signalling amongst the supply chain members regarding the end user preferences (Westgren 1998). On the other hand the knowledge flow is the intellectual input into in the supply chain which leads to the added value in the product or service (Ayers, 2001). Product, process and service innovations are the result of the knowledge flow. Supply chain material, finance and information flows are inter-related and hence one has an impact on the others.

![Figure 2.1: Drivers of supply chain](image)

Kaipia (2007) tries to address two issues namely; choosing of coordination mechanism to match demand & supply and balancing between material flow and information flow by the use of chosen mechanism. As long as the coordination mechanism is concerned it is required to have accuracy in information sharing and flexibility in operational planning to keep the gap between supply and demand as minimum. Frequent planning updates and varying planning processes, lack of planning capability, inadequate information or inability to use shared information are the major reasons for the imbalance between the
material and information flows. Hence together with the four flows, it is highly essential to have proper coordination and incentive sharing mechanism in the supply chain design and operations (Westgren, 1998; Boehlje, 1999).

Distorted or inaccurate information brings a great deal of problem leading to supply chain inefficiency. There are four major causes of this effect (called bullwhip effect) namely:

- Lack in demand forecast updating
- Order batching (periodic or push ordering where periodic ordering varies from time to time)
- Price fluctuations
- Rationing (demand exceeds supply) and shortage gaming (ordering with multiple suppliers and receiving the order which is delivered first)

In order to curb the bullwhip effect in the supply chain, it’s highly essential to understand the root cause of the problem and strategies should be formulated accordingly to tackle it. Nevertheless proper information sharing mechanism (Lajara & Lillo, 2004), channel alignment and improved operational efficiency of the organisation can tackle the bullwhip effect (Lee, Padmanabhan, & Whang, 1997).

2.1.2 Theories supporting supply chain management

Traditionally the business organisations were inventory-driven focusing on to supply the product continuously to the market place without much customer orientation. But after the competition gets stiffened the idea was no more enduring giving rise to the concept of supply chain management. The supply chain management was first developed by Oliver (1980) to address the issues of procurement, production and distribution.

There are two different schools of thought on supply chain management concept viz. (i) the integration school of thought and (ii) the network school of thought. Jones and Riley (1987) as well as Ellram and Cooper (1990) have cited about the integration of thought mentioning about the interlinking of the organisations and their functions to increase the level of value to the customers. On the contrary the network school of thought have cited about the relationships and alliances. Supply chain management is relatively a new concept in the field of management. The concept over a period of time developed from
other disciplines of economics, marketing, and organisational strategy etc. Some key management theories based on these disciplines are discussed hereunder.

Table 2.1: Theories supporting supply chain management

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Focus</th>
<th>Field</th>
<th>Summary of relevant content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Von Bertalanffy</td>
<td>1950</td>
<td>General Systems Theory</td>
<td>Physical Sciences</td>
<td>According to this theory all businesses are systems comprising of several processes. If one component of the system is disturbed then the whole system might collapse. The theory is one of the key theories which describe the supply chain management.</td>
</tr>
<tr>
<td>Penrose</td>
<td>1959</td>
<td>Resource Based Theory (RBT)</td>
<td>Strategic Management</td>
<td>The theory views firms as a bundle of resources. The theory highlights effective management of firm’s resources, productive opportunities and diversification strategy for competitive advantage.</td>
</tr>
<tr>
<td>Williamson</td>
<td>1975</td>
<td>Transaction Cost Economics (TCE)</td>
<td>Economics</td>
<td>The concept of TCE is based on the company’s ‘make or buy’ decisions. The theory says about the total cost incurred by a firm for various heads can be grouped into mainly transaction cost (buy) and production cost (make). These two decisions are crucial for the firm’s ultimate profit and revenue.</td>
</tr>
<tr>
<td>Jensen and Meckling</td>
<td>1976</td>
<td>Agency Theory</td>
<td>Economics</td>
<td>The theory speaks of the contractual agreements and relationships that exist between the service providers (agents) and the companies (principals) to prevent risk.</td>
</tr>
<tr>
<td>Pfeffer and Salancik</td>
<td>1978</td>
<td>Resource Dependence Theory (RDT)</td>
<td>Organisational Studies</td>
<td>The procurement of external resources is vitally important for any company. The External Control of Organisations: A Resource Dependence Perspective by the authors highlights the issues of production strategies and the external organisational links.</td>
</tr>
<tr>
<td>Porter</td>
<td>1980</td>
<td>The Value Chain Concept</td>
<td>Industrial Economics</td>
<td>The value of the firm’s output for which a customer is willing to pay against a certain amount that is price. The major task here is to add value to each segment of the organisational processes.</td>
</tr>
<tr>
<td>LaLonde</td>
<td>1984</td>
<td>Inventory Vs Information-Sharing Trade-off</td>
<td>Industrial Economics</td>
<td>This cites the importance of the information systems. Instead of maintaining a huge inventory it suggests to optimise the inventory level by using the information systems which in turn can deal with the uncertainties and the demand fluctuations.</td>
</tr>
</tbody>
</table>

Sources: Jensen and Meckling (1976); LaLonde (1984); Penrose (1959); Pfeffer and Salancik (1978); Porter (1980), Von Bertalanffy (1950); Williamson (1975)

2.2 Supply Chain versus Logistics

Traditionalist view says supply chain is a part of logistics whereas Unionist view opposes it saying that logistics is a part of the supply chain. Inter-sectionist view says that some concepts of supply chain and logistics are same whereas there are lot of functions of

Supply chain management is a strategic issue where as logistics is more operations oriented. Supply chain management focuses on facilities, inventory and transportation with the help of funds, information and knowledge. But the scope of logistics is limited to the transportation and storage of goods in the firm. Wherever supply chain management is a white collar job, the logistics is perceived to be a blue collar job. But keeping view to the logistics functions, it is one of the core functions of the supply chain. The whole system fails if the logistics in the supply chain fails. Since logistics is a part of the whole supply chain it can be treated to be subset of the supply chain (Council of logistics management, 1998).

However, Council of Logistics Management (1998) defines that, “logistics is the part of supply chain processes that plans, implements and controls the efficient flow and storage of goods, services and related information from the point of origin to the point of consumption in order to meet the customers’ requirements”. Logistics has an impact on supply chain management and hence is an integrated part of it (Monczka et al., 2002). Supply chain entangles logistics along with the market research, sales & promotions, information gathering, R&D, product design, new product development etc. (Bechtel & Jayaram, 1997; Bowersox, 1997; Ellram & Cooper, 1990).

**2.3 Purchasing in Supply Chain**

Purchasing plays a vital role in the sustenance of any supply chain (Tiersten, 1989; Monczka et al., 2002). Cost reduction or improvement, improved material delivery, shorter cycle time, development cycle times, access to product/process technology and quality improvement etc. could be practiced with an efficient purchasing operation in the organisation. Presutti (2003), Lo and Yueng (2004) reveal that 50-70 percent of the sales revenue or manufacturing cost is spent on sourcing of raw materials, components and finished goods/services. Hence in order to make the process successful it is highly essential to look after the following steps:

- Due attention in selecting suppliers
Proper evaluation mechanism for performance
- Raising performance levels by hiking the expectation level
- Performance based incentives
- Field visits to the suppliers’ firms
- Training and education in regular intervals
- Identifying suppliers’ problems and solving them
- Financial assistance to the suppliers

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. Earlier purchasing has been treated to be an operational and tactic level function but today it is viewed as a strategic issue.

It is experienced that strategic management of purchasing may reduce total expenditure by 5-15 percent over a period of three years (Biemans & Brand, 1995). The advantages of strategic sourcing have been manifold and impact the supply chain performance positively. Strategic supplier partnership, sourcing flexibility, supplier evaluation and trust among the supply chain partners are the key dimensions of the strategic sourcing (V. H. Pooler, & D. J. Pooler, 2004). Variables like enterprise resource planning, process and design, sourcing policies, competency development and strategic sourcing of the organisations can also be taken into consideration to increase the scope of strategic sourcing (Khan & Pilania, 2008).

Cost cutting, quality improvements, standardisation and supplier base reduction etc. are some of the most important characteristics in strategic sourcing these days. Cost pressure, supplier base reduction and maintaining good relationships with the suppliers are the strategies found to be followed in switching from multiple sourcing to the single sourcing. In contrast, uncertainty of future supply, need for quality improvement and better purchasing price are the causes found in switching from single to multiple sourcing (Faes & Matthyssens, 2009). There is no rule of thumb in this field as it varies from product to product and from organisation to organisation as per the requirements. So it is essentially required to have proper knowledge & skills (especially leadership) of the sourcing person which positively influence the strategic sourcing (Carr & Smeltzer, 1999; Loarne, 2005).
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; Pooler et al., 2004; Gunasekaran, Patel, & McGaughey, 2004). It has been seen that there is a positive relationship between supplier development and supply chain performance (Sanchez-Rodriguez, 2005).

2.4 Dairy Farming

Dairy farming is a perennial source of income for the people who are especially below the poverty line and practice it as a subsidiary profession along with agriculture and cultivation in rural areas. Unlike any other crops it is source of income throughout the year and hence seen to be surpassing traditional wheat and rice cultivation (Ghanekar, 2008). It is also seen that one fourth of the annual income of the families in the rural areas comes from dairying only (Misra & Pal, 2003). Keeping view to the grass root development it can be said that dairying can be a major contributor to the sustainable development of a country.

The contribution of livestock to Gross Domestic product (GDP) has increased from 4.8 percent in 1980-81 to about 5.6 percent in 1999-2000 – depicting an upward trend in Asia. Because of lack of subsidies to the sector as a whole, the industry is not showing a substantial improvement like developed countries and hence it is unable to compete with the global dairy industry in terms of quality and productivity. The success of cottage dairy industry mainly depends upon the enhancement of milk production through improved feeding, breeding and healthcare services.

