ISBN : 978-81-933546-3-6

# Next Generation Dairy Farming : Smart locally, Competitive globally

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**Amit Saha**

## a. Introduction

The potential of dairy for India is immense. According to the World Bank, India is the fourth largest economy in the world going by the purchasing power parity estimates. Further, India has been identified as among the first 10 emerging markets in the world. India has the vastest domestic market in the world with over one billion consumers – a majority of whom are vegetarians with drinking of milk as habit. The paper is aimed to open up perspectives, ideas and new ways to make dairy farming a smart option for the next gen entrepreneur. India has been a forerunner in dairy industry globally in terms of the production, marketing and growth. However, with changing global scenario, India needs to adapt to ensure that the dairy industry is able to meet the challenges both national and global. A very important component of the dairy industry is the milk production, which forms the backbone of dairy industry. For this, an overview and retrospection of the advantages, challenges, issues and options is necessary to take necessary steps to ensure a long run sustainability of the dairy industry. India needs a customized solution for the dairy industry which caters to its very unique economic, social and political environment and also the perspectives of the upcoming generation needs. The paper concludes that smart dairy farming is not an option for a sustained dairy industry in India but a necessity.

## b. The Background to Indian Dairy Sector Development

Dairy industry is of crucial importance to India. The country is the world's largest milk producer, accounting for more than 13% of world's total milk production. It is the world's

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largest consumer of dairy products, consuming almost 100% of its own milk production. Milk production in India has been growing at an average growth rate of 4.7% per annum for the last ten years closely matching the milk demand in the country with minor surplus for global trade in the last 3-4 years. The growth has happened in a volatile dairy market situation; nevertheless India has managed to insulate itself from it through tariff barriers and an inclusive support policy for dairy development.

Between mid-seventies to nineties, the dairy cooperative movement spread to more than 200 milk producing districts of India with milk production growing at 4 to 5% pa. Even with limited gains on productivity, scarce fodder, and frequent droughts the farmers largely dependent on agri-residual feeding and even then India emerged as one of the largest producers of milk in the world. Another startling thing happened – the per capita milk consumption rose and was almost equal to the global average.

Dairy products are a major source of cheap and nutritious food to millions of people in India and the only acceptable source of animal protein for large vegetarian segment of Indian population, particularly among the landless, small and marginal farmers and women. The huge volume of milk produced in India is consumed almost entirely by the Indian population itself, in a 50-50 division between urban and non-urban areas. Increasingly, important consumers of the dairy industry are fast-food chains and food & non-food industries using dairy ingredients in a wide range of products.

According to the National Sample Survey of 1993-94, livestock sector produces regular employment to about 9.8 million persons in principal status and 8.6 million in subsidiary status, which constitute about 5% of the total work force. The progress in this sector will result in a more balanced development of the rural economy.

India was primarily an import dependent country till early seventies. Most of the demand-supply gaps of liquid milk requirements for urban consumers were met by importing anhydrous milk fat / butter and dry milk powders. But with the onset of Operation Flood Programme, the scenario dramatically changed and commercial imports of dairy products came to a halt except occasional imports of very small quantities. The major objective was to provide an assured market round the year to the rural milk producers and to establish linkage between rural milk production and urban market through modern technology and professional management.

Milk production grew from 21 million tonnes in 1970 to nearly 170 million tonnes in

2016 – more than eight fold, at the compound growth rate of 4.5 per cent. The architect behind this feat, was the father of the white revolution in India, Dr. Verghese Kurien, without whose dynamic leadership all this may not have been possible.

However, with the present global scenario, India needs to have present need based strategies, if India is able to maintain its insulation from the global trends and also meet its growing dairy demand. The challenges in ensuring a sustainable dairy development have been there and seem to have enforced more in the recent times. This is especially, with regards to milk quality; inflationary trends in inputs especially feed, huge imbalance in input requirement and availability; infrastructure bottlenecks and technology accessibility; exchange rate volatility; market access and penetration. The milk processing industry is small compared to the huge amount of milk produced every year. Only 15% of all the milk is delivered to some 500 dairy plants. The unorganised sector of milkmen, vendors who collect the milk from local producers and sell the milk in both, urban and non-urban areas, handles around 60% of the national milk production. In the organised dairy industry, the cooperative milk processors have a 45% market share. The cooperative dairies process 80% of the collected milk as liquid milk whereas the private dairies process and sell only 20% of the milk collected as liquid milk and 80% for other dairy products with a focus on value-added products.

