CHAPTER VIII
SUMMARY AND CONCLUSION

The present chapter portrays the summary of findings starting from the level of milk producers to the customers of the supply chain along with necessary recommendations to improve the sector. It may be noted here that most of the variables (representing a component) are treated from a supply chain perspective and hence efforts are made to correlate them with cost, profit and stakeholders’ satisfaction.

8.1 Milk Producers as Suppliers

In this research, necessary care has been taken to analyse the profitability of the stakeholders participating in the supply chain. Milk producers are the suppliers of the dairy food supply chain so without their participation the dairy industry will come to a standstill position.

8.1.1 Man-woman participation in dairy farming

Dairy farming as a profession basically practiced in the rural and suburban areas in anticipation of extra earnings during leisure time and getting access to consumption of milk as well. Even though both man and woman participate in the process, it is the man who dominates woman in the process. It is observed that man-woman ratio in the profession is 58:42 in the state of Orissa while it is 72:28 in the country. The trend is increasing both at the state and the national level to encourage woman participation so that while man can go out for the agriculture related activities woman of the family can take care of the cattle and help the family to earn more. It may be noted here that the state of Orissa is on the top of the man-woman participation list in the country followed by Tamil Nadu and Himachal Pradesh.

8.1.2 Main vs. subsidiary occupations

Agriculture or cultivation together with dairy farming is the most sought after profession (more than two third cases) found in the rural areas at the grass root level. But due to marginal land and low cattle holding (with one or two cattle), the earnings from the sources do not contribute much to their income and standard of living. Also the common matter of fact “higher the land holding higher the cattle holding” is proved to be wrong at this stage. As a repercussion of small cattle size milk production is found to be drastically lower and not to be contributing to profit and income. It has been seen that below 16 litres
of milk production per day (with no more than two cows) there is no scope for profit irrespective of professions. Almost in two third of the cases negative profit and hence a negative ROI is detected.

8.1.3 Participation at the societies

Dairy cooperative societies are set up within the approachable distance from the milk producers’ houses so that the collection of milk would be easier and perishability can be minimised. In the study two third of the milk producers’ houses are found situated within the radius of one km from the societies and hence “walking” is detected to be a preferred mode of conveyance.

As long as the milk producers’ participations with the cooperatives are concerned it is found that, initially the milk producers try to sell their produce at the nearby markets but due to excessive competition in the unorganised market and lack of accessibility to these markets, they ultimately participate in the society by taking its membership. This comes as a fact when it is found that the average year of experience in dairy farming of a milk producer is more than the average year of time spent in the society. But in one third of the cases it is found that due to inaccessibility or unavailability of society in a particular locality, milk producers are compelled to look for other alternatives to sell their produce.

8.1.4 Driving forces of society participation

Among the members, two different categories are observed namely pouring and non-pouring. The pouring members are those who are selling their produce on regular basis where the non-pouring members are just members on the roll. This is due to the anticipated benefits from the supply chain drags them to join these societies but when remains unfulfilled they quit in a guised way – with an average attrition rate of 40 percent. On the other hand the non-remunerative milk price is found to be responsible for higher attrition rate. However availability of fodder at reasonable price (27 percent variability), hassle free sales (17 percent variability) and empowerment through education (13 percent variability) are the major driving forces observed behind someone’s participation at the dairy cooperative society.

8.1.5 Milk production and seasonal variations

The mean milk production capacity of the cows fluctuates with the periods namely flush season and lean season. The flush seasons starts in the month of September and continues
till February and lean season starts at March and ends in August. It has been experienced that, on an average flush season milk production capacity of cows is 30 percent higher than the lean season. During the flush season there is a scope for the cows to get green fodder which subsequently decreases with the onset of summer (dry period). The production is also found to be affected by the cow’s calving. As the cows come closer to their calving the yielding decreases and increases further after the calf is born.

8.1.6 Range of milk production

The production ranges from 1.5 litres to as high as 100 litres per day depending upon the capacity of the milk producers. The higher milk production is from the bigger farms with having seven or more high yielding cows at their disposal. It is found that 80 percent of the producers produce “less than 18 litres” of milk per day (both morning and evening shifts) with an average of 13.6 litres. The milk production per cow per day found to be ranging from 1.5 to 26.3 litres (3 sigma level) with an average of seven litres.

8.1.7 Factors affecting level of milk production

This is already verified that the milk production level varies linearly with the expenditure incurred on the feed and fodder. But due to low financial background, two third of the milk producers are striving it hard to feed their cattle which ultimately reducing their production level. Though it is slightly an expensive affair to rear high yielding cows (e.g. jersey cows) still more than two third of the milk producers have owned at least one jersey cow in their shed and are able to produce more than four litres of milk per day. It is seen that due to upkeeping of the indigenous cows the average milk production level comes down. Even though people know that the indigenous cows are low yielding still they rear them for the sake of spiritual reasons and perceive that food values of this category milk is higher than other category cows.

8.1.8 Quality of milk produced

Quality of milk varies with the fat and SNF (solid-not-fat) concentration in it and is termed to be the total milk solids (TMS). If one of the components goes down the quality level decreases and the price of milk also comes down bringing loss to the milk producers. The average TMS level is found to be 12.0 percent ranging from 11.1 to 15.3 percent. The federation these days is deducting milk price proportionately upon not meeting the prescribed TMS level of 12.5. The quality is much dependent upon the cattle species e.g.
the TMS level of jersey cows is higher than the indigenous cows and crossbred cows. The expenses on fodder and medicines also are found to be an influencing factor for the quality of milk produced.

8.1.9 Factors of cost of milk production

The cost of milk production depends upon various factors namely infrastructure, equipments as fixed cost items upon which the depreciation is calculated. Under the variable-cost category feed and fodder, medicine and concentrate, labour etc. are taken into consideration for calculating the cost of production.

It is observed that more than half of the cost is incurred for the feed and fodder, another quarter is incurred for the health and medicines. Labour is comparatively cheaper in the rural areas and hence the investment for the factor is low. In most of the cases it is seen that, dairying is a subsidiary profession where people devote their spare time for milk production and hence imposing of outside labour for this activity is found in farms with more than five cows. Since labour cost is one of the major factors of milk production hence it has been given due weightage in the list of factors even though milk producers opine it to be their spare time job. It is seen that the cost of milk production decreases with the increase in milk production up to a certain level and increases further.

8.1.10 Cost of milk production

Neglecting the outliers of the cost of milk production the minimum of it is found to be Rs.10/lt where the level of milk production is 50 litres per day. Otherwise the cost of production is varying from Rs.5.45 to Rs.20.85 per litre depending upon the level of milk production. The mean cost of production is evaluated to be Rs.14.77 per litre where almost 60 percent of the milk producers’ costs of production are found to be falling in the range of Rs.9.30 to Rs.17.

8.1.11 Variables affecting cost of milk production

Again at a constant milk production level, increase in the cattle size will substantially increase the cost of production. It is seen that at 50 litres level of production, with the help of two jersey cows, cost of milk is found to be Rs.10/lt whereas addition of one more cows increases the cost up to Rs.15/lt (50 percent). In this way the cost of production will decrease if the average milk production per cow per day increases. There could be several other combinatorial factors but level of milk production and fodder are the most vital
factors as they substantially influence the cost of milk production. One unit of increase in these variables will respectively decrease and increase the cost of milk production by Rs.1.40 per litre (almost 10 percent) and one unit (same percent of feed and fodder cost) subject to same infrastructural conditions.

Quality of milk (TMS level) also has an indirect effect on the cost of milk production as it gives more profit to the producers. Moreover rearing of buffaloes in the system increases the TMS level and hence higher profit can be earned. This is due to the fact that buffaloes do not need any extra care and hence rearing more buffaloes in the shed gives the more benefit. But this is opposite in case of cows, as extra expenditure has to be incurred on their feeds, health and medicines which more than offsets the costs without giving any additional advantage to the milk producers.

Apart from the level of milk production and various costs; demographic factors like age, gender, land holding, cattle holding and experience in dairy farming are found not to have any significant impact on the cost of milk production. Even the landholding which compensates the cost of feed and fodder has got a low correlation (0.10) with the cost of milk production. It also refutes of the higher correlation between the landholding and cattle size – in the sense that those with higher lands may not necessarily have opted dairying as a subsidiary profession and reared more cattle and vice versa.

8.1.12 Household milk consumption and sales

Though there is an increasing awareness among the consumers for milk consumption still due to low per capita income and income of the family as a whole, affordability for the same is found not to be possible in many cases. Indirectly it is the landholding which decides the income of the milk producers’ families and found to be an influencing factor for the milk consumption. On an average 0.5 to 2.5 litres of milk per day is kept for the household consumption depending upon the rate of production and family size.

There is a difference noticed in the sales and surplus milk at the households of the producers. As the milk producers are the members of the dairy cooperative societies, they are supposed to sell the surplus milk entirely to them but deviations are detected in some cases which indicate existence of informal selling. This is due to the non-remunerative milk price at the DCSs makes them demotivated to sell their produce entirely. Some of the
milk producers even do not bring their surplus milk at all for which over a period of time societies comes to defunct stage if practiced on a large scale.

