Chapter 4: Unfolding Dairy Industry Futures

The dairy industry in India will be facing challenges of providing income to farmers and healthy, safe and fresh milk and milk products to consumers in domestic market as well as abroad. The challenges of dairy industry in future are likely to be shaped by innovation, technology development, technology transfer and application. The dairy industry in India is on the path of evolution and especially in food processing innovation system. Therefore, the technology foresight methodology can provide an opportunity to explore the plausible future of dairy sector for medium to long time horizon. Hence, knowing about the unfolding future of dairy industry is a challenge, but its worth pursuing.

This chapter identify the drivers for growth of Indian dairy industry in future (2015 and 2020). In the next section, there are efforts to identify crucial issues of dairy industry that have high potential to shape the whole sector by year 2015 and 2020. Further, it deals with product innovation and what critical factors will drive the product innovation in Indian dairy industry in terms of short to medium time horizon. In addition, it traces the future processing pattern of raw milk in organised and unorganised sector in the context of the relative demand of milk products by 2020. Finally, the chapter focuses on critical technologies that would evolve by 2020.

4.1 Growth Drivers

The dairy industry has been growing on average 4% annually (department of AHD&F) due to some specific growth drivers. Consequently, food processing industry is emerging as sunrise industry in India. Here, the growth drivers are the factors, which shape the industry and induce growth of the dairy sector. The factors, which drive growth in the Indian Dairy Industry, vary at different times. There have been some important drivers in the past like cooperative investment, government investment, technology import and diffusion, market demand, and setting up
institutions. All the past drivers need not necessarily drive the future growth too. Although, the future drivers may include some of the past driving forces. However, the present growth drivers are likely to change in future in their strength and effectiveness. These are explored hereafter through an analysis of Delphi surveys.

A numbers of future growth drivers of dairy industry are revealed by two rounds of Delphi survey for medium term horizon i.e. 2015 and 2020. The surveys were responded by 50% of the selected respondents from Industry, academic, policy makers, consumers and non government organisations.

As reported by the participants, the major drivers of growth in year 2015 are likely to be private investment, cold chain development, cooperative investment, and market mechanisms. Milk processing technologies, extension system and farmer’s training, food safety policy, and international trade regime (WTO and lowering Subsidies in US and EU) are likely to drive additional growth for Indian dairy industry, as shown in figure 4.1. Further, there are some other less important growth factors as well.

When it comes to the scenario of growth drivers in year 2020, the extension system and farmers training, considered as an important driver in year 2015 becomes much less effective. Market mechanism comes out as most effective and potential driver to steer the growth. The names of the other most influential growth drivers of the sector are cold chain development, private investment, cooperative investment, packaging technologies, R&D and research institutes, food safety, and milk processing technologies.
There are some significant changes in 2020 as compared to the scenario of drivers in year 2015. First, R&D and research institutes and packaging technologies will have greater thrust. Secondly, institutional innovation will increasingly become larger driver. Thirdly, food and regulatory system is likely to emerge as new growth driver. Fourthly, milk processing technologies, food safety policy, and international trade
regime will be less effective factors. However, Government investment will not be driving force for growth in dairy industry.

The analysis of Delphi exercise has revealed five most important growth drivers of dairy industry for both the years (2015 and 2020). As figure 4.2, shows that 90% percent of the total respondents view cold chain development in India as the most important growth driver in year 2015, followed by other three.

Figure 4.2: Five Most Important growth Drivers for Dairy Industry by 2015

Private investment, cooperative investment and market mechanisms- retail are equally considered as significant forces for pushing growth towards upper-side. It means that the present trend of more investment in private sector and retail investment is likely to get strengthened and most likely to become a prominent trend in 2015, as supported

Source: Second Round Delphi Survey analysis by the Author
by approximately 60% of respondents. The farmers and their knowledge and skills are extremely important for dairy sector to provide quality raw milk and enhancing milk productivity of milch animals through adoption of appropriate technologies and practices. The present low milk productivity and lack of best dairy practices by the farmers are key concerns. Therefore, extension system and farmer’s training are likely to assume significance by year 2015 as fifth most important growth driver for dairy industry in India. Milk processing technologies, food safety policy, international trade regime along with extension system and farmer’s training are equally, at fifth position, crucial growth drivers for dairy industry by year 2015. All of these four drivers could provide desired technologies, policy framework, favourable trade regime, and trained and quality conscious farmers to shape up and create competitive Indian dairy industry.