The improvement of health services to the animals and to insuring them against diseases should be taken as priority in order to see the sector progressing. In this connection the government should come forward to provide subsidies like European and American countries to take the industry ahead. The agricultural policies should be formulated accordingly and hence subsidies/incentive sharing mechanism should be brought under practice to compensate the loss incurred by the milk producers or the industry as a whole. The idea behind this is to minimise the demand-supply gaps and price-quality mismatch by encouraging quality milk production (Khanna, 2005; Ramaiah, 2008).

A comparative study from Painter (2007) has revealed that even though Canada and New Zealand are doing well in the dairy farming sector still there are some basic differences
between them. Whereas New Zealand dairy farmers are operating in a free and competitive market with no government subsidies, the Canadian dairy sector is restricted and little subsidised. Because of New Zealand’s free and competitive environment in the sector, it has captured 40 percent of the dairy export market in the world.

The company Fonterra of New Zealand is the top dairy processor in the world with milk intake of 18.6 million tonnes per annum (IFCN, 2008). As a result of free and economic environment in the segment New Zealand’s dairy farmers have good income comparing with the average net worth of all families in New Zealand. Dairy farmers in Canada have also done very well financially in their businesses being protected from outside competition.

However Canadian dairy farmers have a supply management system that protects them from outside competition and provides cost-plus pricing. They are not cost leaders and have not invested in processing and marketing. As a result there are significant differences between the New Zealand and Canadian dairy sectors in term of average farm size, cost, production efficiencies and prices paid to dairy farmers for their produce.

The growing importance of marginal and small farmers to the economy is manifold. On the other hand these kind of people depend upon agriculture and dairying basically to make their living. As dairying is saviour of these farmers - constraints inhibiting their growth should be removed through policy interventions. There is a need to revamp the fodder production, breeding programme and credit policy so that the marginal and small category farmers could be benefited out of these (P. Kaur, A. S. Bhullar, M. Singh, & I. Kaur, 2008).

Today the scarcity of feed and fodder is found to be a major barrier in the dairy farming. The shrinking of land and green pastures are some of the serious problems which are in turn responsible for the green and dry fodder shortages. UNFAO (2008) cites that the rising international cereal prices are aggravating the food inflation in many parts of the world. The report reveals that the cultivation of commercial crops at the cost of food grains, rising transportation costs and longer trade routes are some of the major causes in the increase of the cereal prices. This is also the reason for the high feed and fodder prices across the world resulting in increased cost of animal production and livestock prices. For an instance the Indian scenario of fodder shortages is being depicted in the table 2.2.
Table 2.2: Green and dry fodder shortages in India (million tonnes)

<table>
<thead>
<tr>
<th>Year</th>
<th>Demand Green</th>
<th>Demand Dry</th>
<th>Supply Green</th>
<th>Supply Dry</th>
<th>Deficit as percentage of demand Green</th>
<th>Deficit as percentage of demand Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>947</td>
<td>526</td>
<td>379.3</td>
<td>421</td>
<td>59.95 (568)</td>
<td>19.95 (105)</td>
</tr>
<tr>
<td>2000</td>
<td>988</td>
<td>549</td>
<td>384.5</td>
<td>428</td>
<td>61.10 (604)</td>
<td>21.93 (121)</td>
</tr>
<tr>
<td>2005</td>
<td>1,025</td>
<td>569</td>
<td>389.9</td>
<td>443</td>
<td>61.96 (635)</td>
<td>22.08 (126)</td>
</tr>
<tr>
<td>2010</td>
<td>1,061</td>
<td>589</td>
<td>395.2</td>
<td>451</td>
<td>62.76 (666)</td>
<td>23.46 (138)</td>
</tr>
<tr>
<td>2015</td>
<td>1,097</td>
<td>609</td>
<td>400.6</td>
<td>466</td>
<td>63.50 (696)</td>
<td>23.56 (143)</td>
</tr>
<tr>
<td>2020</td>
<td>1,134</td>
<td>630</td>
<td>405.9</td>
<td>473</td>
<td>64.21 (728)</td>
<td>24.81 (157)</td>
</tr>
<tr>
<td>2025</td>
<td>1,170</td>
<td>650</td>
<td>411.3</td>
<td>488</td>
<td>64.87 (759)</td>
<td>24.92 (162)</td>
</tr>
</tbody>
</table>

Source: Planning Commission, GOI (2001)

As per the figures depicted in the table 2.2, there is a serious shortage observed in case of green fodders amounting to more than 60 percent whilst the dry fodder production can’t cater to the need of around 20 percent demand. It is clear that dry fodder problems can be sorted out but there is a great question mark on the green fodder since the shrinking of land due to sky-scraping infrastructure and commercial crop cultivation instead of the regular crops like paddy, wheat, sugarcane etc. The planning commission has predicted that the shortage will amount to 65 percent by 2020 and will seriously affect the dairy farming in India.

Shortage of feed and fodder has become one of the major threats in dairy farming. As per the statements of some of the dairy farmers from the district of Chittoor (usually said to be milk-bowl of Andhra Pradesh with one million cattle producing 1.5 million litres of milk per day approximately), the profession is profitable if the cow produces 8 to 10 litre of milk per day. The Chittoor district which comes next to Anand (Gujarat) in dairy farming is also one of the major milk suppliers to the entire south in India. The cost of feed and fodder is increasing by leaps and bounds becoming an unaffordable factor for the rural milk producers. These together with the shortage of fodder supply from the government are becoming fiercer day by day making the profession extremely difficult to practice. Due to the increasing burden of this dairy farmers from the districts are selling off their cattle to the slaughter houses (Times of India, The 22<sup>nd</sup> April 2010) and getting rid of the business at the end.
2.4.1 Cooperative based dairying

Cooperative based dairying play a major role in the dairy sector of a country. The sector aims at strengthening the milk producers in the rural areas by marketing their produce in a fair price. Regarding the industry views of some of the practitioners and great quotation are mentioned below.

“In cooperatives men and women have in their hands the tools to fashion their own destiny.” Murray D Lincoln

A cooperative is an association of persons usually of limited means, who have voluntarily joined together to achieve a common end through the formation of a democratically controlled business organisation, making equitable contribution to the capital required and accepting a fair share of risks and benefits of the undertaking (International Labour Organisation as said in Ramkishen, 2003, p.5) where:

- The ownership and control of the enterprise must be in the hands of those who utilise its services
- Business operations are conducted on a cost basis (profit goes to members)
- The return on investors’ capital shall be limited.

There are varieties of cooperatives organised as per the requirement of its members. They are namely marketing, purchasing, service and processing cooperatives. The processing cooperatives are the modern kind where the raw material like milk is processed and sent to the market for selling directly. The rationale behind the cooperative based marketing is to eradicate the middlemen and securing the larger share of price paid by the end user for the final products (FAO, 1955). They are also termed as new generation cooperatives (NGC). This move further empowers the farmers to specialise in the downstream marketing channel and adds value to their products. Today most of the cooperatives are becoming sick due to lack of sufficient capital, inadequate membership support and ineffective management (Kohl & UHL, 2002). The cooperatives are based on seven major principles as stated hereunder:

- Voluntary and open memberships
- Democratic member control
- Member economic participation
• Autonomy and independence
• Education, training and information
• Cooperation among cooperatives
• Concern for community

Dairy cooperatives which have started their beginning way back in 18th century in USA play a major role in procurement, processing and marketing of milk and represent farmers at both state and national level. In contrast to the 15 percent of organised milk market in India, 226 dairy cooperatives with 298 production plants in USA, market almost 83 percent of the total milk production out of which 61 percent is sold as raw whole milk (Richardson, Adams, DeVille, Penn, & Kraenzle, 1998). In USA, 80 percent of the dairy farmers belong to the dairy marketing cooperatives and 98 percent of the milk produced enters the commercial marketing channels as whole milk.

In contrast to USA milk market Karmakar and Banerjee (2006) have revealed that the cooperative milk processors have 60 percent market share in India wherein 90 percent of the milk collected is processed for liquid milk packaging unlike the private dairies. The private dairies focus more on the value based products and sell only 20-40 percent of the procured milk in liquid form after processing and the rest is processed to make various dairy products (Kohl et al., 2002; Karmakar & Banerjee, 2006).

There are so many advantages of the participation in the cooperative societies. Jithendra Kumar and Shankara Murthy (1992) have found that income earned is more by members of the cooperative societies compared to the non-members and the number of employment days created is also substantially more for the members than the non-members. Hence they have concluded that the dairy cooperative societies contribute significantly in generating more income and employment to the dairy farmers.

Self Help Groups (SHGs) work at par with the dairy cooperative societies and hence can be inter-linked to improve the condition of each other. Das and Malik (2005) have highlighted the formation of SHGs and their role in the dairy farming. As per their study in the district of Karnal, 63 percent of SHGs have opted for the dairy indicating favourable attitude towards the enterprise. This is due to the reason that dairy husbandry is a traditional occupation for the marginal and landless farmers and hence can be practiced in a big way at their level.
Thirunavukkarasu and Sudeepkumar (2006) have conducted a survey on milk producers who are tested with 12 major socio-economic and socio-psychological variables under Salem - Namakkal district cooperative milk union of Tamil Nadu. According to them the milk producers in the cooperatives and integrated contract system have higher education level, better land holdings, higher investment, larger herd size, better dairy income, credit behaviour, extension agency contact, mass media exposure and economic motivation. But in case of dairy farming experience they have found that the milk producers from cooperative sector are lagging behind comparing to the vendor and integrated systems milk producers. The level of aspiration for making dairying as a livelihood and occupation is quite similar in all cases. Interestingly almost 95 percent of the milk producers from each category reveal dairying as their subsidiary occupation. Since the study highlights the organised sectoral benefits the authors have cited that efforts should be made to attract more and more milk producers from unorganised sector.