8.1.13 Profit and ROI

It is detected that cost of milk production in the range of “Rs.5.45 to Rs.9.30” (almost one third) the profit and ROI are positive. This is found in some places where there is a scope for the green pastures and landholding in case of a milk producer to some extent. But proper feeding with the fodder and concentrate is rarely detected in the range. The mean profit of all the producers is found to be negative whereas the profit “without the labour cost” is somewhat positive and not very lucrative too. In almost two third cases the profits are negative and so is the return on investment. Another 22 percent of milk producers make a profit of less than Rs.1,500 per month. But if the profession is treated to be a part time affair and labour cost is not taken into consideration then the profit is slightly improved and negative profit is found to be in 22 percent of the cases.

On an average the loss per litre is found to be Re.1 in the sense that if the cost of production is Rs.14.77 per litre then the sales price is coming to be around Rs.13.77 litre with a TMS level of 12.5 percent. The sales price of milk on meeting the stipulated quality standards (TMS of 12.5 percent) is Rs.13.76 per litre as is fixed by the federation.

8.1.14 Variables affecting profit and ROI

The ROI is negative indicating the lack of profitability of dairy farming as a whole. The cost of milk production in most of the cases is found to be higher than that of the selling price at the cooperative societies. The quantity of milk production is another barometer which decides the profit level and the return on investment. It has been observed that the profession is profitable if the minimum level of milk production is about 16 litres per day supported with two cattle.

Penalty on the milk is charged when the minimum TMS level is lesser than 12.5 percent. In almost two third cases the TMS level is found to be 12 (mode) which is found to be subjected to penalty. This penalty system reduces the sales, profit and ROI and leads to discontentment among the milk producers. Further the high cost of milk production brings down the profit and subsequently reduces the return on investment. It is inferred that due to higher cost of production, non-remunerative price and penalty on low TMS, the profit
and ROI are becoming low and leading to discontentment among the milk producers and making them demotivated towards dairy farming above all.

8.1.15 Level of satisfaction being with the supply chain

Since the milk producers are the suppliers of the supply chain, it is highly essential to know their overall satisfaction and level of commitment to make it more competitive. Managing costs of milk production, improving risk coping efficiency and overall performance are all found ending up with negative results. The milk producers’ are not much benefitting from the supply chain. On the contrary the level of satisfaction is found to be an average one (3.19 score on scale) which could be attributed to the satisfactions derived from the factors like hassle free sale and regular payment (input provider) of the system. So it is inferred that joining and remaining in the supply chain for a long time may not necessarily be a value addition for the milk producers unless due price is given them for their produce.

8.2 Dairy Cooperative Societies

Dairy cooperative society (DCS) collects milk from their members twice a day and send it to the specified bulk milk cooler (BMC) through the head loader. The head loader not only carries the collected milk to the BMC rather help the secretary of the DCS in disbursing other activities too.

8.2.1 DCS organisation and membership

It is observed that only one in every four milk producers in the rural areas is associated with the society which shows the inefficiency of societies to organise milk producers into the supply chain. There are villages found with all milk producers as members of the concerned societies while in some other cases the participation is as low as four percent. Out of the average memberships at these organisations, the women play a dominant role with more than 50 percent of the memberships. Again among the enrolled members two categories are detected viz. pouring and non-pouring which is already discussed in the milk producer segment. Respectively 42 percent and 43 percent of the DCSs are found to be operating with “less than 50” and “50-100” members whereas only in 16 percent cases membership base is seen to be more than 100. The average membership found in a typical DCS is around 70 and is going up to the level of 250.
8.2.2 Reason behind DCS formulation

It is observed that high marketable surplus of milk in a particular area is the major driver of DCS formulation whereas the union initiative comes next as an effort. Rests of them have been set up with an intention of getting self employment and is found to be an initiative of unemployed locals. Almost two third of the functional DCSs are found to be registered as per cooperative guidelines whereas the rest are not registered but functioning at par with the registered DCS.

8.2.3 Years of operation and coverage area of a DCS

While some of the DCSs are quite new, some are as old as more than 20 years covering a minimum of three revenue villages with an area of 6.4 sq km. The area of coverage is found to be ranging from 0.5 sq km to as high as 45 sq kms with a maximum distance of 29 kms from a BMC. It is seen that some of the DCSs are recently converted to BMCs due to higher influx of milk and hence in the same place both DCS and BMC operate.

8.2.4 Member - waiting time for delivery

The waiting time of the members on the queue to deliver their produce depends upon the total pouring members of the society present on a given point of time. Thus higher are the pouring members the more will be the average waiting time of a member to deliver. It is quite relative and found to be varying from society to society. It is seen that in few places people are waiting for more than 20 minutes while at some of the societies within two minutes they are served. Today the automated milk collection units (AMCU) at the society level also reduces substantially the waiting time of the milk producers but is yet to be implemented in the state. In this respect Gujarat is much ahead and is an ideal case for all dairy federations.

8.2.5 Milk collection – quantity vs. quality

The collections of milk during lean seasons are seen to lesser by 30-40 percent comparing to the flush seasons. The average society milk collections in flush and lean seasons respectively are found to be 139 and 88 litres per day, with a mean of 113 litres per day (taken flush and lean together). The minimum and maximum collections are found to be respectively varying widely over “5 to 490” litres per day indicating a high degree of dispersion in milk collection. In some of the cases, though not binding, a target is fixed by the supervisors of the union in milk collection. In that case, the fill rates (actual/target) are
varying from 30 percent to 175 percent with a mean of 78 percent. The average TMS level of these societies is found to be varying between 10.6 and 15.4 percent indicating impose of penalty in certain cases.

8.2.6 Factors affecting level of milk collection

In order to determine the factors behind the level of milk collection some of the respondents’ profile and field characteristics have been considered. Educational background of the secretary or supervisor, producers’ participation with delivery and the pouring members’ contribution to the milk pool are found to be positively affecting the level of collection. On the other hand mere participation of the milk producers in the system, irrespective of the reasons, is found to have no/negative impact on the level of collection. Though it is supposed to hike the collection still the low pouring memberships due to the disloyal nature of some members and/or non-remunerative price of milk are observed to be major impediments. It is as good as not to have the rest of the members since they do not contribute to the system.

It is found that higher pouring memberships adding value to the collection irrespective of individual member’s pouring capacity. Each additional committed member will increase at least 1.5 litre of milk collection per day which is an average collection from a member detected in almost half of the cases. Excepting these variables other variables like age of the secretary, registration status of the society, reason behind the society formulation, operational area of the society etc. do not have substantial contribution to the milk collections though they are supposed to contribute to the process.

8.2.7 Average delivery of a producer-member

It is seen that the milk producers in the states of Gujarat, Rajasthan, Punjab and Orissa are delivering respectively 3.07, 2.44, 2.39 and 1.69 litres of milk per day to the dairy cooperative societies as against national average of 1.81 litres. The small quantity of milk when procured from millions of farmers, though meeting the of requirements the dairy federations but not improving the standard of a typical milk producer who owns just “one to two” indigenous or crossbred cattle at his house. The issue here is not just to rear cattle for the sake of consuming milk and selling the surplus to the society rather it has been considered from a supply chain view point where cost and profit are the prime concern.
8.2.8 Cost price of milk

Excluding the cost of collection, the cost price of milk at this stage is varying from Rs.11.23 to 17.12 with a mean of Rs.13.69 per litre, which is being paid to a member producer upon delivery. The fluctuation in cost of milk is found to be Rs.0.80 per litre which depicts that, almost all DCSs’ payment is varying from Rs.11.29 to Rs.16.09 per litre (3 sigma levels).

8.2.9 “Factors and cost” of milk collection

Keeping view to the average milk collections and the TMS level, the cost of collection has been calculated. The DCSs expend very little towards their day to day activities pertaining to house rent, electricity charges, sanitary wares etc. Almost all the societies operate in the rented houses out of which only five percent of them have got artificial insemination facilities (AI). Including the electricity and other charges a mean expenditure at this level has been found to be Rs.350 per month irrespective of the collections. It may be cited here that there is a low degree of correlation found between the level of collection and the expenses incurred. Only seven percent variability in the monthly expenses is found to be attributed to the average milk collections.

The mean cost of collection is calculated to be Rs.0.21 per litre irrespective of all expenses. Initially the cost of collection is very high where the level of collection is less than 50 litres per day. Gradually with the increase in the level of collection, the cost comes down and remains stagnant afterwards. A close look at the cost vs. level of collection curve ensures the trend to have ended with the collection of 100 litres per day beyond which the level of collection does not have any effect on the cost of collection. Other kinds of costs e.g. secretary commission, remuneration for the head loader etc. is borne by the union and hence societies do not have to expend anything in this regard.

8.2.10 Sales and receipts

It may be noted here that the DCS collects milk from the members in terms of litres whereas sales are made in terms of kgs. So the litre-kg variation gives additional profit to the society and is a source of earning. Due to higher specific gravity of milk it is heavier than water and weighs three percent more in mass.