In this era of globalization and liberalization, a global perspective is necessary to get the complete picture to ensure sustainable future dairy development.

## c. Global Outlook and scenarios for an Indian Perspective

### i. Farm Competitiveness and outlook

The annual IFCN work of comparing typical farms around the world has been an ongoing process since the year 2000. Since then, the number of countries participating has increased from 8 to over 50. Moreover, the number of dairy farms analysed has increased from 21 to around 150.

The IFCN Methodology applied for data collection, economic analysis and results validation uses the three elements:

- a network approach of researchers continuously co-operating,
- the concept of typical farms described below and
- a standard model TIPI-CAL (Technology Impact Policy Impact Calculation model) to ensure technical comparability of indicators.

A typical farm represents the most common production system which produces a significant proportion of milk in a country or a region. Usually, two farm types are used per dairy region – the first represents an average farm and the second a larger farm type. The typical farms were built and validated by a combination of accounting statistics and a panel of dairy experts. The data collection and validation were done by researchers in the represented countries, researchers in the IFCN Dairy Research Network and also during the IFCN Dairy Conference held in Belgium in June 2016.

In the IFCN Dairy Report 2016, 146 typical dairy farm types from 52 countries were analysed. Cost of milk production ranges from 8.5 USD per 100 kg milk in extensive farming systems in Uganda (where beef is the major output and milk is a side product) to 106 USD for an average sized farm in Switzerland. The average cost over all countries analysed was 40.5 USD/100 kg milk.

In Chart 1, a simplified global overview on costs of milk production is shown. The illustration is based on the results of the typical average sized farm analysed per country in 2015[1]. The results can be summarised as follows.

**Chart 1: Cost of milk production only on average sized farms 2015**


[1] IFCN – The Dairy Research Network, 09/2016, Global dairy farm economics in the crisis years 2015 – 2016: An IFCN Perspective

**India**: The cost level in India is based on a typical average household farm in Punjab. This is an average-sized farm in the North of India (state of Punjab) with 5 ha land, representing 5% of all farms and 11% of all cows in India. The dairy animals are either of a local breed or non-descript buffaloes, yielding around 2100 kg milk per buffalo and year with a fat content of 7.5%. The buffaloes are kept in a tie stall barn and are milked by hand. Crop farming is the main activity while dairying is a subsidiary activity. Most of the work is done by family members. The cost level was about 47 USD, which is much higher than the global average in 2015 and similar to costs in Western Europe. It is important to note that a larger typical farm in Punjab, India can produce milk at a much lower costs of 35.4 USD per 100 kg milk (ECM).

**Low cost regions:** Based on the average sized farms, three low cost regions have been identified: a) Argentina, Peru, Chile and Uruguay b) Central and Eastern Africa c) Some farms in the CEEC as well as Indonesia.

**Western Europe:** The leading average sized farms in Western Europe had costs ranging from 40 – 55 USD.

**The US:** The smaller farm types in the Eastern Region of USA i.e. Wisconsin and New York had production costs ranging between 45 and 60 USD, respectively. In the western region, the large farm in California had the lowest cost of about 35 USD.

**Oceania:** The cost level in Oceania was very homogeneous about 31.5 USD with very small deviations. It is important to note that New Zealand cost estimates refer to the seasonal year i.e. July 2014 – June 2015.

Costs of milk production decreased from 46 USD to 40.5 USD/100 kg milk on average of all farms analysed in 2015 over 2014. Apart from cost savings measures, this reduction was mainly caused by the devaluation of most of the national currencies to the USD.

**Typical farms from India.**

India has typical dairy farming systems ranging from 1-2 cows household farms to 5-25 family farms and commercial farms ranging from 50-1000 animals.

As soon in chart 2 below, the typical dairy farming systems from Punjab region is shown[2]. The farming system is represented in terms of average milk yield, farm size, and type of returns from the farming system.