Rajgopal (1996) has cited that the procurement pricing in case of the private dairies is 18.37 percent more than the cooperatives based dairies. On the contrary, the cooperatives offer better services to the milk producers. His survey has also shown that retailers prefer more to sell the products of the private dairies rather than the cooperatives based dairies for many reasons. The reasons are basically for guaranteed supply of milk, higher margin and credit facility to name a few. He also has highlighted some of the core problem areas of the cooperative based dairies like:

- Inadequate milk supply
- Low commission
- Regulated pricing
- Long product line
- Weak promotion
- No credit facility etc.

To add to the above arguments Rao and Sharma (2003) have stated various problems faced by the milk producers, cooperative societies and consumers. Their empirical study by them reveals that about 30 percent milk producers do not get their payment on time which brings resentment among the milk producers who solely depend upon the
cooperative societies for selling off their produce. About 70 percent of the milk producers have expressed their unhappiness on the incorrect measurement of milk by the secretaries of the respective cooperatives and 45 percent of them demand that the pricing should be based only on the fat content of the milk rather than both fat and Solid-Not-Fat (SNF) content.

On the contrary, about 60 percent of the secretaries have shown their discontentment on the measurement of milk at the plant level. On the distribution side - processing plants are facing difficulty from the frequent power cuts, improper transportation mode and outdated machineries. Further more than half of the consumers are dissatisfied on the quality of the milk with respect to its price. These are not usually found in case of the private dairies which have got an edge over the cooperative based dairies. There should be a definite policy for procurement of milk in both flush and lean seasons to sustain dairy cooperative societies and its members. Local sale of the milk at the cooperative level should be encouraged to enhance the brand image of the federation especially in the rural areas (Sharma, Saxena, Mahato, & Das, 2007).

Karki (2005) in his study has revealed about some of the major impediments in the cooperative based dairy industry and differentiated the strategic planning of the corresponding industry in developed and developing countries. According to him the developed countries consider the dairy cooperatives as the source of sustainable business and the developing countries like India perceive it as a source of income. Keeping view to the income of the cooperative societies the government of India is might impose income tax on them which might deteriorate their financial status (Ghanekar, 2008).

The cooperative societies should not be treated as other profit making organisations because they distribute surplus earning to their members. Moreover Ghanekar (2008) has cited that the objective of the income tax is to ensure equitable distribution of wealth and facilitating the government to undertake various public welfare programmes. In the similar way, the sole priority of the cooperatives is to upgrade the status of their members (farmers) without any profit making attitude. He also insists for the removal of government control over the cooperatives making them more autonomous in fixing the price and deciding over other major issues.

Dixit (2008) has revealed that Indian dairy industry is enriched not because of the cooperative and government dairies only rather it is the private dairies who contribute to
almost 59.43 percent of the total milk processing in the country hence the governments both at the state and central level should take care of the private dairies which will further blossom the industry in many ways, he has urged.

Khanna (2003) has highlighted about the use of EIAS (Enterprise-wide Integrated Application System) in the cooperative dairy sector which is based on the ERP software solutions. According to him the software can integrate all the functions ranging from the procurement of the raw materials to the distribution of final product to the end user. It reduces inventory up to 25 percent, eliminates wastages at all level of the supply chain, cuts down the manufacturing lead times and improved availability of the quality product to the end users. He also has mentioned about the usefulness of Artificial Intelligence (AI) in the dairy industry in decision making.

With the advancement of technology there is a tremendous growth felt in almost all sphere of life. The invention of automating milk collection machines has brought significant changes in the collection of milk at the dairy cooperative societies by increasing their efficiency. Not only this, it has provided scope for accessing the past record relating to milk collection to plan better and improve the yield and quality of milk so collected. These in turn will be handy for the competitiveness of the Indian dairy industry as a whole. This together with the help of internet help farmers improve their productivity and gain better access to government services (Sharma & Yadav, 2003).

Sarkar and Singh (2006) have highlighted applications of Business process Re-engineering (BPR) in cooperative sector. They have mentioned that the re-engineering may not always guarantee success in the organisation unless until it is backed by strong information and communication technology (ICT).

2.5 Supply Chain Issues in Dairy Industry

The supply chain is based on the three major premises namely cost, quality and time (Monczka et al., 2002). While minimising cost and maximise profitability throughout the supply chain are key issues to see that every stakeholder is satisfied; meeting the demand (with quality products and on time delivery) without any breaks is also extremely important for it (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 right place (Simchi-Levi et al., 2008). Purchasing-, production- and distribution related costs play major role in the total cost calculation of a supply chain.

### 2.5.1 Cost and factors of milk production

According to Sharma et al. (2007) the fodder costs are the highest among all the factors of milk production (70 percent). The factors which affect the cost of milk production are:

- Milk yield per animal
- Feeding policy (pasturing vs. dry fodder feeding)
- Fodders and concentrates
- Herd size
- Health and medicine
- Labour expenses
- Management factors (care and supervision)

Saravanakumar and Jain (2008) have revealed that, the cost of milk production and gross cost increase with the increase in the herd size but the reverse result is found in case of income. The small farmers are able to earn more profits comparing to the large farmers. The small farmers depend more upon the green pasturing since they are unable to afford to dry fodders available in the market for their cattle and hence their cost of milk production is lesser than the large farmers.

Barman, Konwar and Kumar (2008) have revealed the strategies for optimum production of milk at the farmer level. They have illustrated the benefits of proper feed management, use of supplement fat and protein in the regular diet of the reared animals. They have also cited about the various constraints of administering fat, protein and Non-Fibre Carbohydrate (NFC) in the diet of the cattle. According to them high producing dairy cows should eat 3.6 to 4.0 percent of dry matter corresponding to their body weight, protein should be within the range of 18-20 percent and NFC should range between 30-40 percent and fat level should not exceed five percent in the regular ration. They suggest that maintaining of good records is important in dairy farming which later on might provide evidence of a potential problem.

Measuring the cost of milk production is usually not possible at the milk producers’ level and thus can be known with the help of three methods namely survey, direct observation and formula. Regression equation can be developed from the study and later can be used
as a formula to find the cost of milk production. The total cost is calculated on the basis of the investment made on the fixed assets and variable cost per month or annum. While calculating the cost of the fixed assets depreciation is brought under the purview of cost of milk production. The depreciations on cattle and infrastructure (building and equipments) are based on seven years and 50 years of life span respectively (ICAR, 2002; Prasad, 2005).

Sharma et al. (2007) have found that the cost of milk production is Rs.10.75 per litre while making their study in Uttaranchal region of Uttarakhand state. Saravanakumar and Jain (2008) have conducted their study in Tamil Nadu for calculating the cost of milk production in both lean and flush seasons. According to them the cost of milk per litre in flush and lean seasons are respectively Rs.7.59 and Rs.8.03. According to Prasad (2005) the average cost of milk production is found to be Rs.8.27/lt under some specific conditions. He has also cited that the costs incurred on the crossbred cows are more than that of indigenous cows and buffaloes. The cost of production also varies with the urban and rural conditions of cattle rearing. Due to higher Total Milk Solids (TMS) buffaloes are more preferred to cows (Khanna, 2008) and hence 55 percent of the milk produced in the country comes from the buffaloes (Ministry of Agriculture, GOI, 2005-06).

2.5.2 Procurement and chilling

Banerjee (2008) highlights about the country’s export capabilities of the dairy products. He expresses that now-a-days around 45 percent of the total milk produced in the country remains still with their producers because of the high transaction costs. He also emphasises upon the proper storage support system of the produce to address the demand-supply complications.

According to Kohl et al. (2002) the farm price of milk is influenced by the following factors. They also state that the elasticity of demand is lower for fluid products than that of processed dairy products

- The cost of production
- Domestic supply
- Consumer demand
- Government policy
- Federal and state milk marketing orders
• Dairy farmer cooperatives
• Import and export policies

Ashok Kumar and Sayulu (2007) in their study of procurement and processing practices of Karimnagar dairy reveal that the dairy has been paying Rs.12.50 per litre for buffalo milk and Rs.8.75 per litre of cow milk with a combined average price of Rs.10.07 per litre (for a combination of 70:30 milk of buffalo and cow). According to them the dairy assigns 70 percent of surplus as bonus, deposits three percent for cooperative development and allocates 10 percent to village welfare activities and 17 percent to cattle development programmes.

As long as the procurement and processing are concerned there is a rise of transportation charges with a decline in the overhead costs during the study period of 2002-2004. The transportation charges increase from 0.56 paisa in 2002-2003 to 0.62 paisa in 2003-2004 per litre of milk which could be attributed to lack of logistics planning. At the same time the overhead costs decrease from Rs.2.58 in 2002-2003 to Rs.1.98 in 2003-2004 per litre of milk. They conclude by saying that the milk transportation routes must be rearranged and milk collection centres should be provided with storage facilities to reduce the cost of procurement.

Efficient milk procurement could minimise the cost of procurement, chilling and processing. Rangasamy and Dhaka (2007) have compared the cost of milk procurement by cooperative and private dairy plants in Coimbatore district of Tamil Nadu. The cost of collections at the collection centres of cooperative based dairy and private dairy have been found to be respectively Rs.0.37 and Rs.0.38 per litre – depicting a similar trend. The cost of collection much depends upon the level of milk collection – if the collection is higher than the cost of collection comes lower and vice versa. Basically in the lean seasons there is a severe fluctuation in the milk production and hence the procurement at the collection centres gets badly affected. This brings up the processing costs of other downstream members.