However, dairy industry can not continue to be driven by the same set of five most important drivers in 2015 and 2020 due to rapid changes in terms of investment, policies, market demand, competitors, technology and innovation. The industry would be facing more demanding consumers and better developed cold chain along favourable policies. It is clearly demonstrated by the conformity of respondents that the market mechanisms, such as retailing, organised dairying, and others, will be most forceful growth driver by year 2020. 80% of the stakeholders and experts are of this view as shown in figure 4.3.
The further analysis of the views of respondents presents cold chain development as second most important growth driver. It is true because without the development of vibrant and competitive cold chain, the market of milk and milk products will remain unserved due to adverse climatic condition in India. Therefore, the ongoing investment during next 10 years is likely to push up the growth of the dairy industry in terms of volume, area, and value. There are different views on comparative importance of the cooperative investment and private investment as growth drivers. Inspite of diverse views, both growth drivers have tally as third most significant. In recent time private investors such as Reliance and ITC have shown significant interest. It may not be much forceful but by the end of the 10th year from present such initiatives may establish as trends and set to drive the growth process. The R&D in
institutes and companies may drive the development of new product technologies. Therefore, educational and R&D institutions, as fifth driver, will have greater role, next to the other two growth drivers, as viewed by the respondents. While dairy industry growing at faster growth rate may face a number of crucial issues. With out managing such issues at right time, in right manners, with right strategies, and in appropriate context, the dairy industry can not be much ambitious for its growth.

4.2 Crucial Dairy Sector Issues

Dairy sector as a whole faces a couple of difficult and challenging issues at present. Without an iota of doubt, industry will continue to face many of the present crucial issues which are obstacle in the path of higher growth and expansion of dairy sector in overall share of GDP. Presently, food safety issue has become most important world over. Chinese industry has suffered huge losses due to melamine\textsuperscript{18} issue. In same voice, Indian dairy industry is also sitting on such potentially lethal issues. Some of the important issues were presented to respondents through the two rounds of Delphi Survey, as the figure 4.4 presents a scenario of 2015.

Two issues, quality milk procurement and productivity of the milch animals, are extremely crucial for dairy industry by year 2015. Both issues emerged as consensus issues with 100\% respondents agreed. At present, quality raw milk procurement is a challenge for dairy industry and it continue to be remaining most important by 2015.

\textsuperscript{18} Melamine is used to manufacture melamine-formaldehyde resin, a type of plastic known for its flame retardant properties and commonly employed in countertops, dry erase boards, etc. Melamine itself is nitrogen-rich and is sometimes illegally added to milk and milk products in order to increase their apparent protein content. Melamine is known to cause renal and urinary problems in humans and animals when it reacts with cyanuric acid inside the body. The Kjeldahl and Dumas methods used to test for protein levels in milk fail to distinguish between nitrogen in melamine and naturally occurring in amino acids, allowing the protein levels to be falsified. Introduced into milk, it can help conceal its fraudulent dilution with water. Consumption of infant milk caused lacs of hospitalisation and many deaths of infants.
The present health services for animals in villages are very poor. This issue is a major concern to all the stakeholders of the dairy industry. The quality veterinary health services in rural or at farm gate has emerged as third crucial issue during the time horizon. It has to be essentially pursued for addressing all the gaps. Further, enhanced shelf life of the milk and milk products is likely to be more concerning issue to provide direction to dairy industry development and standards. In addition, the issue of future dairy cooperatives structure and their realignment as well as kind of partnership would rock up all the platforms and discussions in year 2015. The recent debate on role and efficacy of present model of AMUL for cooperatives in areas other than Gujarat has created different views. Therefore, the debate could lead to a scenario where present AMUL model may be modified as per the demand of the
market. But for long term horizon it may not be an issue of so much importance, as felt by respondents.

All the five most crucial issues for dairy industry in India are likely to be shifted by 2020, as presented in figure 4.5. Productivity of milch animals is likely to be the most prominent issue among all the issues, as supported by 90% respondents. This issue is likely to be followed by the two other issues of quality milk procurement and quality veterinary health services at farm gate.