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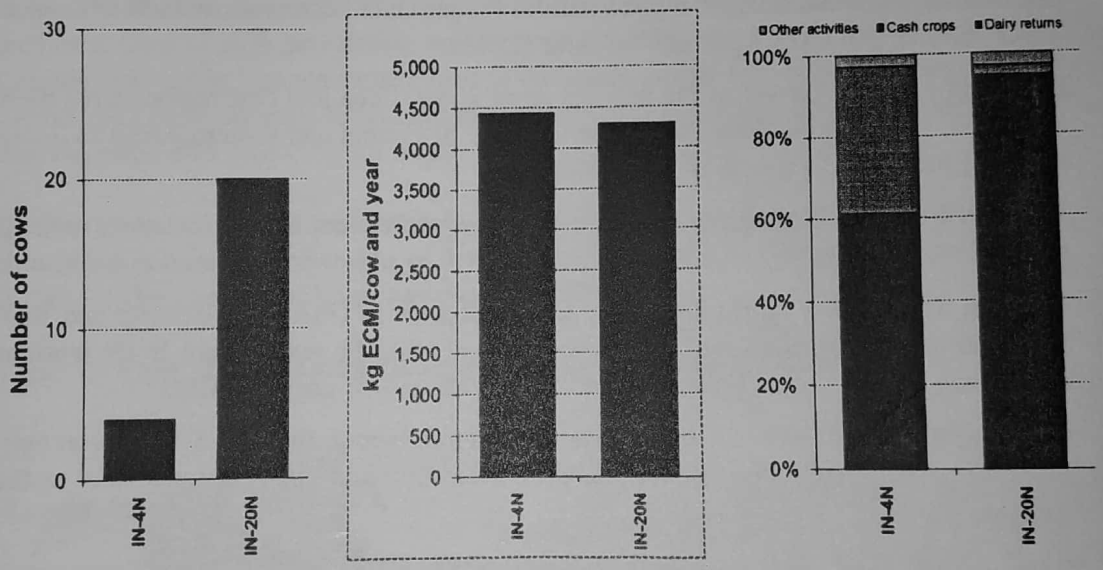
[2] Hemme, Saha, et al. 2015 Global overview of Dairy Farming- -Milk price and cost comparison, -Indian Dairy sustainability and policy, IFCN Regional workshop , November 2015, Delhi, India.

**Chart 2. Representation of Typical dairy farming systems in India**

**Legend:**
**North India**: IN-4N: India- 2 Jersey cross, 2 murrah buffalo farm in Punjab, North India; IN-20N: 20 HF cow farm in Punjab, North India;

**ECM**: Refers to Energy Corrected Milk with 4% fat and 3.3% proteins.

**Farm Size (Number)** **Milk Yield** **Returns structure of farm**




The farm types are as follows:

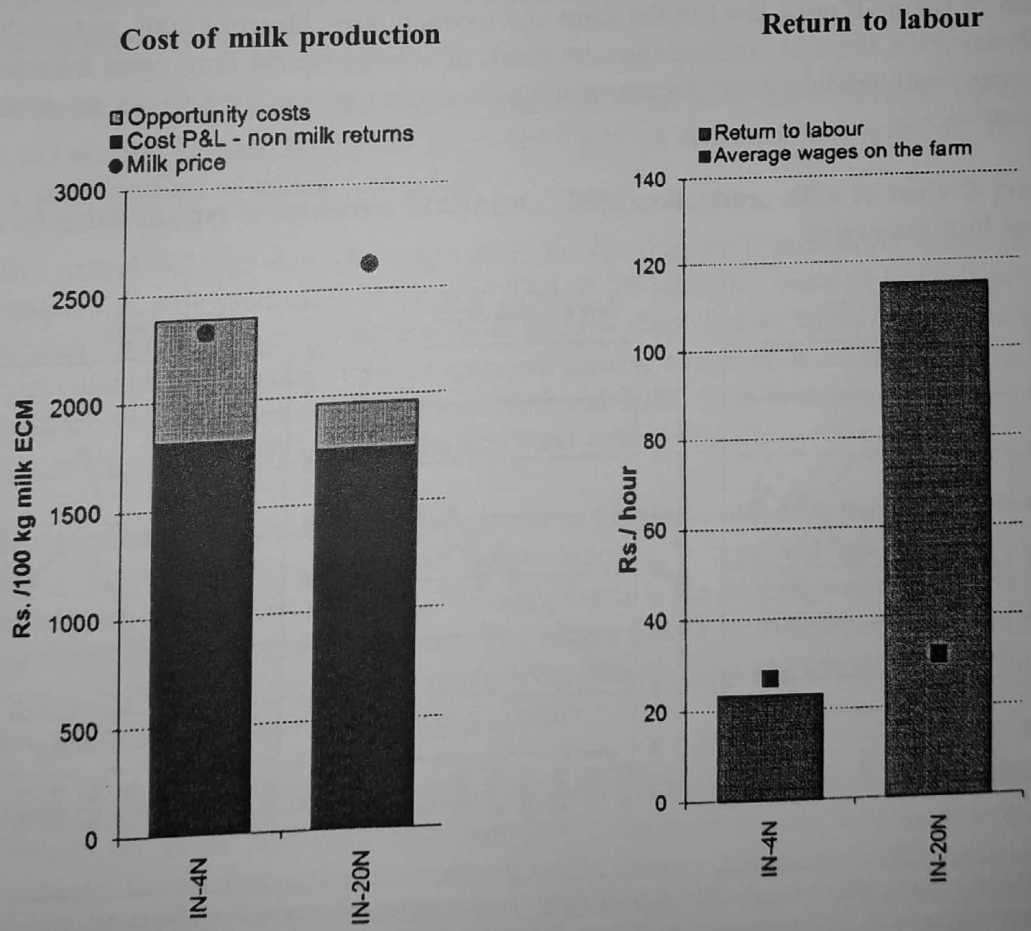
**IN-4N:** This is an average size typical farm from Punjab region in North India, household type with 2 jersey crossbred cows and 2 murrah buffaloes that produce on an average 4.4 ton of milk (ECM) per year. The feeding system is based on green forages home grown on a quarter of the land owned, straw, crop residues and compound feed. The family operates on about 3 hectare of land and a part of the income is coming from crop enterprises.

**IN-20N:** A larger family farm in North Punjab with 20 Holstein crossbred cows and 3 hectare of land. Most of the land is used to grow green fodder throughout the year. The average yield is about 4.3 ton of milk (ECM). The family used hired labour to carry out

70 percent of the dairy operations. The feeding system is quite similar to the average farm type above.

On an average the dairy farms are able to make a wage income ranging from Rs. 23 to Rs. 118 per hour which is much higher than the average wages in the regions ranging from Rs. 25 to Rs. 35 per hour. This signifies the employment potential from dairying in the area. However, it needs to be mentioned that these typical farms are with higher milk yield than the average milk yield in the country ranging from 1780 kg ECM to 7898 kg ECM per cow per year.