In both the cases the respective figures for the procurement and transportation are found to be Rs.0.39 and Rs.0.61 per litre. It may be noted here that the private dairy plant’s supply chain is slightly different from the cooperative based dairy. The private dairy plants directly source from the collection centres whereas the later procures it from the chilling
centres – the next stage of societies. Clearly the longer is the chain the higher is the cost of transportation and processing (Ashok Kumar et al., 2007).

The average costs of chilling at the cooperative based dairy and private dairy plants are found to be respectively Rs.0.31 and Rs.0.32 per litre. The costs of reception are detected to be Rs.0.18 and Rs.0.12 per litre respectively at the cooperative and private dairy plants. The cost of procurement for the cooperative based dairy plant varies from Rs.1.38 to Rs.1.55 per litre depending upon the variations in the level of collection. The respective figures for the private dairies are found to be Rs. 1.33 to Rs. 1.45 per litre. The situation in the cooperative based dairying can improve further if there would be regular payments to the milk producers in the rural areas (Rangasamy et al., 2007).

**2.5.3 Production and distribution**

The increasing supply chain costs are compelling the organisations to increase either the prices of the product or to negotiate with the suppliers to lower down their prices. But in both the cases two end points of the supply chain get hampered which might lead to lesser procurement or lower market share due to non-competitive prices of the product. The higher processing cost is attributed to the lower procurement and in turn is a result of lower participation of the suppliers (milk producers) in the organised supply chain.

Agrawala (2003) has stressed upon the adoption of new equipments for producing milk products. Presently the equipments used in the factories are poor in hygienic design, inefficient in energy use and labour intensive. He has highlighted that in order to overcome the inherent disadvantages versatile equipments should be developed which can manufacture more than one product with varying degrees of quality. Moreover since milk needs utmost care for processing - attempts should be taken to fabricate equipments which can be fully cleaned and conform to the hygienic standards.

Rangasamy and Dhaka (2008) have compared the costs of production and marketing for the cooperative based and private dairy plants in the Coimbatore district of Tamil Nadu. They have considered several products like toned milk, flavoured milk, butter, ghee etc. and tried to find out comparative costs on these items being expended by the plants. In most of the products the total costs incurred are more in case of the cooperative based plant than that of the private plant. In the similar way the market efficiency of the private plant is found to be higher in almost all the products except toned milk where the
efficiency of the same is 0.08 as against 0.17 of the cooperative based plant. The marketing efficiency is nothing but the ratio of margin and total marketing cost of the particular product. Though both the plants have been found to be not very competitive in the market still the private dairy plant is performing at a higher level than the cooperative based plant.

Once the product is produced for being offered it is priced depending upon various situations. The pricing strategies could be cost-plus, competitive or psychological etc but due attention should be given to the quality and price match (Teng & Jaramillo, 2005). Kotler (2000) proposes five major pricing objectives where he has revealed that before setting price the firms should assess themselves on the basis of their offerings. The following objectives are therefore highly dependent upon the market positioning strategy of the firm:

- Survival
- Maximum current profit
- Maximum market share (penetration pricing)
- Maximum market skimming
- Product-quality leadership

Business Standards (2010) in its report says that, the demand of the milk is rising much faster than the production and in order to fulfil the demand it is essential that the production should increase by another five million tonnes of milk per annum. It has been predicted that during 2021-2022 the demand of milk will be around 180 million tonnes per annum which is almost double of today’s production. In order to fulfil the gap it is essential that all the stakeholders in the system should work hard and strive for excellence. The Chairman of the board (Amrita Patel, at 38th dairy industry conference, Bangalore) has reiterated the same and focused on the domestic production rather than sourcing from other countries. In this way the millions of the livelihood in the sector could be preserved and demand-supply gaps could be minimised. According to the report the share of marketable surplus of milk both in the private and cooperative sector should be increased from 30 percent to 65 percent in the organised sector to fulfil these requirements.

Natraj (2005) has described the 3 A’s of milk marketing – Availability, Acceptability and Affordability. He rightly points out that even if milk is available and being accepted by the
people, it is not affordable by the poor people in the country. He has suggested the companies to sell the products in the economy packs to make it reach the down trodden.

Vaswani (2008) has cited that milk and milk products account for a significant 17 percent of total household expenditure on food. He mentions about the various business models for selling of the traditional milk products. According to him though B2C and B2B are the basic models used by the organisations still there is a huge scope for the franchising and online business models for making business on traditional milk products.

Rathinam (2008) has described about the challenges and opportunities in super market retailing of dairy products. Depending upon the requirement of the consumers he has classified them into four different categories namely - unattractive, attractive, attentive and potential. Unattractive customers are those who produce and consume milk themselves whereas attractive consumers purchase dairy products mostly from the unorganised sector. Attentive consumers purchase only from the organised sector which gives quality products. Potential consumers who want to consume milk and allied products but do not come under any of the above categories. By mentioning this he precisely focuses on pulling the consumers towards the organised sector through retail stores and super markets. Currently the organised retail market is valued at Rs.350,000 million as against the total market size of Rs.9,900,360 million representing only 3.5 percent of which the food and grocery organised sector is represented by only 0.6 percent.

2.5.4 Quality and safety issues

Now-a -days there is an increased tendency found for the quality of the product and production process. This is due to the increased level of consumer awareness and stringent government regulations for food products. The situation is tighter when it comes to the perishable products like milk and meat. The illness arising out of consumption of damaged products could be extremely fatal and might lead to loss of life. Hence the stringent quality check of the product has essentially become a part production process. There are different concepts followed in various organisations to control the quality of the product and production processes namely; Good X Practice codes (GXP), International Standardisation Organisation systems (ISO-9000), Hazard Analysis and Critical Control Points (HACCP) and Total Quality Management (TQM). The differences among ISO, GXP and HACCP are mentioned in the following table where TQM is the most comprehensive way of
maintaining quality in the organisation across the board and some way or the other covers all the principles of the later ones.

Table 2.3: Distinctions among various quality standards

<table>
<thead>
<tr>
<th>Feature</th>
<th>ISO</th>
<th>GXP</th>
<th>HACCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom-up approach</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Orientation</td>
<td>Process</td>
<td>Product</td>
<td>Process/Product</td>
</tr>
<tr>
<td>Health demonstrable</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Fit for true certification</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Documentation needed</td>
<td>Very much</td>
<td>Much</td>
<td>Little</td>
</tr>
<tr>
<td>Self-management</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Farm-specific</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Labour-intensive</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Many people involved</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>


It can be seen from the table that, a product like milk is more of farm-specific where the quality can be controlled in an effective way. The farm-gate milk quality is essentially an impact of cattle health, harvesting and storing conditions, feeding process. In this case the role of a milk producer is highly crucial because he/she is the person who rears dairy herds and sells milk to the cooperatives or to the open market. Hence the consciousness among the milk producers should be of paramount importance about the HACCP rules. This can be practiced in the following ways at the farm level to upgrade the quality and safety of milk:

1. Conduct a hazard analysis: identifying the areas where hazards occur like physical or chemical change of the material (e.g. curdling or damaging);
2. Identify the critical control points: the step at which the damage can be prevented for which temperature, time and procedural issues can be considered;
3. Establish critical limits: establishing criteria for each critical point (e.g. till how long milk can be preserved without chilling);
4. Establish monitoring procedures: the process should be monitored and records should be kept for future use;
5. Establish the corrective actions: the corrective actions should be taken in proper way to ensure that no damaged material (product) is released from the farm and
6. Establish verification procedures: there should be proper mechanism to be followed to oversee that the controls are working as per the planning.

Some of the HACCP criteria may not be understood at the milk producer level and hence can be eradicated by proper training and education. The milk producers are the only source of supply to the organised dairy chain and hence the quality and safety of the product can be mostly controlled by them while producing the same. Once this is practiced throughout the entire supply chain this can be maintained without flaws which will help it to perform better.

Khanna (2005) expresses his concern over the HACCP and Codex principles so as to recognize Asian products in the global market. The rising awareness about the hygienic standards and adulteration of milk has led consumers in the urban areas to consume pasteurised milk which might increase the demand for milk and milk products from 155 million MT in 1998 to 567 million MT in 2025.

Karmakar and Banerjee (2006) have highlighted various aspects of the Indian dairy industry. According to them cost of production, infrastructure, provisions for sanitation etc. need to be developed. They also stress upon the ISO and HACCP certifications for the dairy plants. Manufacturing of eco-friendly products also these days are getting attention due to the increased pressure from the government and other regulatory authorities. The customers are getting aware in this regard and hence the impact of eco-friendly food products on the long term relationship with customers can’t be overlooked. It has been seen that while purchasing a food product consumers in India mostly give priority to the qualitative, recyclable, refillable and eco-friendly products. Hence in addition to the ISO, HACCP and other best manufacturing practices it is also essential to look into the manufacturing of eco-friendly products (Deb, Mishra, Guin, & Sinha, 2007).

Sohrab (2008) highlights some basic issues of quality and safety for the Indian dairy industry. According to him an estimate of the World Health Organisation (WHO) every year there have been 1.5 billion food borne illnesses caused out of which 3 million death cases recorded. In order to deal with such difficulties and to make Indian dairy industry competitive in the global market he has urged for the involvement of the top level management in the sector. He further has emphasised on training and education of the
personnel in Hazard Analysis and Critical Control Points (HACCP) principles in the organisation and mentioned that ISO 22003 criteria should also be applied to the consultants who basically certify the industries on various quality aspects to make the system more transparent.

### 2.6 Supply Chain Risk

A famous quote by the Greek Historian “Herodotus” depicts that, “Great deeds are usually wrought at great risks.” So in order to improve the overall supply chain value, it’s highly needed to tackle risks and uncertainties with a suitable strategy. Of late, supply chain risk management has gained attention throughout the world. Identifying potential supply chain risks and unearthing a suitable strategy to mitigate them have been found to be the key success factor irrespective of the nature of the organisation. Though not much of work is done in this context still some of the empirical works published by various theoreticians and practitioners will give direction for others to opt for the critical issues and a prospective solution thereto in the supply chain. So there is a need for research to fortify the concept (Thun & Hoenig, 2009; Juha & Pentti, 2008).