Figure 4.5: Five Most Crucial Issues for Dairy Industry in India (2020)

The consumer awareness and evolving food safety regulatory system in India could help the intensification of the demand and debate on food safety in India. Therefore, food safety is likely to be very important issue for dairy industry by year 2020. These
issues are likely to be followed by the fifth important issue, healthy food for consumers, in dairy sector. It demonstrates that consumer consciousness and activism would be significantly high.

There are additional issues along with above discussed five most important. The figure 4.6 has shown all the issues in relative prominence. Traceability and surveillance/monitoring system for food born diseases are not considered as important issues for dairy sector by year 2015; whereas by year 2020, these issues will acquire importance.

Food labelling has been an important concern for any kind of food in recent time. The food labelling facilitates the decisions of the consumers about the choice of milk and milk products. It is perceived as equally important.
Figure 4.6: Crucial Issues for Dairy Industry in India

- Quality Milk Procurement
- Productivity of milch animals
- Quality Veterinary health services in villages or at farm gate
- Enhanced self life of milk and milk products
- Future dairy cooperative model as well as dairy cooperative restructurisation and realignment
- Food Safety
- Food Standards and Regulations
- Use of Milking Machine/Mechanisation of dairy farms
- National Food Safety Policy
- Healthy food for consumer
- Information and data availability on dairy sector
- Food labelling
- Veterinary drugs use for milch animals and Standards
- Traceability
- Surveillance/Monitoring system for food poisoning and food born diseases
- Food additives

Source: Delphi Survey analysis by the Author
India has dearth of appropriate regulatory system for use and application of drugs and medicines for animals. Farmers are found to be administering, in ignorance of adverse effects, lots of drugs and medicines to animals with the help and advice of poorly trained veterinarians and Para-vets. This issue is of much less importance till 2015 but by 2020 the scenario is likely to be radically different as it will become very important issue. Food safety, National food policy, Food Standards and Regulations are also important issues for dairy industry in 2015. Some of the respondents view use of Milking Machine/Mechanisation of dairy farms as relevant issue. Food standards and regulations are equally important issue in year 2020. Food labelling is much important issue in 2015 than 2020. The issue of traceability is not of much importance; only 20% view it as important. On the other hand, it is not an issue in 2015. Veterinary drug use for milch animals is not an issue in 2015 but in 2020 it assumes much importance therefore it may emerge as an important concern for dairy industry.

Management of all the important issues is essential for the growth of dairy industry. Policy makers, academics, investors, and legislator need to be involved rigorously for management of the issues.

4.3 **Product Innovation Critical Drivers**

The dairy industry is driven by innovations at products, process, organisational and institutional level. But most prominent is product innovation at present. A wide product mix of indigenous milk products is provided to consumers. Various Indian dairy products are manufactured through application of advanced technologies which was not the scenario two decades earlier. When it comes to identifying the drivers that will drive the milk product innovation by year 2015 in India, the outcome provides five most critical drivers. Figure 4.7 shows the five expected most critical innovation drivers in year 2015.
The properties of the milk products which provide health benefits are likely to drive the innovation. Second important innovation driver is price of the products. Consumers in India are highly price conscious. Therefore, price will remain innovation driver. Higher will be the price of the products lesser will be demand for the products. The affordability and price are determining factor for bringing any kind of innovation. Microbial, chemical and physical safety, and packaging are other two most important innovation drivers for milk and milk products. Different kinds of packaging, which can provide safety to products with food standards, will be helpful in emergence of new innovations in indigenous dairy products. All of the above mentioned four product innovation drivers, in 2015, are suggested by 70% respondents. In addition, fifth milk product innovation driver is preservation and naturalness.
Responses suggest a significantly different pattern of five most critical drivers of milk product innovation in year 2020.

Figure 4.8: Five Most Critical Drivers of Milk Product Innovation in India (2020)

Health benefits along with microbial, chemical and physical safety are the two most critical innovation drivers with 80% of response agreements, as shown in figure 4.8. These two drivers have less confusion and dispute in views of industry, academics, policy makers and non government organisation. Packaging, preservation and naturalness, and price are likely to drive innovation by year 2020. 50% respondents agree that packaging, and preservation and naturalness of milk products will keep on pushing more innovations.
Advertisement and publicity, freshness, and flavour are some other significant milk products innovation drivers in year 2015 as shown figure 4.9.