**Chart 3. Economics of Typical dairy farming systems in India**

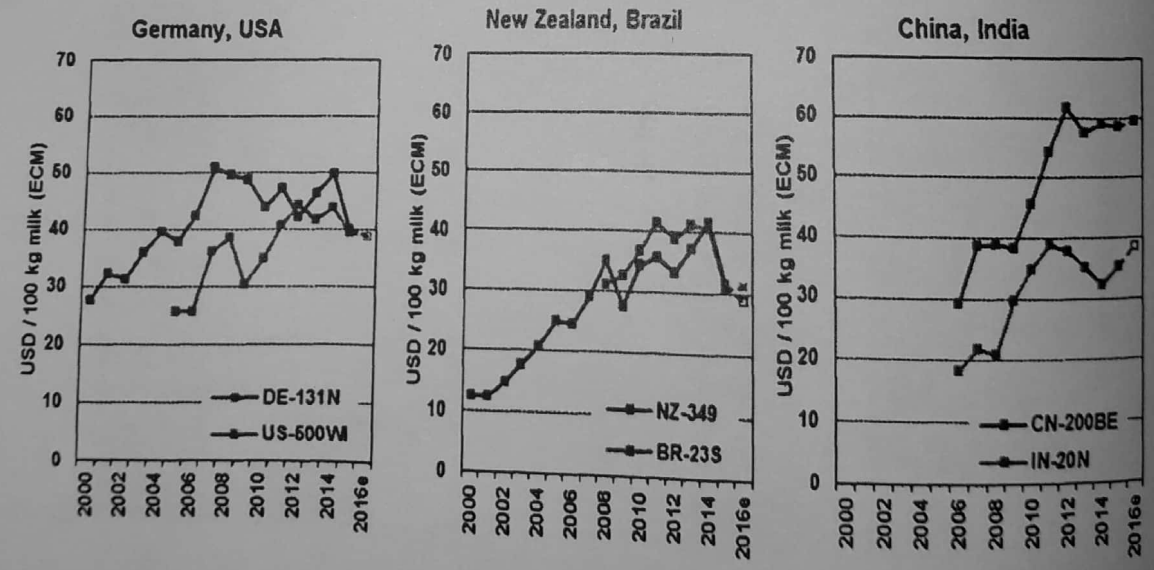


The chart 3 above shows the cost competitiveness of milk production in the typical dairy farming systems in Punjab. It can be seen that the cost of milk production in 2014-15 was about Rs. 24 per kg ECM in the average farm and Rs. 20 in the larger farm. The cost reduction by about 20 percent is mostly owing to the labour economies of scale as shown in the graph depicting the return to labour. With herd size increasing from 4 to 20 animals, the return to labour increases by about 5 times making dairying a better employment alternative at the present wage levels.

**ii. Cost of milk production developments 2000 – 2015/2016 (estimated)**

It is very important to comprehend the average cost trends of typical farms over a period of time to understand the factors behind the competitiveness of milk production. It also enables IFCN to take a view on the levels of milk production costs to sustain milk supply levels or the milk price level in the short and medium term. Hence, in this part of the analysis, IFCN tends to compare the cost trends of average typical farm types from the six major milk producing nations representing the major regions of the world[3] as shown in chart 4.

**Chart 4: Cost of milk production 2000 – 2015/2016 estimates of typical dairy farm types in 6 countries.**




[3] Hemme, Saha, Sharma etal. 2016 Global dairy developments and perspectives for sustainable dairy farming in India, IFCN Regional workshop, November 2016, Anand, Gujarat, India.

**Legend on farm types:** DE-131N: 131 cow family farm in Germany-North; US-500WI: 500 Cow family farm in Wisconsin; NZ-349: 349 family farm in New Zealand; BR-23S: 23 cow family farm in Brazil-South; CN-200BE: 200 cow business farm in China, Beijing; IN-20N: 20 cow family farm in India-North. Data for 2016 were estimated based on the average milk and feed prices (January to August 2016) and exchange rate.

**Stabilizing cost trends in major dairy nations: Major dairy nations** like Germany, USA; NZ have shown tendencies of cost stabilization in milk production towards the 40 USD mark. In case of Germany, from 2008 – 2012, the costs showed a declining trend towards 42 USD per 100 kg milk. The key drivers were a devaluation of the Euro by 14%. Costs increased again to 50 USD in 2014 due to higher feed and energy prices and labour costs in Euro terms. There was a decrease to 40 USD per 100 kg milk as a result of the depreciation of the Euro.

In USA, the case of 500 cow farm in Wisconsin, costs have stayed between 40 and 45 USD per 100 kg milk for the last five years. Costs are estimated to drop below 40 USD in 2016 because of falling feed prices.

The typical 349 cow dairy farming system in New Zealand was a world leader in cost competitive milk production in the year 2000. IFCN identified costs of 12 USD per 100 kg milk, which was the lowest cost level in those days. Driven by an increase in input prices and an appreciating currency, costs increased to a level of 40 USD per 100 kg milk in 2014, but decreased to 30 USD in 2015 and 2016. This decrease was based on a depreciation of the NZD against the USD and cost saving measures on farm.

**Urgent need for productivity enhancement in high inflation countries:** Countries like Brazil, India and China have faced higher increase in feed and labour costs due to inflating resource price tendencies. The other factor is the exchange rate volatility, making the global markets highly volatile. The easiest option at farm level, to remain competitive, is to improve the resource productivity of both input and output through the best options for the particular situation in a country.