In this research one of the important objectives has been to detect the potential risks for the dairy-food supply chain and a strategy for risk mitigation. Risk management is a proactive approach rather than reactive approach (Gray & Larson, 2008). The risk management process starts with identification of the risks and ends with the risk mitigation through the risk response development. Risk mitigation, avoidance, transferring, sharing and retaining are various strategies undertaken to deal with the risks in the organisation.

The risks involved in the supply could impede the flow of the supply chain. Zsidisin (2003) has suggested a grounded definition of risk after having an in-depth case study research. According to him:

> “Supply risk is defined as the probability of an incident associated with inbound supply from individual supplier failures or the supply market occurring, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety.” (p. 222)

He has further opined that the supply risk depends on the risk sources and outcomes whereas understanding the risk sources differs from industry to industry. Supply chain
risks are increasingly rampant in the globalised era. All decision makers of the supply chain have to come across this deadlock (Akcaoz, Kizilay, & Ozcatlas, 2009). Definitions of risk and risk management are multifarious and many have emerged over time (Zsidisin, 2003). The British Standards Institute (BS 4778, 1991) defined, “risk as a combination of probability or frequency of occurrence of a defined hazard and magnitude of the occurrence.”

Risk and uncertainty though used interchangeably in various studies, are not one and the same. Wherever in case of risk the probability is known, it is not known for the uncertainty. But both incur loss to the supply chain (Siegel, 2005). No matter how robust is the supply chain - risks and uncertainties can’t be ruled out which requires attention and if unattended will affect the supply chain adversely in many ways (Simchi-Levi et al., 2008).

Supply chain in any industry is entangled with many stakeholders and so is supply chain risk. The risks and uncertainties in the supply chain earlier were dealt with as a company specific task (Juttner, 2005). It is today realised that since the supply chain is a complex bonding of several stakeholders, distortion at one of the components distorts the entire chain by varying degrees. Supply chain risk management is at infancy stage and gradually becoming a popular research area day by day.

Vanany, Zailani and Pujawan (2009) reviewed 82 relevant articles pertaining to supply chain risk management from several established journals and data bases from the year 2000 to 2007. They have segregated these papers on the basis of type of risk, unit of analysis, industry sectors and risk management processes/strategies. Understanding, identifying and assessing the risks based on probability of occurrence and severity of impact is a starting point for companies to develop effective risk management strategies. Certain terms are used in the risk management process very frequently (Sadgrove, 2005):

- Hazard: a source of potential harm
- Risk: the possibility that a hazard will cause damage
- Risk assessment: evaluating risks in terms of impact
- Risk management: a discipline of dealing with uncertainty
Supply chain vulnerability is a threat to the entire supply chain network which disrupts it in many ways. The vulnerabilities in the supply chain can be experienced in many ways. According to Alder (2007) in terms of business risks they are namely:

- Commercial risks (price contracts with the suppliers)
- Process (supply-demand match)
- Operational (shortage of materials)
- Strategic (not understanding the market properly)
- Financial (insufficient funding)
- Knowledge management (lack of key knowledge)
- Contractual (exposure to liquidated damages)
- Reputation (brand damage)
- Compliance (stock exchange rules)
- Environmental (natural disasters)
- Employee risk management (insufficient staff)
- Political and economic instability (EXIM policy etc.)
- Health and safety risks

To add to the above risk factors human related flaws and vulnerabilities too play a crucial role in the entire supply chain. Operational losses that incur through inadequate staffing for required activities are commonly termed as human risks. These may be due to the lack of training, poor working culture, loss of key employees, bad management and so on. Some operational risk score data on human risks might be available, such as expenditure on employee training, staff turnover rates, number of complaints and so on. But human risk remains one of the most difficult operational risks to quantify because the only information available on many of the important attributes will be subjective beliefs. There seems to have a crucial role of the suppliers in the whole supply chain. The suppliers’ risk coping efficiency is one of the major antecedents for it. The problems pertaining to financial instability, capacity constraints, quality related risks and the technological
changes are the major variables found disrupting the suppliers’ stand in the supply chain (Zsidisin & Ritchie, 2008).

Procurement is one of the key activities of the supply chain management. It has been seen that the organisation’s 60 percent of the sales income is invested for the procurement of material (Tiersten, 1989). Procurement related risks are oftentimes perceived differently by the industry people. Whereas the high-tech organisations follow the informal and decentralised process in the risk management, the traditional manufacturing organisations are leaned towards the centralised and formal process (Juha & Pentti, 2008). The qualitative study by Juha et al. (2008) on eight traditional manufacturing companies and seven high-tech companies in Finland reveals the results. They have suggested that “perceived risk of a buying task can be most efficiently managed by changing dynamically buying centre structure to different buying situations and during the buying process”. Companies should utilise their internal networks more efficiently as well to manage the purchase-related risks, they highlight in their study.

Schoenherr, Tummala and Harrison (2008) have highlighted the risk issues pertaining to the off-shoring decisions in the supply chain. This decision in the production process might give rise to poor quality, higher transportation costs, lower reliability, supply disruptions, logistical failures, natural disasters and increased communication difficulties etc. In order to find the best solution for this they have undergone through the Action Research method with the help of Analytic Hierarchy Process (AHP). They have identified 17 risk factors and then used AHP to evaluate the importance of each risk factor and to determine the best alternative. According to them product cost and quality are highest vulnerable areas associated with the off-shoring decisions putting natural disasters and engineering and innovation as the least concerned areas in it.

Thun and Hoenig have conducted a survey of 67 manufacturing plants in German automotive industry for investigating the vulnerabilities of supply chains. They have found that supply chain risks are predominantly vulnerable wherein globalisation, product variant, supplier reduction and the outsourcing are some of the key drivers which disrupt the chain. According to them the internal supply chain risks are more likely to occur and affect the supply chain performance more adversely which has taken to be one the hypotheses of this research. Their study says companies with higher degree of supply chain risk management perform better than others who perform at a lower level of it.
Furthermore the results show that the group using reactive supply chain risk management has higher average value in terms of disruptions resilience or the reduction of the bullwhip effect whereas the group pursuing preventive supply chain risk management has better values concerning flexibility or safety stocks.

Managing supply chain risks has become one of the major concerns in the value chain. Though the severity of the risks get realised in varying degrees across the supply chains, organisations perceive the risks in different ways. Some are risk takers whereas some are risk avoiders who want to be at the safe side. No matter what a company’s attitude is in risk management, there is a little bit of impact realised throughout the chain. To know about how companies react to the risks, the Economist Intelligence Unit surveyed 500 executives from various companies across Asia-Pacific, North America and Europe. According to the report 62 percent of the respondents opine demand unpredictability as one of the major disrupting force in the supply chain. More than one-half of all respondents have been hit by the rising input costs and volatility in energy prices and over one-third has been affected by the insolvency of partners or suppliers. Furthermore one-half of the respondents opine for improving the collaborations with the partners or suppliers as the major weapon to combat supply chain risks.

2.6.1 Supply chain risks in agriculture

Vithal (1986) has highlighted some major factors that affect the smooth functioning of the dairy cooperatives. According to him factions among the villages, caste dominance, practice of proxy, menace of local vendors and lack of professionalism among the staff etc. are some of the basic issues which retard the day-to-day activities of the cooperative societies. All these factors can be treated as the risk areas for the dairy cooperative societies which operate in the rural areas. Ashok Kumar et al. (2007) and Kaur et al. (2008) have raised some of the major problem areas – among those some of them are:

- Inadequate supply of feed and fodder
- Sudden changes in seasons
- Unsuitable location for milk collections etc.

The asymmetric information between the suppliers and the manufacturer could lead to supply chain disruption and finally lead to market failure. The study by Gorton, Dumitrashko and White (2006) in Moldova has tried to look into the issue. The authors
with the help of a dairy case have suggested that rebuilding relationships, contracting and strengthening of the village collection centres could ease the problems.

Ramaswami, Ravi and Chopra (2004) have defined the agricultural related risks what an Indian farmer usually face these days. The major threats, the Indian farmers are facing today are declining size of the land holding, degradation of soil and water resources, inadequate institutional credit support and lack of opportunities for non-farm employment etc., they have cited in their book on State of the Indian farmer: Risk management. According to them there are basically two types of risk at the farm level - agricultural risk and non-agricultural risk.

Production risk (weather, pest and diseases), price risk (lack of demand) and input risk (shortage of inputs or when their prices vary) are the risks come under the agricultural risks. There are certain risks which are common to all are called as systematic (covariate) risks and risks specifically related to a particular farmer are termed as idiosyncratic risks. Risk management and mitigation can be done at the farmer level or at the community level as a whole. This can be done either with the help of self-insurances for the crops or risk pooling and mutual insurance at the community level - they have added to their work as a method of risk management strategy.

Ali and Kapoor (2008) have discussed about various types of risks for the fruits and vegetables. Investment, socio-economic, environmental, production and market risks are the major perceived risks in the production of fruits and vegetables. Price and production risks are the most vital risks in this case - they have mentioned. Better risk management in this can be done through the improved information technology, development of financial markets and promotion of market based price ensuring marginal farmers to get benefit out of it.