Figure 4.9: Critical Drivers of Milk Product Innovation in India

Price, as one of the five most important product drivers by year 2020, has two equivalents, organic milk and milk product, and advertisement and publicity, product innovation drivers. On the other hand organic property of milk and milk is not important product innovation driver in year 2015.
The manufactures of milk products have to keep in mind above product innovation drivers to win over the competitors. Innovation can make much more competitive to innovators. Innovation is a determinant of future milk and milk product demand in the market, India and foreign. Innovation can trigger demand for new or existing products. Therefore, potentially shape up the future market of the milk and milk products.

4.4 Future Market for Milk Products

The market of milk and milk product is expanding at more than 7% per annum. 15 years ago no one may have imagined and agreed that some of indigenous milk products such as lassi, chhach, misti dahi, and curd could create huge demand in the market. In same voice, probiotic milk products too had same imagination before their launch. However, the relative demand of the milk products in India by 2020 would be changing from the present scenario. When demand of the different milk products is measured on 7 point rating scale, the following figure 4.10 has appeared.

Indigenous milk products are going to be in huge demand by year 2020. It is clearly surfaced that curd or dahi and misti dahi will be in high demand with weighted average 5.6 on scale of 7. As the life style of people is changing as the demand pattern for dairy product is also likely to follow it. The cold chain and market mechanisms are likely to get strengthened by 2020. Therefore, the demand of milk products too will become much larger. Ice cream and probiotic milk products will have more demand than other milk products, except curd, and misti dahi, with weighted average demand 5.20 and 5.10 on scale of 7 respectively.
The probiotic products are beneficial for health. The same fact is well accepted by the consumers in India. The rising consciousness about healthy diet and lifestyle in India will make consumers think to take decisions in favour of probiotic milk products. Ice cream, as an important milk product, is becoming part of consumer choice. Therefore, people will be demanding more and more varieties and quantity of ice cream.

The paneer has become a major part of diet in urban India. This product is going to generate huge demand, next to probiotic, in the market. The weighted average for
relative demand of paneer in year 2020 is 4.70 on scale of 7. This is significantly high relative demand score. The demand of the paneer is closely followed by chhachh and lassi with weighted average of 4.60. The Delphi results suggest that fermented milk products will have highest demand in the market. In addition, western fermented milk product yogurt would have a larger demand by year 2020. Respondents have ranked its market demand at weighted average 4.50 on scale of 7.

Consumers in India prefer ghee in their every day diet. This trend is embedded part of food habit in India. The respondents have also agreed that ghee will have a large market demand with weighted average of 4.40. Similarly, sweets as constituent of food habits and culture in India will also generate high market demand as supported by weighted average 4.3 on scale of 7.

Cheese has been unknown to Indian taste but scenario is becoming perceptibly different. People have started using this product. The most prevalent uses of cheese are as appetizers, salads, salad dressings, in cooked foods and desserts. Therefore, cheese is also ranked at weighted average 3.89 on scale of 7 for market demand in 2020. The butter will be still preferred by the Indian consumers by year 2020. Its demand will not be very high but will be significant with weighted average 3.80.

Other dairy products will have less chance to generate such market demand by year 2020. Flavoured milk and dairy whitener or coffee creamer will have less than average demand with weighted average 3.33 and 3.22 respectively. Chhana, Shrikhand and sweetened condensed milk would have a lesser amount of demand in the market. The weighted average for each of three is 3.20, 2.78 and 2.22 on scale of 7.