Monitoring a typical 20 cow family farm in North India since 2006, showed a permanent upward trend in the production costs until 2011. The main drivers were increasing feed and land prices as well as the extraordinary rise in salaries. This increase stopped in 2012 as rising input costs were compensated by a higher milk yield per cow and a depreciation of the currency. In the last two years, costs per 100 kg milk increased again, mainly

because of rising feed costs and salaries. Needless, to mention that if the inflationary cost trends continues, even larger farm types in India will not be competitive than the highly industrialized farming systems in USA, Germany in near future. This will make it even more difficult to have the smaller typical average 2 cow farm model to sustain under a liberalized and globalized environment.

In Brazil, the costs of 23 cow typical family farm were steadily increasing since 2009, due to a revaluation of the Brazilian Real in 2011 which pushed production costs in USD. The increase in labour costs in 2012 was stronger than the devaluation of the Real, leading to increased costs in 2012. Costs remained stable at around 40 USD for three years. The devaluation of the Real was stronger than the increase in costs which led to a decrease in production costs in USD by 25% in the last two years.

**Higher herd size doesn't ensure competitiveness:** China embarked upon the policy of supporting large sized farms after the melamine crisis. However, monitoring costs in China since 2006 showed a strong increase in cost due to the appreciation of the Yuan could be seen. In 2012, the Yuan had gained value by + 25% to the USD compared to 2000. The costs on Chinese farms did not drop sharply in 2009 as was observed in most other countries, because the drop in prices in national currency was almost fully compensated by the appreciation of the Yuan. In 2010, rising feed prices were a strong driver for increasing cost of production to about 60 USD per 100 kg milk where costs have remained since.

Thus, it is very clear, that monitoring feed prices, wage rates, exchange rates in real time is very important to take strategic decisions to ensure competitiveness of milk production in the short run. In the long run, suitable policy measures, to ensure cost competitiveness is very much essential to take advantage of the global dairy markets and ensure farm sustainability.

### iii. Farm Milk price developments in India in relation to World milk prices

The development of the Indian and world dairy prices are shown in the charts below[4]. The IFCN World Milk Price is based on the weighted average of three IFCN World Price Indicators: skim milk powder & butter (35%), cheese & whey (45%) and whole milk powder (20%). This converts the global dairy commodity prices into a global "farm gate milk price indicator".

[4] Hemme, Saha et al. 2016. Global dairy crisis and India dairy perspective; Dairy Times, November 2016, www.agronfoodprocessing.com

**Chart 5. IFCN World and India Milk Price 2007–5/2017**

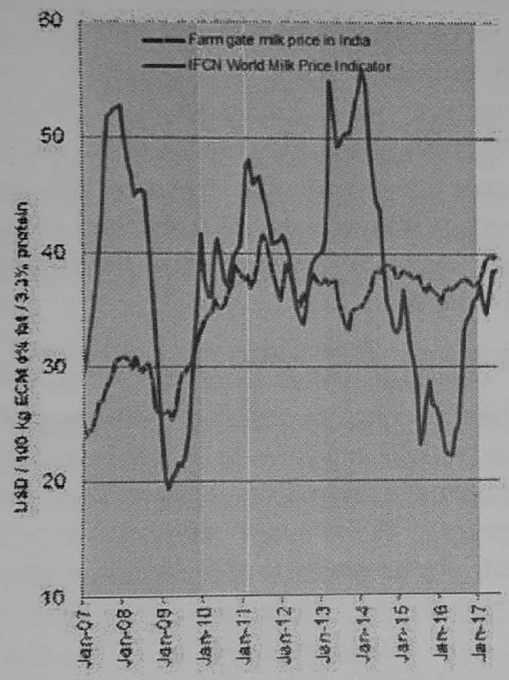
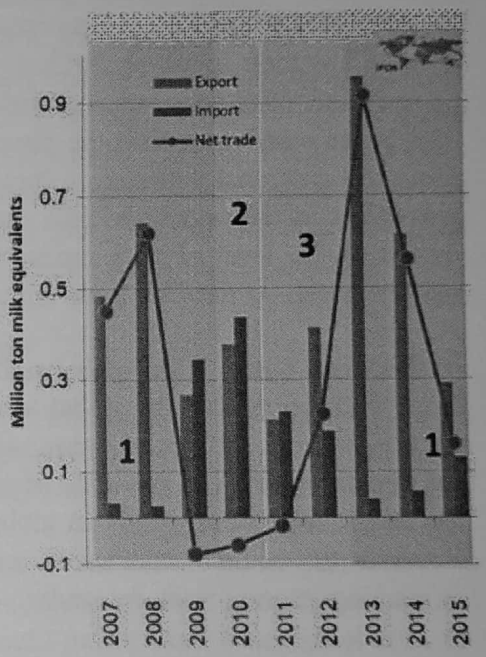