Akcaoz et al. (2009) have conducted a survey of dairy farmers in the Antalya province of Turkey in order to know the risk management strategies in the farms. In all the farms irrespective of their size - milk price variations, lack of hygienic conditions and the meat price variability have been found to be three major risk sources keeping aside the marketing problems. They have also identified that keeping the debt low, producing at the lowest cost possible and good liquidity conditions are the key risk management strategies followed there.
2.7 Supply Chain Coordination

Malone and Crowston (1994) reveal that, “coordination is an act of managing dependencies between entities and joint effort of entities working together towards mutually defined goals”. Instead of setting up of objectives at different levels of the supply chain it is better to have a common defined goal. This will not only eradicate the differences among the channel partners rather help achieve the desired goal by maximising the return at all levels of it. On the other hand collaboration is defined as, “the process by which two or more parties adopt a high level of purposeful cooperation to maintain a trading relationship over time.” Both parties have equal power to shape its nature and future direction over time. The firms should have limited number of suppliers so that the proper buyer-supplier relationship can be maintained in the long run (Monczka et al., 2002).

Coordinating the various activities of the supply chain is one of the complex phenomena. The supply chain which constitutes of several stakeholders in the system has conflicting objectives and that’s why a proper coordination mechanism is the need of the day in order to have overall profit maximisation. According to Ramdas and Spekman (2000) lack of coordination might result in low performance affected by inaccurate forecast, low capacity utilisation, excessive inventory, inadequate customer service, extended lead times, low customer satisfaction etc.

Simatupang and Sridharan (2002) define collaboration as, “two or more chain members working together to create a competitive advantage through sharing information, making joint decisions and sharing benefits (Pyke et al., 2000) which result from greater profitability of satisfying end customer needs than acting alone”. Simatupang et al. (2002) have identified six key issues in collaboration namely:

- Setting up of joint objectives
- Integration of decision rules
- Using appropriate measure of performance
- Creation of coherent decision domains
- Information sharing
- Use of appropriate incentive system
The supply chain coordination aims at increasing the total supply chain profits and maximizing end user satisfaction. The lack of proper supply chain coordination leads to bullwhip effect (Lee et al., 1997). This occurs because of the conflicting objectives and individualistic attitude of the stakeholders in maximizing profits. In order to have better control over the supply chain - a proper coordination mechanism is highly essential. It facilitates the inter-firm strategic decision making (Westgren, 1998). The choice of coordination system has a significant impact on whom that has power and control in the supply chain and how risks and rewards are shared. Supply chain incentives and/or penalties used to reward performance and share risk (Boehlje, 1999).

Fitzgerald, McIntosh and Akintoye (2000) describe about the importance of the supply chain collaboration and finds out some of the major drivers of it. The drivers or the driving forces are the ones which are responsible to make desires in the firms to opt for the collaboration in the competitive market place. The major driving forces for the supply chain collaboration are:

- Meeting customers’ requirements
- Reducing costs
- Focusing on core competencies
- Intensified competition
- Information/technology boom
- Shorter innovation/product life cycles
- Globalisation etc.

Basmaci (2003) has conducted a survey on supply chain collaboration in Turkey Textile Industry. According to the study, 12 percent of the companies do not make any collaboration with any other company while 56 percent of them collaborate with one to five companies. The rest of them make collaboration with more than five companies. Almost two third of them have responded that the collaboration increases customer satisfaction, productivity and product quality. More than 90 percent of the respondents opine that in order to have successful collaboration - trust on each other, willingness to share information and believing that it leads to mutual benefits, are to be practiced. Most of the respondents opine that lack of confidence, unwillingness to share information, lack
of consistent collaboration performance metrics and difficulty in calculating the level of contribution to the collaboration are major barriers to the supply chain collaboration.

Nix, Zacharia, Lusch, Bridges and Thomas (2004) have studied on effective collaborative endeavours in supply chain by focusing on “nature and scope, factors, key drivers and outcomes” of successful collaborations while conducting a survey of 477 companies in USA to reach at a consensus. They have concluded that joint decision making, ideas and information sharing, openness to each other, frequent meetings, higher level of commitment and effective working relationships are the key drivers of a successful collaboration. Some of their major findings are as cited below:

- Firms with strong collaborative capabilities and a commitment to collaborate intensely with supply chain partners can achieve as much as 40 percent improvement in collaboration performance.
- Firms with strong collaborative capabilities and a commitment to collaborate intensely with supply chain partners can achieve as much as 55 percent improvement in relationship quality.
- Firms with the capability to learn from supply chain partners and a commitment to collaborate intensely can achieve as much as 40 percent improvement in collaboration performance.
- Firms with the capability to learn from supply chain partners and a commitment to collaborate intensely can achieve as much as 55 percent improvement in relationship quality.
- Firms with higher levels of problem-specific capabilities and a commitment to collaborate intensely with supply chain partners can achieve as much as 42 percent improvement in collaboration performance.
- Higher level of problem-specific capabilities and a commitment to collaborate intensely with supply chain partners can dramatically enhance relationship quality.

Supply chain integration (Pyke et al., 2000) is one of the crucial areas of the supply chain management. The study made by Van der Vaart and Van Donk (2008) shows the relationship between the supply chain integration and the performance. The review made by them shows that there are significant differences in the factors and the constructs used to measure supply chain integration. In order to measure the same - attitudes, practices,
patterns and the inter-relationships items can be considered to avoid more concentration on the firm itself. Furthermore the performance measurement of the supply chain should focus on the buyer-supplier relationships (BSR) by considering the power (inter-dependencies) and business conditions of the focal firm. According to Cookson and Delattre (2001) even though the collaboration raises the degree of complexity and risks in the supply chain still the benefits can be plenty and prepares the background for the optimally coordinated supply chain (figure).

Figure 2.2: Steps in optimally coordinated supply chain

Knolmayer, Mertens and Zeier (2002) have discussed some of the contemporary practices of effective supply chain management like Concurrent Engineering (CE) and Simultaneous Engineering (SE), Collaborative Planning, Forecasting and Replenishment (CPFR) and Efficient Consumer Response (ECR) systems. According to them whereas CE is directed towards a distributed realisation of certain development tasks; SE concentrates on developing products and processes in parallel. They also have cited that ECR is a bundle of methods aiming at removing inefficiencies along the value chain stressing upon the joint agreements among all stakeholders to achieve a win-win situations. ECR is a comprehensive management concept based on vertical collaboration in manufacturing and
retailing with the objective of an efficient satisfaction of consumer needs. The main components of ECR are supply chain management and category management (Seifert, 2007). The ECR has two basic components namely (i) consumer and (ii) efficient response.

Harrison and Van Hoek, (2005) have defined the ECR and CPFR. Where ECR focuses on meeting the customer demands, CPFR looks after the strategic and operational levels to ensure competitiveness of the supply chain. According to them the efficient customer response system includes category management, continuous replenishment and enabling technologies. The main objective of this two is to improve customer service while decreasing costs in inventory management. Therefore the trade-off between efficiency and effectiveness should be resolved by collaboration in planning and implementation between organisations.

The two basic components are aimed at fulfilling customers’ needs and demand efficiently. On supply side, the cooperation in logistics between the manufacturers and retailers are required to make the supply chain a highly responsive one. On the other hand, the demand side collaboration in marketing via category management and exchange of customer data are highly essential.

Souviron and Harrison (2003) have developed a seven dimensional framework of supply relationships with people management aspects. They are:

(i) **Goals**: Each stakeholders should have a specific goal and should be compatible with the aggregate goal of the supply chain;

(ii) **Information sharing**: Two way open and honest information sharing which will strengthen the ties among the partners;

(iii) **Relationship structure**: The firms have to choose from bow-tie or diamond relationship structure. The bow-tie relationship is having a single point of contact and is little narrow in its scope whereas diamond structure has multiple contacts which characterises close relationships;

(iv) **Coordination mechanism**: The coordination mechanism should be flexible and informal aiming at nurturing relationships rather than controlling it;

(v) **Locus of decision making**: Giving autonomy to the managers in making decisions to handle local difficulties with the relationships;
(vi) **Top management commitment:** Top management commitment and involvement should be there throughout the relationships; and

(vii) **Compatibility:** Operational and cultural differences should not hinder the collaborations so that relationships can be successful avoiding the incompatible values.

Collaboration is a process of joint planning and decision making (Lajara et al., 2004) among all partners so as to improve the overall supply chain performance. The benefits of a proper collaboration are plenty and can be resulted in higher profitability and service improvements. Stank, Keller and Daugherty (2001) have studied the relationship between collaboration and service improvement in supply chains. Their findings reveal that internal collaboration considerably influences logistical service performance. Furthermore the external collaboration in the supply chain influences internal collaboration positively which consequently improves logistical service. Collaboration is utmost needed both within and beyond the firm’s boundaries which in turn requires more resources and a flair for it.

Partnership is an important aspect of successful supply chain management (Lambert, Knemeyer, & Gardner, 2004; Pyke et al., 2000). According to the authors although the supply chain brings many opportunities still the real opportunities for the better performance come from effective relationships among the partners. They have identified eight drivers of successful partnership. They are namely:

- Planning
- Joint operating control
- Communications
- Risk and sharing reward sharing
- Trust and commitment
- Contract style
- Scope
- Investment
Organisations are attempting to gain a competitive advantage by integrating their suppliers into the supply chain processes which ultimately require greater strategic and operational cooperation between the buyer and supplier. With the advancement of the information technology the firms are sharing their planning information with each other quickly and accurately to make effective collaborative planning. The trust and quality of information sharing between the firms are most important factors for the effective collaborative planning (Doney & Cannon, 1997; Petersen, Ragatz, & Monczka, 2005).

According to Seifert (2007) the “CPFR is an initiative among all participants in the supply chain intended to improve the relationship among them through jointly managed planning processes and shared information.” The concept is coined by Wal-Mart and Warner-Lambert in United States which primarily intended to reduce the inventory costs throughout the supply chain. The CPFR has been proved to benefit the supply chains in the following ways (Fraser, 2007):

- Improves forecasting accuracy
- Decreases inventory level
- Reduces stock-outs
- Improves service level
- Increases sales

Keeping view to citations on supply chain coordination, three coordination mechanisms are being discussed in this research. They are namely procurement-production coordination (Goyal & Deshmukh, 1992), production-distribution coordination (Sarmiento & Nagi, 1999) and coordination issues in third party logistics provider (Huiskonen & Pirttila, 2002).