The sales turnover of a DCS, on an average, is found to be 3,512 kgs per month with a standard deviation of 2,901 kgs. It is seen that around half of the DCSs collect less than
100 litres of milk per day in both the shifts (morning and evening) with a mean shift collection of 50 litres. Considering the collections, fat and SNF price and sample collection (10 ml of milk collected separately as sample for detecting the TMS level from each milk producer) the sales turnover are calculated. The minimum and maximum sales turnovers are Rs.2,419 and Rs.208,910 respectively, where more than half of the DCSs have a mean sales turnover of Rs.49,534 per month. In some cases, the net receipts are calculated after a due deduction as penalty upon not meeting the prescribed TMS level. It has been seen that almost half of the DCSs are not meeting the specifications and liable to pay penalty thereto. Many a time, they complain that, the specified TMS level is an ideal case and in order to achieve the same high yielding cows need to be reared and is an expensive affair for most of the members.

8.2.11 Profit and ROI

It is seen detected that the sales price at this stage is varying from Rs.11.74 to Rs.17.93 with a mean of Rs.14.34 per litre after due deductions. The minimum and maximum profits per litre of milk are seen to be Rs.0.51 and Rs.0.81 respectively, with an average of Rs.0.64. The total profit at this level is the profit made from sales of milk as well as sale of fodder and medicines, which is usually provided to the members at a subsidised rate. The profit made from the fodder and medicines is quite nominal and is in interest of the members. The total profit is found varying between Rs.119 to Rs.12,222 per month depending upon the level of collections. The net profit after all operational costs per month is again found to be varying between Rs.-372 to 11,422 which is slightly lesser than the profit before meeting the monthly expenses with an average of Rs.2,500.

As is said previously only a few DCSs operate in their own houses while others operate in the rented houses with a mean asset level of Rs.56,262 including the Milko Tester. The Milko Tester is usually provided by the union to the DCSs on credit and is recovered from them over a period of time on instalment basis. This particular cost is not taken for consideration here since most of the cases the amount accrued are found to have been recovered. Since the DCSs are operating with comparatively lower investments, there is a higher scope for them to earn profit and make their ROI as positive (mean of 70 percent). It is seen that, only five percent of the DCSs have a negative profit, thus making them to have a negative return over their investments.
8.3 Bulk Milk Coolers

BMCs or the chilling centres chill the milk collected from the DCSs, at around 4°C temperature and subsequently send it to the production plant for further processing. Once in a day, the milk is collected by the tankers from the respective BMCs as per the route assigned to them. The tankers are maintained at around 25°C - 30°C temperature in order to transport the content without damage till the production plants.

8.3.1 Infrastructural status and processing capacity

Keeping view to the marketable surplus of milk in a particular area the BMCs are set up by the union/federation by getting funds from central, state or non-government agencies. The funding agencies finance the union for purchasing machineries and equipments whereas the federation provides land and building in most of the cases for a BMC to be set up. Two third of the BMCs are found to have their own infrastructure whereas another one third of them are found depending upon the rented houses for their day to day operation. On an average one fourth of the total expenditure is incurred for the required building whereas the rest is expended for the machineries.

8.3.2 BMC operational area

The minimum and maximum distances of the BMCs are found to be respectively 25 and 125 kms with a mean distance of 71 kms from the production plant. The BMCs are found operating with an average area of 75 sq kms and DCS base of 11. The DCSs are generally found in the interior of the rural areas whereas the BMCs are seen in the urban or semi-urban areas with proper road connectivity. The average distance of a BMC from the DCSs is around seven kms with a minimum and maximum distance of 2.5 and 13 kms respectively. It is also seen that the average number of milk producing members under a particular BMC to be 557 with a minimum and maximum of 55 and 1,700 respectively.

8.3.3 Procurement of milk and capacity utilisation

The average collection and chilling is found to be around 800 litres (824 kgs) per day at a typical BMC. As a whole the unions through these 33 chilling centres are found to be procuring 26,000 litres of milk per day. The average chilling or the machine running time is found to be seven hours per day with a standard deviation of two hours. It can be further seen that, the minimum and maximum machine running time per day are respectively
three hours and 12 hours. Due to lack of milk procurement, the average capacity utilisation of most of plants is below 50 percent indicating the under-utilisation of machineries.

**8.3.3A Factors affecting procurement level**

It is detected that higher DCS coverage and producer memberships contributes positively to the level of milk procurement. The operational area is negatively impacting the milk procurement at these BMCs. The larger is the area coverage by a particular BMC, the lesser is the supervision and monitoring, and hence lesser is the procurement. So in order to improve the milk procurement it is essential to have a broad DCSs coverage and the active participation (pouring) of the members in those societies.

**8.3.4 Cost of purchasing**

According to the level of purchasing as mentioned previously the minimum and maximum costs are depicted to be Rs.54,210 and 1,460,760 per month respectively with a mean of Rs.352,284. It may be noted here that the deductions are not always a factors where the TMS level is more than 12.5 percent. In around 80 percent of the cases there is no penalty imposed on the DCSs and hence the purchasing cost before penalty is same as the purchasing cost after penalty. The penalty is applicable for both upstream and downstream members in this case. The total purchasing is calculated to be Rs.16,909,632 for the entire month which is being expended by the unions for meeting purchasing costs. There is an average deduction of Rs.44,928 per month from the payment of the DCSs due to lesser TMS. On the other hand, an average of Rs.936 is deducted per society per month who does not meet the specifications.

**8.3.5 Sales turnover and selling price**

The minimum and maximum sales turnover are found to be Rs.61,050 and Rs.1,645,650 respectively per month with due penalties. In almost 70 percent of the BMC cases there is found to be no penalty whereas the rest pay penalty due to their low TMS level. The mean and standard deviations in this case are respectively Rs.396,871 and Rs.357,644. The average sales turnover of the unions is reported to be approximately Rs.19,049,808 per month. The union on an average pay Rs.50,688 (0.26 percent of sales) as penalty where the average BMC level penalty is found to be Rs.1056 per month. The sales price of milk is ranging between Rs.14.09 and 20.42 with a mean sales price of 16.48 and a profit of Rs. 0.09 thereto.
8.3.6 Cost of chilling and transportation

The cost of collection of milk is observed to be ranging between Rs1.23 and Rs.2.49. The average cost of collection is found to be Rs.1.76 whereas the standard deviation is Rs.0.28. Though the milk procurement is not substantially affecting the cost of collection still 15 percent of the variation in it could be attributed to the average milk collection by the BMCs. The cost of collection is low for the BMCs who are procuring minimum 1,500 litres of milk per day irrespective of their capacity. The cost of collection for these units is around Rs.1.58 per litre of milk.

Transportation is the major cost head accounting for 32 percent of the total operational costs followed by “salary and wages” (25 percent) and secretary commission (19 percent). Electricity (chilling) cost is another major head of expense accounting for 18 percent and all other expenses (maintenance and miscellaneous, house rent and depreciation) constitute a mere six percent of the total operational costs. Among all the major heads of expense - transportation, salary & wages and commission of the secretaries are responsible for more than 75 percent of the total expenses.

8.3.7 Profit and ROI

On an average, the profit before expenses is found to be Rs. 1.85 per litre of milk across the BMCs. After meeting various expenses it is seen that around 40 percent of them are making profit and hence their ROI is positive. In the rest of the cases the lack of profitability and negative ROI can be attributed to the lack of procurement. These loss making units over a period of time becoming sick and the unions decide to close them by stopping operation in the corresponding areas. The procurement variations could be attributed to the high proportion of local milk marketing leading to defunct of the BMCs and making losses to the unions. The net ROI of the union on behalf of all the BMCs is observed to be 5.6 percent.

8.4 Production Plant

Once the milk is delivered at the door step of the production plant, it is further taken for other processes like clarification, standardisation, pasteurisation etc.

8.4.1 Capacity utilisation vs. milk procurement

Except paneer the production capacities of the various products have been under-utilised so far. Though there is a tremendous potential for the dairy to grow, due to lack of milk
procurement it’s unable to produce the desired quantity of the products ultimately putting the capacity utilisation at a lower level. In certain cases due to lack of demand for a particular product in the respective operational area the production is adjusted to match the supply and demand. But above all especially in the lean season the production plants suffer due to lack of procurement and hence the production processes for the various products get hampered.

8.4.2 Cost of processing at plant level

Table 8.1: Cost of processing (figures are in percent)

<table>
<thead>
<tr>
<th>Expense heads</th>
<th>Milk (toned)</th>
<th>Milk (double toned) and products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>85</td>
<td>78</td>
</tr>
<tr>
<td>Processing</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Packaging</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Administrative</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Total cost</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Around 80 percent of the total cost is incurred towards the raw material acquisition followed by processing and administrative expenses. Packing costs are found to be varying from product to product depending upon their nature.

8.4.3 Quality and safety issues

The safety aspects of the plant covers three basic constituents namely men, machineries and materials. Adequate measures are being taken by the plant to prevent hazardous incidents which are intact in the production processes. In order to facilitate the process in the organisation adequate training and education programmes for the staff are arranged both by the federation and NDDB.

8.4.4 Transportation by third party logistics providers

Transportation plays a vital role in the effective and efficient performance of the supply chain. Today, in order to minimise the supply chain costs most of the activities of the firms have been outsourced. This is in accordance with the competitive strategy which the firms go on changing from time to time. In order to cope with the competitive environment, some of the firms are having a combination of both in-house and outsourced
transportation. This is greatly influenced by the firm’s nature of business and the size of the shipment.