**Chart 6. India dairy trade**




IFCN World Milk Price (based on world market prices for butter; Skim milk powder; Whole milk powder; Cheese, Whey Powder)

The last ten years can be divided into 3 types of cycles[5]:

**Type 1: The rollercoaster price cycle**

**(duration: 3 years; 2007- end 2009):** This was the first rollercoaster scenario with low milk price of 22 USD and price peaks of 53 USD per 100 kg ECM at the world level. The price fluctuation was of almost +/- 50% around the mean. The start of this cycle was driven by global demand which was increasing faster than worldwide supply in 2005 and 2006. Due to the low milk supply in 2009 and a strong demand in late 2009 on the world markets world prices recovered.

[5] Hemme et al. 2017 World milk price developments and its cycles, IFCN Dairy Research Network; Kiel

**(duration: 4 years; 2013- 2016):** A new rollercoaster scenario started with high world milk prices in 2013/14 and low prices in 2015/16. This fluctuation at +/- 50% equals phase 1. So far it looks that this phase has ended in 2016 or early 2017 as prices reached the 37 USD/100kg ECM in February 2017. The key driver which started this 4th phase was the low milk supply in 2013. Due to bad farm economics, especially in 2012, and poor weather conditions reduced world milk supply growth in 2013 down to +0.5%/ year. This phase was longer than the phase 1 (2007-2009) as the EU quota abolishment has provoked additional milk supply despite very poor farm economics. The end of this cycle was driven by the reaction of milk supply growth. In absolute, the 2016 year was marked by the lowest level of milk production growth since 1998. Such supply reaction was mainly driven by the EU, Latin America and Oceania.

In this price cycle, when global milk prices were high, Indian dairy farmers received lower milk prices than the global level with very less price transmission between global and national prices. This happened twice during 2007-08 and 2013-14. Chart 2 represents the import-exports and net trade of milk equivalents by India from 2007 to 2016. India has taken the presence of higher global milk prices to its advantage being a net exporter. However, this could be considered as a diversion of milk supply to global markets instead of meeting internal milk demands.

During the period of global dairy crisis, when milk prices declined significantly, Indian prices did not due to trade regulation (tariffs) in 2009 and 2015-16.

**Type 2: Zig zag cycle**

**(duration: 1 year; 2010):** In this period world milk price was quite stable with a fluctuation of only +/- 10%. This level of stability was driven by the high level of stocks at the end of 2009 which gave the market a certain floor until they were gone.

There is a very close price transmission of Indian milk prices with world prices. India remained self-sufficient during 2010 with a net trade balance.

**Type 3: Dynamic cycle**

**(duration: 2 years; 2011- 2012):** In this period world milk price showed a moderate volatility of +/- 20%. In this time world milk supply and demand have been growing at a similar rate and minor imbalance existed.

Indian milk prices also trend to follow the world prices very closely. India has tended to have a balance of dairy exports and imports during these periods, signifying a general tendency of rising dairy demands in the country, which is likely to increase in near future. Since 2007, the world milk price has ranged from low prices of 20 USD per 100 kg milk ECM (Energy corrected milk: 4% fat & 3.3% protein) to over 55 USD on the world level. On average this price was 38 USD per 100 kg ECM in the period of 2007 – 2016. Indian milk prices have been tracking at an average of 5-6% lower than the world milk price since 2007. Indian milk prices, follow the global trends to some extent especially during the zigzag and dynamic cycles as described below. But, national demands and trade canalization by the government govern the price movements to a great extent.