The milk producers, dairy cooperative societies, bulk milk coolers and production plant are the respective stakeholders in the procurement-production coordination. While the production plant and transporting agencies are associated with the production-transportation interface; the production plant and the retail outlets are being involved into production-distribution coordination phases. Goyal et al. (1992) focus on the two coordination mechanism viz. supply chain contracts and joint decision making process where cost has been taken as the measure of the performance. Huiskonen and Pirttila
2002) also have used the same mechanism of coordination in their study to measure the logistics performance.

### 2.8 Supply Chain Performance

Supply chain management practices are widely prevalent in today’s business scenario irrespective of the nature of the firm. Since the supply chain work under a diversified working environment, most of the times, it is essential to measure the performance of the stakeholders including the customers’ satisfaction. But the performance measurement of any entity is not an easy task to deal with. This requires a valid and reliable instrument, which further requires an extensive background work and expertise. To make the study more precise and practical some of the findings of the academicians, researchers and practitioners in this field have been cited hereunder.

Supply chain performance measurement has been one of the key issues for the organisations to identify their stand in the market place. Since the supply chain considers several stakeholders in the system, in order to measure the performance, it is essential to measure the performance of the individual stakeholder. The performance level of the organisation is greatly influenced by the performance of the individual stakeholder – may be positive or negative. If the performance of each of them is positive and optimal then it adds to the overall performance of the chain. So in order to see the better performance of the supply chain it is essential to have relatively better performance in case of individual stakeholders.

In order to measure the performance of the supply chain it is necessary to have a proper measuring instrument with requisite parameters. All of these parameters or key performance indicators (KPIs) may or may not be applicable to each stakeholder in the system. Even applicable it is difficult to say that it impacts every stakeholder in the same way. This is due to the conflicting objectives among supply chain partners which often brings out sub-optimal results, may be detrimental to the overall performance of the chain (Aramyan, Lansink, Van der Vorst, & Van Kooten, 2007). This conveys that a parameter set by a stakeholder in his/her day to day operational activities without due consultations with others might not result in the same way what he/she extracts out of it.

Sometimes in order to improve the supply chain performance it is essential to compare it with the other best performers in the field (benchmarking). Benchmarking is a process of
identifying the best practice and modifying actual knowledge to achieve superior performance in the organisation (Camp, 1989; Splendolini, 1992). It can be used both internally and externally where internal benchmarking is to develop the inferior departments in the organisation; the external benchmarking is to compare with the other organisations performing well. According to Splendolini (1992) there are five basic steps of benchmarking namely:

(i) Strategy: planning for short and long term;
(ii) Forecasting: predict trends;
(iii) New ideas: stimulate new thoughts;
(iv) Process comparisons and
(v) Setting objectives and targets: base them on best practice.

Supply chain management has been a very complex phenomenon. Firms are now taking utmost care to exist sustainably in the market place. That’s the reason why benchmarking is overwhelmingly exercised by them to know their drawbacks and fortes compared to the competitors.

Anderson, Fagerhaug and Randmael (n.d) elaborated the benchmarking process flow which includes the steps of measurement, comparison, learning and improvement:

- Measurement of own and benchmarking partners performance level both for comparison and for registering improvements
- Comparison of performance level processes
- Learning from the benchmarking partners to introduce improvements
- Improving the performance levels, processes etc.

They have also stated some of the major challenges for the benchmarking process. Difficulty in finding benchmarking partners, sharing of information, lack of understanding between partners and comparability of companies and processes are major impediments in the benchmarking process. As a part of the benchmarking it is essential to improve the process of the organisation which comes in varying degrees.

According to Bohn (1994) as said in Slack and Lewis (2009) there are eight stages ranging from “total ignorance” to “complete knowledge” for process development.
(i) **Complete ignorance:** There is absolutely no knowledge of what is significant in the process;

(ii) **Awareness:** There is awareness that certain phenomena exist and their relationship to the process but there is no formal measurement or understanding of how they affect the process;

(iii) **Measurement:** There is an awareness of significant variables that affects the process but there is no control on them in the process;

(iv) **Control of mean:** There is some ideal to control the significant variable but the control is not precise. In this case the mean is controlled but not the variations around the mean;

(v) **Process capability:** The knowledge exists to control both the average and the variations in case of significant variables;

(vi) **Know how:** In this case the knowledge exists to know how the variables affect the output and which can get adjusted to optimise the process;

(vii) **Know why:** The scientific knowledge exists in this case which can control, predict the variables in a wide range of diversifying conditions and

(viii) **Complete knowledge:** This an ideal condition, as good as working at more than six sigma level. It is never reaching condition since it is virtually impossible to know the effects of every conceivable variables and conditions thereto.

According to Neely, Gregory and Platts (1995) performance measurement is the process of quantifying the effectiveness and efficiency of various actions. They have revealed that the efficiency is the measure of economic activities of the farm whereas the effectiveness is the extent to which customers’ requirements are met. So clearly in order to measure the performance of the chain it is essential to measure both the performance of supply chain partners including the customers’ satisfaction. They have also identified quite a good number of approaches to the measurement system viz. balanced score card method, performance measurement matrix and questionnaire etc. Short-termism, lack of strategic focus, system not aligned with strategic goals and organisation culture etc. are some of the major limitations adhered to the measurement system, they have included thereto.

Anderson (1995) has suggested a benchmarking wheel for the organisations with five different stages namely plan, search, observe, analyse and adapt as depicted in the figure 2.3.
Van der Vorst, Beulens, DeWit and Van Beek (1998) mentioned that supply chains should be concerned with the reduction or even elimination of uncertainties to improve the performance of the chain. Order forecast horizon, input data and administrative and decision policies are three major causes of uncertainty in the supply chain. The inherent uncertainties relating to the demand and supply add to the supply chain uncertainties. In order to avoid these complicacies organisations should follow supply chain activities together with the internal control design. Furthermore the authors have cited that a proper coordination mechanism is essential to maximise the benefits of the supply chain activities. There are certain drivers of increasing interest in the supply chain performance measurement.

According to Neely (1999) there are seven drivers for increasing interest in supply chain performance measurements. They are namely:

- Changing nature of work
- Increased competition
- Specific improvements initiatives like just-in-time and so on
- National and international quality awards
- Changing organisational roles like management by objective (MBO)
- Changing external demands
- The power of information technology

Christopher and Towill (2000) presented various models of supply chain performance measurement which being condensed in the table below:

**Table 2.4: Supply chain performance models**

<table>
<thead>
<tr>
<th>Types of supply chain</th>
<th>Supply chain performance</th>
<th>Supply chain metric</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supply chain measure</td>
<td>Supply chain sub-measure</td>
</tr>
<tr>
<td>Efficient</td>
<td>Cost, price (market winner)</td>
<td>Total chain cost Purchasing price</td>
</tr>
<tr>
<td>Quick/Agile/Market responsive</td>
<td>Delivery Quality Flexibility (market winner) Cost</td>
<td>Delivery reliability Quality conformance Flexibility (mix) of production Total chain cost</td>
</tr>
<tr>
<td>Lean</td>
<td>Primary: Cost (market winner) Quality Secondary: Delivery, Novelty and Customer service</td>
<td>Total chain cost Purchasing price Quality conformance Delivery reliability, Delivery (lead time)</td>
</tr>
<tr>
<td>Hybrid (lean &amp; quick/agile/market responsive)</td>
<td>Quality Delivery Cost Flexibility</td>
<td>Quality conformance Delivery reliability Total chain cost Purchasing price Flexibility (mix) of production</td>
</tr>
</tbody>
</table>

Source: Christopher and Towill (2000)
According to them there are four kinds of supply chains which require various performance measurement parameters. If the supply chain is an efficient one then cost and price are the major indicators to be considered. While there are not much difference found in case of quick/agile/market responsive and hybrid supply chains - lean supply chains focus on novelty and customer service. Monczka et al. (2002) in their book on purchasing and supply chain management have stated the benefits and problems with measurement of the supply chain management. According to them:

"The fundamental objective of a purchasing and supply chain performance measurement system is to aid in strategy implementation through a formal, systematic approach to monitoring and evaluating purchasing activities. Managers can use several types of information to achieve this goal: the most effective blend financial information with non-financial information." (p.144)

Furthermore they have stated that - improved decision making, improved level of communication and identification of flaws are some of the major benefits that can be achieved if measurement of supply chain performance is done on regular basis. But sometimes due to conflicting messages from the stakeholders and lack of congruence in the objective formulation the measurement can’t retrieve the facts of the supply chain.

Chopra and Meindl (2003) have mentioned that in order to achieve strategic fit in the supply chain it is necessary to understand the customers and uncertainties. They have also cited that since the scope of strategic fit is to include all channel partners, it is essential to have a common framed goal irrespective of its members. Individual goals, though profitable for the concerned, do not much add value to the supply chain’s performance.

Supply chain performance indicators viz. efficiency, responsiveness, flexibility, product quality and process quality are all indispensable part of the supply chain. However the flexibilities like volume, delivery, system, supply, organisational and information flexibility are some of the major sub-indicators which influence the overall performance of the supply chain. The higher is the ability of the firm to change its production and delivery to the customers (as a part of the flexibility) the higher is the value addition to the total supply chain profitability (Vickery, Canlantone, & Droge, 1999; Duclos, Vokura, & Lummus, 2003; Garavelli, 2003).