**8.4.4A: Operating cost and receipts for transportation**

The various factors which are responsible for the aggregate transportation costs are fuel, maintenance, salary, trip related costs etc. It may be noted here that for transportation; fuel, depreciation and maintenance costs account for around 70 percent of the total operating costs. On the other side, the operating cost for out-bound transportation is found to be Rs.7.16/km where the receipt from the plant is Rs.7.60/km (average). In addition to the costs incurred by the third parties to deliver the goods to the retail outlets, they get Rs.50/day extra towards their vehicle insulation charges which is a pre-requisite to hold the tender and carrying on operations. On an average, for both in-bound and the out-bound logistics 5,000 kms is covered per day to get the products reach to the end users. From the plant side an amount of Rs.20,657 per day is expended towards transportation cost with an average of Rs.7.60 per km (receipt of the third party logistics). It is found that the average transportation cost per litre of milk is Rs.0.64 with a minimum and maximum of Rs.0.16 to Rs.1.78 respectively according to the distance covered by the vehicles.

**8.4.5 Sales and profit**

Currently the liquid milk market is estimated to be around 60,000 litres per day (approximately), out of which 50 percent is shared by the dairy while the informal milk market contributes to 45 percent of the same and the rest is shared by the private firms. In case of organised milk marketing, it is the dairy which contributes to more than 90 percent of the market while less than 10 percent of the market is captured by the private dairy processors. The initial outlay of the plant which was Rs.100 millions has now reached at Rs.241 millions over a period of last 10 years. The plant is growing at the rate of 10.0 percent in its operation annually with an ROI of 6.0 percent.

**8.5 Retail Operations**

Due to the good brand image and demand of cooperative based products it is found to have virtually a competition among the unemployed youths to acquire the agency to sell the brand. Moreover those who have got the agency are found to be making good money out of the business except a few who retail the products with an intention of expanding
their parent business (7.3 percent) and hence can’t concentrate on the later. Without the loss of generality it can be said the concerned business is a profitable one.

8.5.1 Retailer operational area

The retail outlets which are scattered in various geographical regions found to be operating being at a maximum distance of 120 kms from the production plant. Since the products are highly perishable in nature and need conditioned transportation, distributing in a circle of more than 100 kms radius found to be a difficult task for the plant. The higher distance from the plant sometimes is found to be a problem for the retail outlets to get the products on time and in adequate quantity as desired. In order to facilitate sales in various areas and avoid conflicts among the retailers the federation has endorsed one retail outlet in the radius of 0.5 km. But in certain cases deviations are found leading to conflicts among the retailers.

8.5.2 Sales of dairy products: The mean sale of milk by a typical retail outlet is seen to be close to 200 litres per day with a maximum of 950 litres depicting a greater spread over the milk sales. In case of milk selling the federation has kept an incentive provision of one pouch free for every 50 litres of order. The promotional milk supply provision is meant for generating more sales and revenue which in turn attracts the retailers to order for more quantity. Out of the total milk received from the plant, it is seen that around 65 percent is sold at the counter whereas the rest is sold through home delivery.

It is seen that respectively 44 percent and 24 percent of the total sales are attributed to the counter milk sales and milk sales through home delivery (higher gross profit ratio). So only milk sales constitute almost two third of the total sales per day and is a major source of earning for the retail outlets. Other demanding products are paneer and sweet curd which constitute another 16 percent of the total sales made during the day. Other products don’t have substantial sales; still add to the sales in varying degrees.

8.5.2A: Sales, expenses and profit

The minimum and maximum annual sales are found to be Rs.185,000 and Rs.9,522,600 respectively with an average of Rs.1,822,220. Since retailing of this kind of products is found to be a low investing and high profit making business concern interest among the shopkeepers is quite prevalent. With an average investment of Rs.45,000
annual sales turnover is found to be manifold in many cases which in turn making the business a profitable one.

The major expenses are wages detected to be house rent and electricity charges which constitute almost 75 percent of the expenses. In total an average amount of Rs.3,779 is expended by a retailer to meet all the expenses out of which wages for the labourers contribute maximum i.e. 37 percent followed by house rent (20 percent) and electricity charges (16 percent). Here “wages & salaries” and electricity charges are found to be major expenses (more than half).

It is also detected that in order to have higher sales, it is essential to incur more expenses towards these two major heads. The minimum and maximum expenses are found to be respectively Rs.617 and Rs.16,758 with a standard deviation of Rs.2,732 per month. The mean profit before taxes (after expenses) is found to be Rs.8,764 ranging from Rs.644 to a whopping Rs.52,896 per month. Return on investment is also very high as the mean profit after meeting all the expenses is a catching figure.

8.5.2B: Factors affecting retail sales

Unlike milk production which has been seen to be a women-centric activity; selling of dairy products is a man centric activity. Definitely higher investment leads to higher sales but the higher operational area is found not to be influential in sales since demand is not increased at par with the increase in the operational area. Other demographic factors are found to be ineffective for the retail sales. Higher distance from the plant, product shortages etc. are found to be negatively influencing the sales expansion.

8.5.3 Retail fill-rates

The minimum and maximum product fill rates (PFRs) are respectively found to be 30 percent and 95 percent. In contrast to this minimum and maximum order fill rates (OFRs) are found to be 20 percent and 90 percent respectively. Especially for packaged milk the PFR of 77 percent indicates that 23 percent of the market is lost because of lack of product availability. It’s also observed that due to lack of availability of dairy products (e.g. ghee) the PFR is low which in turn lowers down the overall OFR of the retailers.

8.6 Customers: The End Users

Customers are the epicentre of any business concern. The supply chain makes profit and increases the overall value, if the customers are satisfied with its output.
8.6.1 Per capita milk consumption

The existence of any business or supply chain indispensably depends upon the end users or customers of its products or services and hence no supply chain can be thought up without their active participation. The factors influencing the buying behaviour of a person are income, education, size of the family, flair for milk consumption and so on. The per capita milk consumption is found to be 270 gms per day whereas the minimum and maximum are found to be respectively 56 gms and 1,000 gms. The standard deviation in this case is detected to be around 146 gms per day which shows the fluctuations in consumption trend among the consumers according to the standard of living. The per capita consumption of milk is found to be more than the per capita availability in the country (national average of 246 gms per day).

8.6.2 Factors affecting expenditure on milk

Among all the important demographic characteristics of a person it is seen that income influences positively the expenditure to be incurred on milk and its derivatives. It is observed that as people jump from lower income group to higher income group they usually prefer to order the packaged milk from their houses where the payment is made to at the end of the month. It is observed that there is a sharp rise in expenditure when people move from lower income group (less than Rs.10,000 per month) to higher income group (Rs.20,000 to Rs.30,000 per month). The slope of the curve is higher at the origin part comparing to the slope at the subsequent part of it, indicating that the highest change occurred at the first two income groups which necessarily influence the expenditure on the dairy products. Accordingly the per capita consumption of milk varies from just 56 gms to 500 gms with a mean of 270 gms. Education and size of the family are also observed influencing the expenditure to be incurred on milk and allied dairy products.

Many a times due to inflation and the resource constraints the companies are compelled to increase the price of various products and services. But consumers are found to remain indifferent towards the expenditure which shows the inelastic behaviour of the premium product sales with respect to its price.

8.6.3 Driving forces of brand purchase

Retailer availability, product availability, quality, safety and price are five driving forces for making a purchase but it is the quality and safety of the product which take a pivotal
role in the process. In some cases retailer availability and price of the product are also seen to be important criteria especially for the people who are earning less than Rs.10,000 per month.

8.6.4 Customer satisfaction

There are seven different factors detected which are responsible to bring almost two third of the variability in the customer satisfaction namely:

i. Packaging and labelling of the products;
ii. Safety and reliability of the products;
iii. Taste of the products;
iv. Accessibility of retailers;
v. Responsiveness of the retailers;
vi. Reliability of retailers and
vii. Customer centric vision of the company.

Finally it is inferred that 73 percent of the customers are satisfied on the performance of the brand as a whole. On the contrary performance level of the aforesaid factors is also 73 percent in the market.

8.7 Supply Chain Cost and its Underlying Factors

The supply chain aims at minimising cost, maximising profit and above all maximising the stakeholders’ satisfaction. The cost what is being incurred starting from milk production to the level of consumption is depicted in the below given table as a cost summary.

<table>
<thead>
<tr>
<th>Table 8.2: Supply chain cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Component</strong></td>
</tr>
<tr>
<td>Milk producer</td>
</tr>
<tr>
<td>Dairy cooperative society</td>
</tr>
<tr>
<td>Dairy coop. society to bulk milk cooler</td>
</tr>
<tr>
<td>Bulk milk cooler</td>
</tr>
<tr>
<td>Bulk milk cooler to production plant</td>
</tr>
<tr>
<td>Production plant</td>
</tr>
<tr>
<td>Production plant to retail outlets</td>
</tr>
<tr>
<td>Total supply chain</td>
</tr>
</tbody>
</table>

*If procurement milk price is increased
The cost of milk production is the most critical factor where the federation has to give a thought. It has been observed that due to low level of milk production at the producers’ houses this is going up by 30 percent (average) by making it to a minimum level of Rs.13.66 per litre. It can be seen that processing cost is the highest and could be attributed to the low TMS value of procured milk which need addition of some more ingredients (e.g. skimmed milk powder). This increases the cost of processing to the tune of 23 percent which can be controlled by enhancing quality of the procured milk by proper awareness among the milk producers.