4.5 Milk Processing Pattern in Organised and Unorganised Sector

The whole scenario of market demand, critical technologies, milk product innovation, managing important dairy issues and dairy industry growth drivers will make changes in present pattern of milk processing. Presently organised sector processes around 17
percent of the total milk production in India. Some of the respondents are of the view that considering the current rate of growth of organized dairy sector, India will be able to achieve only 20% processing in the organised sector. There is a need for more consumer awareness to bring shift from vendor's milk to packaged milk & milk products. Moreover, most of the manufacturing of indigenous dairy products is with unorganised sector. Technology for mechanized manufacturing is required so that production of these products can be undertaken in organised sector. The proportion of total milk production processed by the organised dairy sector in India by year 2015 is likely to move upward. This is likely to reach at 20% of the total milk production. This slight growth is due to short time horizon as the reason given by some of the respondents. But 30% of the respondents view that the score may reach to 25% of the total milk production. However, by 2020 the share of the milk processed by organised dairy sector is likely to reach 30%. Some of the respondents are of the view that approximately 28 to 29% is achievable due to cooperative and private investment in organised sector.

The proportion of milk handled by the organised and unorganised dairy sector at present is approximately 50%. 35% of this is converted to traditional dairy products and 15% converted to western dairy products. The remaining 50% remains as liquid milk in the market. The proportion of total milk production would be processed by organised and unorganised dairy sector by 2015 will be 50% as agreed by the majority of respondents. Others believe that not much shift in processing of total milk is expected as increase in organised sector will result in corresponding decrease in unorganised sector. On the other hand, the share of milk processed by the organised and unorganised dairy sector in total milk production will increase slightly over the 50% by year 2020. Some of the respondents believe that it may reach to 54 to 55%. The reason being the milk production is likely to go up and farmer will have more surpluses, as presently farmers retain 50% of total milk produce in household and remaining they sell. Therefore more per-house hold production means more surpluses
generated. Hence, farmer household needs for the milk will not increase consequently farmers will devote more than 50% of milk produced by them.

4.6 Critical Technologies

There are some important technologies for dairy industry which provide direction to market of milk and milk products in India. Some of these are some of these technologies can be named as critical for the dairy sector. Critical technologies are most important technologies of a sector. These are the frontier technologies for the concerned sector.

Packaging technologies will be critical ones for Indian dairy industry by 2020. Packaging technologies are important for providing safe and good quality milk products to consumers. It is assumed by 90% of respondents. With same number agreements, Artificial Insemination (AI) Technology is identified as another critical technology for dairy sector in India in 2020. Further, biotechnology and cold chain and low temperature storage are other two critical technologies identified by 80% of the respondents, as shown in figure 4.11. Without any doubt biotechnology will play a major role in development of probiotic fermented and functional dairy products. Cold chain and low temperature storage technologies are crucial for dairy industry because of climatic conditions of India and perishable nature of milk. Without such technologies milk and milk products can not be stored and transported for longer time.

Preservation Technologies are appeared to be critical technologies by year 2020 for dairy industry. To maintain freshness, flavour, and quality of milk and milk products preservation technologies play key role. Therefore, such technologies will have greater role when innovation in dairy products is led by them. The view is suggested by 70% of the respondents in 2nd round of Delphi survey.
In addition, there are three more technologies identified as critical for dairy industry by year 2020. Firstly, Nutraceutical and functional foods technologies (for value addition) are critical to provide direction to dairy industry in future. Secondly, indigenous milk products technologies are likely to be very important. Thirdly, embryo transfer technology could also be significant for dairy sector for enhancement
of productivity of the milch animals. The views on all these three technologies are supported by 60% of the respondents.

50% of the respondents consider information communication technologies and milk and milk product testing technologies as critical for dairy industry by year 2020. These technologies have played a crucial role for growth of dairy industry. These technologies will have greater role in future.

There are some other technologies which are considered by minority opinion as critical. The 20% respondents view nanotechnology, western dairy product technologies and flavour technologies as critical by year 2020. Nanotechnology may have greater role in terms of preparing better packing material.

4.7 Summary

The dairy industry has been growing at an average 4% during last three decades. This trend is likely to be moving towards higher level in future. The two rounds of Delphi survey has came out with significant results. The dairy industry growth will be driven by a number of drivers. Four most important growth drivers of the dairy industry by year 2015 are private investment, cold chain development, cooperative investment, and market mechanisms. With same level of percent agreement on fifth position, there are four growth drivers such as food safety policy, extension system and farmer’s training, international trade regime, and milk processing technologies by year 2015. Further, two out of five most important growth drivers in year 2020 are market mechanisms and cold chain development in descending order of level of percent agreement. In addition, four growth drivers such as private investment, packaging technologies, educational institutes and R&D, and cooperative investment are most important for growth of dairy industry in India.