Sankaran and Luxton (2003) have discussed about the factors which facilitate and/or inhibit the supply chain efficiency in dairy industry. The factors are namely; the payment
system, cooperative ownership structure and vertically integrated nature of the industry. The systematic payment system together with the incentives to the farmers improves the operation of the cooperatives but the collection of milk beyond its capacity results in diseconomies of scale. The cooperative ownership avoids the non-cooperative behaviours on the part of the dairy farms but it is essential to process the milk supplied by the suppliers irrespective of the extent. Similarly the vertical integration helps in system-wide improvements while there is a chance of distorted behaviour on the part of the cooperatives due to the employment of the financial model for remunerating them.

Gunasekaran et al. (2004) in order to measure the supply chain performance have developed and sent a questionnaire to 150 industries in the UK with a response rate of 14 percent. The questionnaire has got four basic sections namely; plan, source, produce and delivery at different levels of the organisations. The findings of the study say that 76 percent of the industries get benefited out of the supply chain management practices by improving their return on investment (ROI). Around two third of the respondents agree that their market share have gone up due to implementation of the various supply chain practices. But the success of the industries is not automatic unless due care has been given to the measurement of the supply chain in regular interval of time. They have also revealed that there should be a common goal for the entire chain irrespective of the stakeholders – the goals could be customer satisfaction and the enhanced competitiveness.

For measuring the performance of logistics and supply chain it is essential to include both financial and non-financial terminologies. Costs, profits, ROIs etc. are the financial measures whereas productivity, asset management, order fulfilment and quality are the non-financial measures. Both of these financial and non-financial measures are pertaining to the internal indicators whereas customer perceptions, service quality, reliability, responsiveness, relationship, learning and innovations are the external measures. In order to measure the performance of the logistics both of internal and external measures are important (Kaplan & Norton; 1996; Sople, 2004).

According to the Huang, Sheoran and Wang (2004) there are four basic measures by which the supply chain performance can be measured. They are according to supply chain operations reference (SCOR, www.supply-chain.org/scor) namely; plan, source, make and deliver. Planning is the basic principle of any business concern followed by sourcing where the raw materials are procured and transformed into products and services by a
proper throughput. Once the product or service is in its finished form of consumption or delivering, it is delivered to the prospective customers. The whole process comes through certain stages. While the planning is done at the strategic level; sourcing is done at the tactic level. Making and delivering of the same is performed at the operational level of the supply chain. Huang et al. (2004) have suggested eight different parameters of supply chain performance based on the SCOR model as mentioned below:

- Cost
- Inventory turnover
- Quality
- Lead time
- Delivery precision
- Internal performance
- Customer satisfaction
- Service grade

Bozarth and Handfield (2006) have mentioned that operations and supply chain can have enormous impact on the business performance. They suggested that quality, time, flexibility and cost are the four basic dimensions relevant to operations and supply chain activities. Slack and Lewis (2009) have suggested six indicators to measure the operational performance in the organisation. They are namely; quality, speed, dependability, flexibility, cost and process knowledge.

- **Quality:** No. of defects per unit, level of customer complaints, scrap level, warranty claims, mean time between failures and customer satisfaction score etc. can be taken into consideration while referring to the quality factor.
- **Speed:** Customer query time, order lead time, frequency of delivery, actual versus theoretical throughput time and cycle time.
- **Dependability:** Percentage of orders delivered late, average lateness of orders, proportion of products in stock, mean deviation from promised arrival and schedule adherence.
- **Flexibility:** Time needed to develop new products or services, range of products or services, machine change-over time, average batch size, time to increase activity rate, average capacity or maximum capacity and time to change schedules are the deciding factors in this case.
- **Cost:** Minimum delivery time or average delivery time, variance against budget, utilisation of resources, labour productivity, added value, efficiency, cost per operation hour.
- **Process knowledge:** The key to excel in the field of operation is to have the proper process knowledge. Though it’s difficult or sometimes impossible to have a perfect knowledge for certain process still things will continue to improve when people try to come closer towards it. The process improvement is like a journey where there is always a scope for further improvements.

Food Chain Centre of UK (Nov 2007) has mentioned that the dairy industry is wasting £1.5 billion per year. The big amount of loss is attributed to all the stakeholders in the system collectively which could have been saved by referring to some of the key strategies of the supply chain management. According to the report one of the best ways to curb this wastage is to apply lean manufacturing to the industry by adopting following steps. The steps are basically as hereunder:

- Operational management (milk production, quality improvement)
- Transport inefficiency (milk collection, distribution)
- Reducing information complexity
- Demand management
- Introducing overall supply chain key performance measures
- Developing a better understanding of customer value

Performance measurement of transporters can be done by considering financial measures as well as non-financial measures being brought under the purview of internal and external measures. Sople (2004) has elaborately discussed about the performance measurement in the transportation industry with the following financial and non-financial parameters. Among the financial measures operating costs and return on investment (ROI) are the major indicators. As far as non-financial measures are concerned it is the productivity, asset management, order fulfilment and quality are the major indicators.

More over there are some external indicators too on the basis of which the customers’ perceptions of the service quality can be measured. The details of the parameters are as discussed below:
(A) Internal measures:

(i) Financial/Operating cost:

- Warehousing cost per unit
- Freight cost per unit of material transported
- Labour cost
- Cost of goods damaged during transportation
- Logistical packaging cost
- Order processing cost
- Per unit (throughput) cost in warehousing
- Administration cost

(ii) Financial/Return on Investment (ROI)

(iii) Non-financial/Productivity:

- Units loaded per person per hour onto the transport vehicles
- Cases filled and packed per person per eight hour shift
- Idle time of the handling equipment
- Throughput in the warehouse per hour

(iv) Non-financial/Asset management:

This is a measurement of inventory turnover ratio, ROI and inventory stock levels in a particular number of days. Inventory turnover ratio indicates the rotation of the given value of inventory w.r.t the value of sales in a stipulated timeframe (generally one year). Higher ratio indicates faster cash rotation in the business cycle and higher utilisation of assets.

(v) Non-financial/Order fulfilment:

- Cycle time (order processing, replenishment, procurement, manufacturing and distribution)
- Delivery (on-time or delayed)
- Fill rates (order fill, case fill, product fill)
- Stock out frequency
• Shipping errors (wrong delivery, incorrect invoice, and material shortage)

(vi) Non-financial/Quality:

• Transit damage frequency
• Value of the total damage
• Frequency and cost of goods returned from the customers (damaged or inferior quality)
• Material shortages frequency
• Delivery commitment deviations (frequency and tolerance)

(B) External measures:

(i) Customer perceptions:

• Service quality
• Reliability
• Responsiveness
• Relationship

(ii) Innovations (best practices/benchmarking):

• Order processing procedure
• Transportation (route, modes, freight rationalization)
• Warehousing (storage, material handling system, automation)
• Packaging
• Logistical productivity
• Delivery service
• Information flow and connectivity

Aramyan (2007) have considered exhaustive list of indicators proposed by various authors like; efficiency, responsiveness, flexibility, product quality and process quality in their study of “performance measurement in agri-food supply chains”. They have carried out this study in case of Dutch-German tomato supply chain by considering one breeder, seven tomato grower, one wholesaler, one distributor and two retailers. The twelve stakeholders have been interviewed by them on the basis of a structured questionnaire
with both open and closed ended questions under a five-point rating Likert scale. They have concluded that many indicators are used on the basis of objectives of the stakeholders which complicate the harmonisation of performance measures for the entire chain. At the end they have suggested a four dimensional performance measurement system for the agri-food supply chain. The dimension-wise indicators as per their study have been mentioned hereunder:

- **Efficiency**: Costs, profit, return on investment
- **Flexibility**: Mix flexibility, volume flexibility
- **Responsiveness**: Lead time, customer complaints
- **Food quality**: Appearance, product safety

A report from Confederation of Indian Industries (CII) and Technopak (2010) has focused on the Public Private Partnership (PPP) model of the Indian dairy sector for better performance. The private parties can be integrated into the sector so as to improve the performance in many ways. They are namely:

- Procurement and processing
- Infrastructure and logistics development
- Operations management
- Capacity building through training and extension
- Research and knowledge transfer

The supply chain of any organisation has to come across various adverse situations in the form of risks and uncertainties. These risks and uncertainties often plunge to the supply chains by disrupting its flow and bring damage to it. In order to have a better performance in the chain it is highly imperative to consider the risks and uncertainties which are not usually mentioned in the set of indicators. The concept of risk and uncertainty are not being mentioned in the study made by Aramyan et al. (2007). The actual performance of the supply chain not only depends upon the set of operational indicators rather depend upon the risk factors too. Though it is difficult to generalise the contribution of each to the overall performance of the chain still there is a need to concentrate on both of these dimensions.
2.9 Conclusion

Supply chain management has emerged as one of the most sought after strategies in the organisations. It entangles all the processes ranging from the suppliers’ supplier to the customers’ customers to make the product reach the end point on time with the respective stakeholders’ satisfaction. The macro-processes which come under the gamut of supply chain are supplier relationship management (SRM), internal supply chain management (ISCM) and customer relationship management (CRM). Whilst the SRM deals with the procurement side of the supply chain, ISCM deals with the internal affairs like production and operation. CRM deals with all the processes that are required to enhance the market share and the customer satisfaction. Each strategy in the supply chain are inextricably related to each other without which the there may be a chance of supply chain breakdown or sub-optimal level of overall value generation. On the contrary the benefits of the practices are manifold and appear in the form of enhanced supply chain performance. With respect to the study macro-processes of the supply chain at each level of the supply chain are discussed so as to make it wide and more practical. The views of academicians, researchers and practitioners have been reiterated in the chapter to the make the study more precise and logical without making any change in the sense and represented in the same order what they are meant to talk about.

2.10 References


Fodder shortages in Chittoor district of Andhra Pradesh. (2010, April 22). *Times of India (Hyderabad)*, p. 4.