An amount of Re.1.00 is being expended towards the in-bound and out-bound transportation costs which can be reduced to some extent since the sub-optimal level of milk is transported due to lack of procurement and chilling at the bulk milk coolers. Already we have seen that the level of capacity utilisation is slightly more than 50 percent and hence the same level of capacity is being utilised for the transportation too which can substantially reduce the cost of transportation at least by 30 percent. The same percent of the cost can be reduced at the chilling centres if not 100 percent at least 75 percent of the plant capacity will be used.

Except the collection cost at the societies and the transportation cost from the production plant to the retailers, other interim costs can be reduced substantially if due planning and implementation of some of the processes will be into force. If these figures have been analysed properly, the interim supply chain cost could be reduced from Rs.8.26 to Rs.3.68 (55 percent). Similarly the product price could be reduced by 40 percent from Rs.21.92 to Rs.13.24. On the other hand the benefits out of this could be shared with all the stakeholders in the system so as to make them feel that they are part of the system and their participation is not only for the supply chain rather for their individual gains too.

8.8 Supply Chain Profitability

According to the current practice, the price of milk being paid to the producers is less than what they deserve. On an average their earning per litre of milk is 10 percent lesser and the introduction of the penalty system due to low TMS are making them lost in the business and hence withdrawing from the profession is quite natural. This is not only putting their lives at stake rather bringing great loss to the supply chain in procurement. Though this is realised that the producer participation and procurement are the two major susceptible areas still not much initiatives are being taken to make the supply chain
competitive in the long run. Societies somewhat are making profit and hence the supply chain is bit relieved of their distress. It is also observed in case of chilling centres and hence the cost of chilling is going up and in some places due to lack of procurement they are found to be defunct. In total, though the chilling centres on behalf of the unions are not making any profit, they are not incurring any loss too, so are in the breakeven point of the profit curve.

**Table 8.3: Supply chain profitability**

<table>
<thead>
<tr>
<th>Components</th>
<th>Cost price/lt (Rs.)</th>
<th>Processing/collection cost/lt (Rs.)</th>
<th>Total cost/lt (Rs.)</th>
<th>Selling price/lt (Rs.)</th>
<th>Profit/lt (Rs.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk producer</td>
<td>14.77</td>
<td>0.00</td>
<td>14.77</td>
<td>13.66</td>
<td>-1.15</td>
<td>Loss making</td>
</tr>
<tr>
<td>Dairy coop. society</td>
<td>13.66</td>
<td>0.21</td>
<td>13.87</td>
<td>14.48</td>
<td>0.61</td>
<td>Profit making</td>
</tr>
<tr>
<td>Bulk milk cooler</td>
<td>14.48</td>
<td>1.76</td>
<td>16.24</td>
<td>16.29</td>
<td>0.05</td>
<td>Breakeven</td>
</tr>
<tr>
<td>Production plant*</td>
<td>16.29</td>
<td>5.63</td>
<td>21.92</td>
<td>19.30</td>
<td>-2.62</td>
<td>Loss making</td>
</tr>
<tr>
<td>Retail outlet</td>
<td>19.30</td>
<td>0.00</td>
<td>19.30</td>
<td>20.00</td>
<td>0.70</td>
<td>Profit making</td>
</tr>
</tbody>
</table>

*for packaged milk only

Keeping view to the market conditions, the production plant on the other side is unable to charge higher amount for packaged milk and hence is incurring losses for the same. But the production of the dairy products compensates the loss and hence that do not feel the problems as is being felt at the procurement side of the supply chain. Among all the stakeholders the retailers are benefitting from the supply chain by making a good profit which makes their ROI as positive. In their case the investments are usually earned in a couple of years and hence there is a competition among the existing shopkeepers and public at large to get the authorisation of the brand selling.

**8.9 Identification and Assessment of Supply Chain Risks**

The risks and uncertainties faced by the upstream members harm or damage the subsequent downstream members and vice versa. So a vulnerability at any point on the supply chain directly or indirectly bring damage to it since the stakeholders depend on each other for their business operations. The inference about the risks and uncertainties are depicted in the grid. It says the higher the probability and higher the severity, higher is the risk impact. On the contrary lower probability and lower severity lead to lower level risk
and hence impact of the same is also low. Higher probability and lower severity or vice versa can lead to a risk with medium impact on the supply chain and hence depicted as medium risks. There are 15 risks detected across the supply chain as mentioned in the grid with their varying impact. These risks directly or indirectly affect the efficiency and effectiveness of the dairy food supply chain with two third variations. If these risks are addressed with due planning and implementation then two third of their impact on the supply chain can be mitigated. The impact of these risks and uncertainties across various levels of the supply chain are being discussed categorically.

### 8.9.1 Risk Grid

<table>
<thead>
<tr>
<th>Severity</th>
<th>Probability</th>
<th>Low (3 nos)</th>
<th>Moderate (2 nos)</th>
<th>High (8 nos)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Delivery risks to the plant</td>
<td>Product shortages</td>
<td>Low milching cattle</td>
<td>Illiteracy of milk producers</td>
</tr>
<tr>
<td></td>
<td>Seasonal fluctuations in production</td>
<td>Process/control/quality risks</td>
<td>Non-remunerative milk price</td>
<td>Low milk procurement</td>
</tr>
<tr>
<td></td>
<td>Incompatible price w.r.t pdt. quality</td>
<td>Moderate (2 nos)</td>
<td>Logistical risks</td>
<td>Hazard risks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Demand unpredictability</td>
<td>Lack of product reliability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High cost of fodder and medicines</td>
<td>Leadership skills of secretaries</td>
</tr>
</tbody>
</table>

**Figure 8.1: Risk grid for dairy industry**

### 8.9.2 Impact of high risks on supply chain

**(i) Low milching cattle:** Rearing of low milching cattle brings down the level of milk production and hence increases the cost at the producers’ house. It has been seen that, the higher is the production; the lower is the cost of production per litre of milk. The downstream members like the dairy cooperative societies and the bulk milk coolers in the procurement chain suffer out of the ordeal. Subsequently the production and distribution side of the supply chain also suffer and can’t fulfil the demand of the customers at the end. Due to sub-optimal level of procurement, cost of chilling, transportation, processing etc.
increase and the onus is either on the supply chain as a whole or reflected in the form of price rise of the products. Profit and ROI of the supply chain also get hampered and lead to discontentment among the channel partners.

(ii) Illiteracy or ignorance of the milk producers: Illiteracy and ignorance bring up cost of production and quality deterioration at milk producers’ level. Lack of understanding of the business facts bring down bargaining power at the DCS level and hence they get underpaid for their produce; which ultimately snatches their avocation over a period of time.

(iii) Non-remunerative price of milk: Non-remunerative price does not affect the cost or quality of milk directly but certainly won’t entice the producers from the unorganised sector to join the societies. For the existing milk producers in the society lesser price of milk does not contribute to their income & savings which make them bankrupt over a period of time. Having suffered for a long time they usually sell of cattle and get refrained from milk production. This seriously affects the level of procurement both for the union as well as for the production plant.

(iv) Low level of milk procurement: Lower involvement of the milk producers in the societies brings down level of collections and lower level of collection in return increases the cost and decreases profit. Subsequently, lower level of milk procurement has a tremendous impact on chilling and transportation. It substantially decreases capacity utilisation of the chilling plants which ultimately increases the cost of chilling and transportation. Low procurement at the downstream supply chain leads to low production and distribution at the upstream.

(v) Logistical risks: The delay in the process deteriorates production and distribution which ultimately lead to customer dissatisfaction. Since the production plant only deals with the out-bound logistics the delay in it hampers distribution processes and cause perishability to products on the way. It is explored that the logistical risks contribute to more than half of the total risks experienced at the production plant.

(vi) Hazard risks: This kind of risks, though applicable to BMCs and the production plant, still found to be a high risk factor for the transport agencies too. Once the products handed over to these agencies at the plant, the onus of these items are borne by them and any deviation in distribution lead to penalisation. So in order to make the products reach
the destination on time transporters expedite their process of delivery which sometimes brings road casualties.

**(vii) Demand unpredictability:** Unpredictability of demand in the market place doesn’t allow the retailers to put exact advance in front of the production plant. Hence sometimes the sub-optimal level of production at the plant under-utilises the machineries and leads to downtime. On the other hand when demand is very high, procurement does not support the level of production leading to opportunity losses. This happens due to very nature of milk and lack of warehousing facilities. Moreover a product like packaged (pasteurised) milk is not stored for more than four days due to loss of food values – which is an ethical issue.

**(viii) Lack of product reliability:** Variations in quality and taste of the dairy products from time to time lead to customer dissatisfaction and are apparently seemed to be threats for the federation as a whole. Though this is a problem felt by the customers, still found to be a concern for the entire supply chain since they are the epicentre of the whole process. If due attention is not given to the customer service or satisfaction then market share might come down at the downstream and indirect effect of the same might be experienced at the upstream of the supply chain.