Dairy sector as a whole faces a couple of difficult and challenging issues at present. Without an iota of doubt, industry will face many of the present crucial issues which create trouble for higher growth and expansion of dairy sector in overall share of
GDP. The five most crucial issue of dairy industry in year 2015 are, expected to be, quality milk procurement, productivity of the milch animals, quality veterinary health services in rural or at farm gate, enhanced shelf life of the milk and milk products, and future dairy cooperatives structure and their realignment. On the other hand, quality milk procurement, productivity of the milch animals, food safety, quality veterinary health services in rural or at farm gate, and healthy food for consumers came into view as five most crucial issues in year 2020. Food safety, food standards and regulation, national food safety policy, and milking machine and mechanisation of farms could be significant issues by 2015. Food standards and regulation, national food safety policy and use of milking machine and mechanisation of farms are also significant issues for dairy industry by 2020. The issues have to be managed through innovations in the sector.

The dairy industry is driven by innovations at products, process, organisational and institutional level. However, presently most prominent is product innovation. A wide product mix of indigenous milk products is provided to consumers. Various Indian dairy products are manufactured through application of advanced technologies which was not the scenario two decades earlier. When it comes to identifying the source of products innovation then some key drivers of milk product innovation are surfaced. Five most important product innovation drivers are health benefits, prices, microbial, chemical and physical safety, packaging, and preservation and naturalness by year 2015. Five years later, 2020, the group of five most milk product innovation drivers is slightly different to drivers in 2015. Health benefits, packaging, and preservation and naturalness, and microbial, chemical and physical safety are crucial driver of product innovation in year 2020. In addition, three innovation drivers of equal level of agreements are organic, advertisement and publicity, and price of the products in the same year. In recent time, a couple of innovations around the dairy sector have triggered the demand in the market.

The market of milk and milk product is expanding at more than 7% per annum. 15 years back no one has imagined and agreed that some of indigenous milk products
such lassi, chhach, misti dahi, and curd could create huge demand in the market. Similarly, probiotic milk products too had the same imagination before their launch. However, the relative demand of the milk products in India by 2020 would be changing from the present scenario. There will be some dairy products which will have very high market demand by year 2020. These are ranked in range of 5 and 6 on scale of 7 for their market demand. These are dahi, misti dahi, probiotic milk products, and ice cream. In second group, the products, which will have high market demand by year 2020, are ranked between 4 and 5 on scale of 7. The names of such products are paneer, chhachh, lassi, yoghurt, ghee, and sweets. Third group with moderate to high demand are ranked in range of 3 and 4 on scale of 7. These products are cheese, butter, flavoured milk, dairy whitner or coffee creamer, and chhana.

The whole scenario of market demand, critical technologies, milk product innovation, managing important dairy issues and dairy industry growth drivers will make changes in present pattern of milk processing. Presently, organised sector processes around 17 percent of the total milk production. The organised dairy sector will be processing 20% and 30% of total milk production by 2015 and 2020 respectively. Both organised and unorganised sector will be processing 50% and 53% of total milk production in India by year 2015 and 2020 respectively. But this also depends on available appropriate technologies and investment.

The critical technologies, for dairy industry, provide direction and shape the market of milk and milk products in India. Critical technologies are most important or frontier technologies of a sector. Five most critical technologies of the dairy sector by year 2020 are packaging technologies, artificial insemination technologies, biotechnology, cold chain and low temperature storage technologies, and preservation technologies. In addition, there are five additional critical technologies identified for dairy sector by year 2020 such as Nutraceutical and functional food technologies, indigenous milk products technologies, embryo transfer technology, information communication technologies, milk and milk products testing technologies. These technologies have played a crucial role for growth of dairy industry. These technologies will have grater
role in future as well. These technologies have to be developed by the R&D institutes, cooperatives and companies. The process for development of some of the critical technology is shaped up by R&D institutes in food sector such as CFTRI and NDRI. It is up to the capabilities of such institute that can provide direction to future of the dairy industry. Therefore, their role will be crucial for shaping up dairy industry in future.