**8.9.3 Impact of medium risks on supply chain**

**(i) High cost of fodder and medicines:** Cost of fodder and medicine constitute almost 60 percent of the total cost of production. If the fodder and medicine cost increase by just 10 percent of the market price then the cost per litre is increased by Rs.1.50 to make it to Rs.16.27 per litre (earlier Rs.14.77 per litre) at the downstream. But concurrently the selling price per litre of milk does not increase and hence the percentage of loss is found to be comparatively larger.

**(ii) Leadership skill of secretaries/supervisors:** Lack of leadership skills incapacitates secretaries and the field supervisors to disburse their duties properly. This makes them inefficient to motivate the milk producers of a certain locality to join societies too. Sometimes they are unable to put forth the demands of the members before the union/federation and hence indirectly arouse the discontentment among the member producers. Often, it is seen that skill of secretaries/supervisors do not minimise the gap between the target versus actual milk collections at the society and chilling centre level leading to low procurement.
(iii) **Delivery risks to production plant:** If the milk is not delivered to the production plant on time then the production processes get affected seriously and might increase the risk of perishability on the way and any delay in it will incur more chilling costs.

(iv) **Product shortages:** Though demand unpredictability and product shortages seem to be apparently same still is not true. While the former is felt from the downstream members (customers); the latter is widely experienced from the upstream member (production plant). This can’t cater the need of the market and sometimes leads to customer dissatisfaction (retailers and customers both).

8.9.4 **Impact of low risks on supply chain**

(i) **Seasonal fluctuations in milk production:** Seasonal fluctuation of milk production hampers the profit by increasing the cost of milk production. The milk production during lean seasons decreases by almost 30-40 percent and hence increases the cost of milk production substantially by 60 percent over the flush seasons. It is detected that the cost increases by 25 percent over the average cost of milk production unlike cost of production in flush seasons.

(ii) **Process/control/quality risks:** Operating the chilling plant with under-qualified persons may lead to hazards and put the machineries in obsolescence. Lower level of milk procurement on the other hand under-utilises the machineries. Overlapping of poly-pack machines stops the production process sometimes and delays in other subsequent processes like distribution. The probability of meeting quality related problems is found to be more than 0.60. Quality in terms of TMS decreases the earnings at all the level of the supply chain and leads to increase in processing costs. The production plant which caters the dairy product-needs of three districts with a geographical area of more than 16,729 square kms always faces difficulty from controlling (monitoring and supervision) issues related to production and distribution.

(iii) **Incompatible price w.r.t quality:** Quality and price respectively are great concerns for the customers at large. If quality is found to be inferior then it leads to customer dissatisfaction.

8.10 **Strategies to Combat High Risks**

The table 8.4 summarises the results of major risks and suggests the strategies to be undertaken in order to minimise their impact on the supply chain.
Table 8.4: Summary and strategies to combat high risks in dairy industry

<table>
<thead>
<tr>
<th>Risk heads</th>
<th>Immediate risk owners</th>
<th>Process related</th>
<th>Root causes</th>
<th>Risk type</th>
<th>Initial effects</th>
<th>Ultimate effects</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low milching cattle</td>
<td>MP</td>
<td>Procurement</td>
<td>Exorbitant price of high milching cattle</td>
<td>Endogenous</td>
<td>Low milk production, high cost of production</td>
<td>Loss/low profit, Low procurement</td>
<td>Subsidised high yielding cattle supply and loan facilities, feed management</td>
</tr>
<tr>
<td>Illiteracy of milk producers</td>
<td>MP, DCS</td>
<td>Procurement</td>
<td>Poverty, family influence, lack of interests to learn</td>
<td>Endogenous</td>
<td>Inefficiency in understanding business practices</td>
<td>Loss/low profit, lack of bargaining power</td>
<td>Providing education and training on regular intervals at the DCS level</td>
</tr>
<tr>
<td>Non-remunerative price of milk</td>
<td>DCS</td>
<td>Procurement</td>
<td>Lack of quality, policy issues</td>
<td>Endogenous</td>
<td>Discourage milk production among members</td>
<td>Loss of members at DCS, facilitate informal selling</td>
<td>Hike in price, educating the milk producers to yield quality milk with optimum feeding</td>
</tr>
<tr>
<td>Lower level of milk procurement</td>
<td>BMC</td>
<td>Procurement</td>
<td>Low milching cattle rearing, lack of producer involvement, informal milk sales</td>
<td>Endogenous</td>
<td>Lack of profit, high cost of processing</td>
<td>Defunct of DCSs and BMCs, higher processing costs</td>
<td>Motivating producers to join societies, increasing procurement price of milk</td>
</tr>
<tr>
<td>Logistical risks</td>
<td>PP</td>
<td>Production</td>
<td>Bad conditioned roads, vehicle break down, non-cooperation of retailers, perishability</td>
<td>Partly endo. &amp; partly exogenous</td>
<td>High costs, delay in distributions, perishability</td>
<td>Loss/lower profit, discontentment among retailers</td>
<td>Proper warehousing, training &amp; education to staff, coordination among stakeholders</td>
</tr>
<tr>
<td>Hazard risks (fire, sabotage etc.)</td>
<td>TA</td>
<td>Transportation</td>
<td>Accidents, political turmoil (bandhs), road blocking, bad conditioned roads</td>
<td>Exogenous</td>
<td>Delay in transport &amp; delivery, perishability</td>
<td>Loss/lower profit, loss of property and lives</td>
<td>Proper training to staff on disaster management, precautions to minimise risks</td>
</tr>
<tr>
<td>Demand unpredictability</td>
<td>RO</td>
<td>Distribution</td>
<td>Lack of experience, forecasting knowledge, non-coop. with PP</td>
<td>Exogenous</td>
<td>Sub-optimal/low profit, cust. dissa.</td>
<td>Loss of market share</td>
<td>Education and training to the retailers, collaboration with PP</td>
</tr>
<tr>
<td>Lack of product reliability</td>
<td>CUS</td>
<td>Distribution</td>
<td>Variations in quality from time to time</td>
<td>Endogenous</td>
<td>Customer dissatisfaction</td>
<td>Loss of goodwill and market share</td>
<td>Continuous quality improvement throughout the supply chain</td>
</tr>
</tbody>
</table>
8.11 Supply Chain Coordination

Internal resources, trustworthiness, commitment, information sharing, buyer-supplier relationships and joint-decision making etc. are the various parameters responsible for the supply chain coordination.

(i) **Internal resources:** In order to have a better coordination among the stakeholders it needs to have proper technology, inter and intra-personal relationships. All these items are covered in the internal sources parameter and presumed that a good coordination mechanism requires better internal resources. The internal resources could be tangible or intangible assets which are required to have a better communication process. In this way the overall score for the same have been retrieved to be 2.07 in a five point rating scale which is very low and hence the lack of internal resources found to be an impediment for the communication process.

(ii) **Trustworthiness:** Better supply chain coordination is possible when the stakeholders trust each other and act accordingly. For an example the milk producers are found to be complaining against the federation authorities stating that there is no field visits from the top officials, no proper grievance handling mechanism etc. and above all the kind of help they expect from the union is also seriously lacking. In this way they are losing their faith on the system and gradually withdraw from it in the long run. In this case the overall trustworthiness for the entire supply chain is at the level 1.84 and is a serious concern.

(iii) **Commitment:** The higher level of commitment among the supply chain partners will lead to higher procurement which will solve almost half of the problems of the supply chain. The overall commitment level of the supply chain is found to be 2.26 on a five point rating scale which depicts a below average performance of the indicator.

(iv) **Information sharing:** Information sharing seems not to be a problem for the entire supply chain with an overall score of 3.51. Though the level of awareness for the forecasting and intimation of the forecasting results to downstream members has been one of the crucial parts of the coordination process still found not to be practiced due to lack of expertise and interest to some extent. It is also seen in some cases that due to lack of trustworthiness information sharing is obstructed.
(v) **Buyer – supplier relationship:** Buyer – supplier relationship is found to attain a score of 3.07 indicating that almost in two third of the cases the relationship is maintained and hence is not an immediate threat to the coordination process.

(vi) **Joint-decision making:** In this case consultations between the interfaces and working together in certain situations are seemed to be in a better off position with having a score of 3.14. More specifically in two third of the cases this is practiced and in the rest it is not followed. So the scope of this could be enlarged by involving immediate stakeholders in all decision making processes both upstream and downstream.

(vii) **Overall degree of coordination**

Irrespective of interfaces and indicators the degree of coordination is found to be 2.65 on a five point rating scale. So it can be concluded that the degree of coordination existing in the supply chain is at an average level and hence there is a higher scope to improve further.

### 8.12 Supply Chain Performance

(i) **Efficiency:** Efficiency of the supply chain to control costs and increase “profit & ROI” is found to be 2.60 on a five point rating scale which indicates an average performance in this connection. The figure is lowering down by the less contributory score of the BMCs which are mostly incurring losses (with a score of 1.64). On the other hand the efficiency of the production plant is found to be low as the highest selling product i.e. milk is not a profitable one. Other stakeholders are seen to be performing at an average level. In aggregate the supply chain is not performing well from the view point of the cost and profit.

(ii) **Flexibility:** It is the indicator which shows the organisation’s adaptability to change its production or delivery processes to maximise profit and customer satisfaction. The procurement chain seems to be out of purview of the flexibility which is not at all a good indication. The most vulnerable part in this case is the milk producer who produces as low as 1.5 litres of milk per day and can’t be able to upkeep hybrid cattle in his shed. This is due to the low financial capability of the milk producer and non-remunerative price of milk which does not entice him/her to practice dairy farming in a fully-fledged way. So the volume flexibility is a great constrain for the entire supply chain being originated from.
the milk producers. The overall score in this regard is found to be 3.14 – a little better score than the efficiency of the supply chain.

(iii) Responsiveness: Due to low volume of production the fill rate of the milk producers has come down influencing the fill rates of entire downstream supply chain. Variations in TMS level at the reception desk of the production plant bring down the performance of the responsiveness parameter of the BMCs. Many a times, this leads to altercations and impose of penalty by the plant authorities thereto bringing discontentment among the union officials.

The production plant is found to be less agile to respond to the customers (retailers), which ultimately decreases the overall performance of the supply chain in this regard. Retail outlets sometimes deliver damaged and leaked products to the customers and demand more money than the maximum retail price on the pretext of refrigeration which leads to customer dissatisfaction. The overall responsiveness of the supply chain is found to be 2.50 (poor) which require further attention of the stakeholders.

(iv) Product quality: Product appearance, taste and safety indicators are found to be working well and hence the score for the supply chain in this case is 3.57 depicting a good performance. Especially the production plant is seen to be proactive and taking necessary action in maintaining quality of the product above all. But the price-quality mismatch of the products should be minimised to avoid customer dissatisfaction issues in the distribution chain. Among all the parameters it is the product quality which is performing better and hence the overall supply chain performance is raised.

(v) Process quality: The performances in case of working condition and chemical usages etc. are quite similar in the supply chain operations. Energy and water usages are maintained at an optimal level and found to be concerns for the production plant only. Sales promotion figures out well in the chain wherein a relatively better performance is essential in case of the retail outlets. As long as store display and the customer services are concerned, it is the retailers who need to upgrade their performance to little above than current performance (3.05). The process quality indicator scores relatively lesser than the product quality but the two variables seem to do well throughout the supply chain. The overall supply chain score in this case is found to be 3.35 – a better score than other indicators excepting the product quality.
(vi) Component-wise performance: who needs to improve where?

From the viewpoint of efficiency considerations bulk milk coolers, production plant and transporting agencies need to perform better by minimising the costs. Though minimising costs at the transporter level might not be an easier task due to high cost of fuels (keeps rising further) still a judicious planning of the distribution route might help improve their performance in this regard. Responsiveness of the retail outlets is also required to perform better in order to strengthen the distribution chain. Supply chain performance in this case is coming down due to lesser flexibility and low level of responsiveness. In order to improve the performance of the supply chain it is highly essential to concentrate on these two aspects especially at the level of milk producer and bulk milk cooler.

8.13 Supply Chain Summary

Since the flexibility and responsiveness is found to be susceptible and scoring less in most of the cases, it can be said that, “the supply chain is efficient but not an effective one”. Including the customer satisfaction and the risk coping efficiency of the stakeholders it is found to be operating at a level of 2.65 which is an average performance score. According to the discussions made in various sections of the analysis it is inferred that the supply chain to be:

- Independent (purchasing function is not strategic)
- Efficient (cost is the primary objective)
- Non-flexible (unable to change as per market demand)
- Un-responsive (low fill rate i.e. mismatch in target and actual)
- Risk averse (risk coping efficiency is low)
- Un-coordinated (degree of coordination among stakeholders is low)
- Customer centric (customers are paid due attention)

8.14 Results of Hypotheses Framed

Out of 20 hypotheses framed under various objectives 11 are found to be accepted while the rest are deemed to be rejected. The repercussions of the hypotheses could be realised with respect to their nature. The component-wise inferences of framed hypotheses are depicted in the table below.
Table 8.5: Inferences of hypothesis

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Hypotheses</th>
<th>Level</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Participating in the supply chain brings down cost of production</td>
<td>Milk producer</td>
<td>Rejected</td>
</tr>
<tr>
<td>2</td>
<td>Participating in the supply chain lowers down risks &amp; uncertainties</td>
<td>Milk producer</td>
<td>Rejected</td>
</tr>
<tr>
<td>3</td>
<td>Participating in the supply chain improves overall performance</td>
<td>Milk producer</td>
<td>Rejected</td>
</tr>
<tr>
<td>4</td>
<td>Higher is the membership higher is the amount of milk collection</td>
<td>Dairy cooperative society</td>
<td>Rejected</td>
</tr>
<tr>
<td>5</td>
<td>The larger the pouring members (low pouring capacity) the higher is the level of collections</td>
<td>Dairy cooperative society</td>
<td>Accepted</td>
</tr>
<tr>
<td>6</td>
<td>Higher pouring capacity (low pouring members) of producer members increases the level of collection</td>
<td>Dairy cooperative society</td>
<td>Rejected</td>
</tr>
<tr>
<td>7</td>
<td>The larger is the operational area the higher is the level of procurement</td>
<td>Bulk milk cooler</td>
<td>Rejected</td>
</tr>
<tr>
<td>8</td>
<td>The larger is the DCS base the higher is the level of procurement</td>
<td>Bulk milk cooler</td>
<td>Accepted</td>
</tr>
<tr>
<td>9</td>
<td>The higher is the milk producer participation (active members) the higher is the quantum of procurement</td>
<td>Bulk milk cooler</td>
<td>Accepted</td>
</tr>
<tr>
<td>10</td>
<td>The higher is the level of procurement the lower is the cost of chilling</td>
<td>Bulk milk cooler</td>
<td>Accepted partially</td>
</tr>
<tr>
<td>11</td>
<td>Retailing of dairy products is a low investing and high profit making business concern</td>
<td>Retail outlet</td>
<td>Accepted</td>
</tr>
<tr>
<td>12</td>
<td>Higher is the area of operational area higher is the sales</td>
<td>Retail outlet</td>
<td>Rejected</td>
</tr>
<tr>
<td>13</td>
<td>There is a high degree of positive correlation between income and expenditure on dairy products</td>
<td>Customer</td>
<td>Accepted partially</td>
</tr>
<tr>
<td>14</td>
<td>Customers are increasingly becoming quality conscious while making a purchase</td>
<td>Customer</td>
<td>Accepted</td>
</tr>
<tr>
<td>15</td>
<td>Risk and uncertainties exist at each level of the supply chain</td>
<td>All components</td>
<td>Accepted</td>
</tr>
<tr>
<td>16</td>
<td>Endogenous risks have more chances of occurrence than exogenous ones</td>
<td>All components</td>
<td>Rejected</td>
</tr>
<tr>
<td>17</td>
<td>Higher is the trust higher is the level of commitment and better is the buyer-supplier relationship in the supply chain</td>
<td>All components</td>
<td>Accepted</td>
</tr>
<tr>
<td>18</td>
<td>The higher is the degree of supply chain coordination the lower is the risk</td>
<td>All components</td>
<td>Accepted</td>
</tr>
<tr>
<td>19</td>
<td>There is a difference in the performance level of stakeholders</td>
<td>All components</td>
<td>Rejected</td>
</tr>
<tr>
<td>20</td>
<td>Supply chain performance is positively influenced by the risk coping efficiency of the stakeholders</td>
<td>All components</td>
<td>Accepted</td>
</tr>
</tbody>
</table>
Out of the 20 hypotheses framed 11 hypotheses are found to be accepted and the rest are deemed to be rejected.

8.15 Comparing Dairy Federations in India

Data from various sources like NDDB, Ministry of Agriculture, Indiastat etc. (table provided in the introduction chapter) have been complied together to make a comparison of all major dairy federations in the country. The rationale behind this is to provide a benchmarking platform to the dairy federation of Orissa to compare with others and take necessary steps accordingly to upgrade the weaker sections of dairy food supply chain.

8.15.1 Top performing dairy federations in various fields

- Society formulation: MP, UP, Rajasthan, Gujarat, Karnataka
- Farmer membership (man): Gujarat, Karnataka, Tamil Nadu, MP, UP
- Farmer membership (woman): Tamil Nadu, Gujarat, Karnataka, MP, UP
- District coop. union formulation: UP, Maharashtra, Rajasthan, WB, Karnataka
- Production plant set up: Maharashtra, Gujarat, UP, Rajasthan, Karnataka
- Production plant processing capacity: Gujarat, MP, Tamil Nadu, AP, Karnataka
- Milk procurement: Gujarat, Maharashtra, Karnataka, Tamil Nadu, Rajasthan
- Liquid milk marketing: Gujarat, Maharashtra, Karnataka, Tamil Nadu, AP
- AI programme conducting: Karnataka, AP, Tamil Nadu, Punjab, UP

Keeping view to major indicators together with average milk collections at society, union, average milk marketing per dairy and so on the following rankings are done.

8.15.2 Ranking of dairy federations

Based on the society formulation, members, women participation, milk procurement, production plant processing capacity, milk marketing etc. the following ranking is done. The mean ranking of a federation is calculated on the basis of rankings on various parameters as stated above. Higher values indicate higher ranking. By Friedman Rank test the ranks are significant at 5 percent level of significance with a Chi-square value of 75.10 and 14 degrees of freedom (df). It is inferred that Gujarat, Karnataka and Tamil Nadu are the top performing dairy federations in the country (table below). The state of Orissa is performing poor almost in all basic indicators of cooperative based dairying which is clearly reflected in the primary data interpretations. The following suggestions are given
to strengthen the concerned dairy federation of the state. The suggestions are also applicable to other federations in the country, aiming to improve the cooperative based dairying.

Table 8.6: Overall ranking of dairy federations on various parameters

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>State</th>
<th>Dairy federation</th>
<th>Brand</th>
<th>Mean ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gujarat</td>
<td>GCMMF</td>
<td>Amul</td>
<td>12.50</td>
</tr>
<tr>
<td>2</td>
<td>Karnataka</td>
<td>KMF</td>
<td>Nandini</td>
<td>12.44</td>
</tr>
<tr>
<td>3</td>
<td>Tamil Nadu</td>
<td>TCMPF</td>
<td>Avin</td>
<td>12.06</td>
</tr>
<tr>
<td>4</td>
<td>Uttar Pradesh</td>
<td>PCDF</td>
<td>Parag</td>
<td>10.89</td>
</tr>
<tr>
<td>5</td>
<td>Rajasthan</td>
<td>RCDF</td>
<td>Saras</td>
<td>10.11</td>
</tr>
<tr>
<td>6</td>
<td>Maharashtra</td>
<td>MRSDMM</td>
<td>Vikas</td>
<td>9.78</td>
</tr>
<tr>
<td>7</td>
<td>Andhra Pradesh</td>
<td>APDDCF</td>
<td>Vijaya</td>
<td>9.67</td>
</tr>
<tr>
<td>8</td>
<td>Punjab</td>
<td>MILKFED</td>
<td>Verka</td>
<td>7.72</td>
</tr>
<tr>
<td>9</td>
<td>Madhya Pradesh</td>
<td>MPCDF</td>
<td>Sanchi</td>
<td>7.67</td>
</tr>
<tr>
<td>10</td>
<td>Kerala</td>
<td>KCMMF</td>
<td>Milma</td>
<td>6.33</td>
</tr>
<tr>
<td>11</td>
<td>West Bengal</td>
<td>WBCMPF</td>
<td>Ben's</td>
<td>6.00</td>
</tr>
<tr>
<td>12</td>
<td>Haryana</td>
<td>HDDCF</td>
<td>Vita</td>
<td>5.33</td>
</tr>
<tr>
<td>13</td>
<td>Bihar</td>
<td>COMPFED</td>
<td>Sudha</td>
<td>4.89</td>
</tr>
<tr>
<td>14</td>
<td>Orissa</td>
<td>OMFED</td>
<td>OMFED</td>
<td>3.44</td>
</tr>
<tr>
<td>15</td>
<td>Himachal Pradesh</td>
<td>HPSCMPF</td>
<td>Him</td>
<td>1.17</td>
</tr>
</tbody>
</table>

8.16 Suggestions and Recommendations

The supply chain management is a very complex process to deal with. In a dairy food supply chain where the milk producers demand a fair price for their produce, customers want a qualitative product at reasonable price. So managing these two independent bodies is found to be an extremely difficult task for the dairy federations. At the upstream supply chain procurement is a challenge, whereas quality is a problem at the downstream. Hence if these two issues are tackled properly then almost half of the problems are solved. Still in order to fortify the dairy food supply chain operation the following items are recommended.

**Milk producer level:** The supply chain is operating with a higher cost due to low procurement and inferior quality of milk. Low procurement is a repercussion of non-remunerative price for raw milk at the procurement chain. Being the suppliers, the
milk producers feel underpaid and over a period of time they get restrained from producing milk. This not only snatches their avocation in the long run rather disrupt the supply chain from smooth functioning. At this level, increasing the procurement price is inevitably essential to raise the level of procurement at the society. Feed and fodder supply is not enough and need to be supplied according to the requirement of the members in the societies. Quality of feed and fodder should be improved in order to make it more acceptable among the members. Milk producers themselves should try to maintain a standard level of milk production while upgrading quality by rearing high yielding cows.

- **Dairy cooperative society level:** Secretaries of societies and/or supervisors of the union should improve their skills to organise milk producers in the rural areas. They should participate in various training programmes to learn the basic issues of leaderships and motivation. They should also be sent to societies of other brands (like Amul or Nandini etc.) to learn the core competencies for improving level of procurement at the society. Through this they can also be able to identify and assess their strengths and weaknesses. Efforts should be made to attract the large milk producers towards the system. Along with the small and marginal milk producers they will increase the procurement at the society level. Retention of the existing members in the society should be given priority and efforts should be made to unearth the reasons for their attrition. Infrastructure of the societies should be strengthened to facilitate coordination process.

- **Bulk milk cooler level:** Instead of opening of new societies in a particular area endeavours should be made to strengthen the existing ones and chilling facility may be provided at the society level so that perishability of milk can be minimised at the society itself. Regular field visit of the top officials of the union/federation is highly essential to build up trust and commitment among the suppliers (milk producers). Efforts should be made to evaluate the milk producers on regular intervals so that their value addition to the supply chain can be assessed. If required they should be provided with necessary financial help and high yielding cattle to produce and sell milk to society thus implementing Contract Farming Schemes in the system. Penalty ceiling of 12.5 percent total milk solids (TMS) should be reconsidered and might be reduced to 12.0 percent keeping view to the TMS level of indigenous and crossbred cows.
**Production plant level:** Necessary care should be taken to handle milk and products to avoid process and in-transit losses. Quality of the product should be improved and due care should be given to control it both upstream and downstream. Quality-price mismatch can be minimised in order to increase customer satisfaction. Availability of milk in small packets (like 250 ml or so) should be made possible so as to make it more popular among lower income groups. Rural milk markets might be tapped in order to hike sales. Customer satisfaction and complaints should be given due importance and certain demanding products (like ghee) should be made available as per requirement.

**Transporting agency level:** Judiciously milk distribution routes should be planned so as to reduce the operating costs. Necessary care should be taken to avoid logistics related risks and hazards. Drivers and cleaners of the distribution vehicles should be well trained to efficiently disburse their duties while maintaining a good public relationship with the retailers and plant authorities.

**Retail outlet level:** Credit facility to the retailers should be provided and demanding products should be supplied as per their requirements. Suboptimal level of supply will give rise to opportunity loss. Retailers should be trained to forecast the demand of various products of the brand so as to assist the plant/federation in production/demand forecasting to minimise perishability. Once the demand is forecasted the demand-supply gap will be easier to deal with. Thus the higher demand of certain products will motivate concerned stakeholder to look back the downstream supply chain.

**Federation level:** Before taking any decision regarding the procurement milk price with the government officials/bureaucrats, attention should be given towards the milk suppliers in the rural areas about their cost of productions. The milk producers should be trained enough to calculate their own cost of milk productions (roughly) so as to control it to some extent. More importantly purchasing function should be viewed as a matter of strategic importance. Retail margin on packaged milk might be reduced and the same can be diverted to upstream. The incentives on performance and bonus distribution schemes should be invigorated and practiced on regular basis. Instead of focussing on cost reductions always, efforts should be made to maximise stakeholders’ satisfaction. Programme implementations should be followed by due monitoring and supervision so as to encourage the stakeholders in the field. This way trust on the system can be built up while minimising the malpractices.
For all stakeholders: Efforts should be made by all the stakeholders in the system to coordinate with each other by facilitating joint decision making and information sharing. Trusting each other and working hard (commitment) are required to be groomed both upstream and downstream to increase the effectiveness of the supply chain. This way a collaborative work environment can be established to increase overall stakeholder satisfaction.

8.17 Direction for Future Research

Even if India is the largest producer of milk in the world, still it is not a major player in dairy trade. New Zealand having one fifth of its productions is on the top list of dairy trade and commerce. So a comparative study between these two countries can be made to analyse the drivers and barriers of dairy trade and commerce. Research works for supply chain risk, coordination and performance can be further carried out and hypotheses can be verified to strengthen the ideas. Especially the intangible items of coordination and performance (e.g. “trustworthiness and commitment of coordination” and “responsiveness, product quality and process quality of performance”) can be studied to broaden the service operations of a manufacturing supply chain – irrespective of industries.

8.18 Conclusion

The dairy-food supply chain is highly a riskier business concern to deal with. No matter what the precautions are taken, risks and uncertainties can’t be ruled out from the industry. Since it is not possible to avoid them completely, a proper risk redressal mechanism could at least minimise their impact on supply chain performance. A basic priority for the dairy industry is to ensure that products distributed to the customers are safe and suitable for consumption. Milk borne injuries can be extremely fatal leading to unnecessary litigations by tarnishing the image of the organisation in the long run. An efficient and effective supply chain operation could provide hygienic measures throughout the supply chain by adhering to the proper food value requirements of the consumers at large.