**Lessons from the global milk price cyclic trends:**

The main driver of the world milk price is a result of world milk supply, demand growth and the balance of global dairy exports - imports and regional milk availability. The world milk price is affecting national milk prices in every country in the world.[6]

India needs to adopt to milk supply management at farm level rather than resort to protection measures in the long run in order to ensure improving competitiveness and sustainability of the dairy supply chain. This would mean, more integration with the global markets and preparing for the same across the dairy stakeholders. This will also help the Indian dairy farmers to benefit from the global dairy markets

**iv. Global outlook of the dairy sector in 2025 in relation to India**

Today the dairy world is serving over 7 billion consumers and providing livelihoods for approximately **ONE** billion people involved in the dairy chain. In the future, even more people will need to be served with dairy products. Indeed, the dairy sector with its complexity entails great challenges due to its high rate of significant changes, influenced by economic and political decisions and drivers.

A global picture of the dairy world in 2025 is based on an extensive collection of data (obtained since 1996) and the expertise of the IFCN Network[7]. The aim of producing a

[6] IFCN June 2017, Outcome of the 18th IFCN Dairy Conference Kiel, Germany 10 - 14 June, 2017

[7] IFCN – The Dairy Research Network, 09/2016 , IFCN Long-term Dairy Outlook - The IFCN Vision of the dairy world in 2025, IFCN - The Dairy Research Network, Schauenburgerstr.116, 24118 Kiel, Germany

long-term outlook is to provide all stakeholders of the dairy value chain with a clearer understanding of future developments in the dairy sector. Therefore this analysis is the result of a lengthy cooperation between many international IFCN Research Partners and the IFCN Center.

**Long-term milk price level:** As a key result, a long term world milk price of 41 USD/ 100kg milk (ECM 4.0% fat, 3.3% protein) is estimated. At this price level, it is predicted that world milk demand and supply will balance out. Compared to the average milk price level in 2015 this level is 46% higher. Nevertheless, this level is comparable to the average world milk price of 40 USD/100kg milk in the time frame 2007 to 2014. With Indian milk prices already close to the 40 USD mark, there is not much scope to increase supply based on milk price increase, if markets are made more liberal.

**The dairy growth story is expected to continue:** In the last 10 years milk demand and supply increased by 26% or annually by 2.4%. IFCN predicts, for the next 10 years, a growth of 25% which will be an average annual growth of 2.3%. Even though this percentage of growth is lower than in the past, the volume growth will be stronger compared to the last 10 years. According to this, 208 million ton more milk will be consumed and produced. This represents 8.5 times the current milk volume of New Zealand. Nearly half of this milk demand will be coming from India alone.

**Population growth and higher per capita consumption drives future demand.** Until 2025, global population will increase by 12% up to 8.2 billion people, so almost 1 billion more consumers will demand milk products. Global per capita consumption will increase by 13 kg ME per year (127 kg per person). The highest increase in per capita consumption will take place in India (South Asia) i.e. (+30%) up to 174 kg ME per person.

**Trade of dairy products will gain further relevance.** Within the time period 2005-2015, world trade increased by 29%. Looking at the next 10 years, the net trade is expected to increase by 51% up to 79 mill t milk (ECM) in 2025. This reflects the increasing importance of trade in the dairy world and the development of shifting dairy production to more competitive locations. There is a greater scope for India to harness this opportunity to become a net exporter taking advantage of the rising global trade potential and the strategic location of India.

**The dairy world will have new net importers and new net exporters.** In 2025, some countries will have changed their net trade status. While India and Iran are predicted to

be net importers, thus demand exceeding production. However, some countries will strengthen their current position. While China, Africa and Pakistan will increase their net imports, EU-28, New Zealand, Belarus and Argentina will increase their net exports. There needs to be a systematic strategic planning to ensure that India is able to at least maintain its self-sufficiency trends.

**Level of global milk supply will keep on growing and cover global demand.** Milk production is expected to increase by 25%, up to 1038 mill t milk (ECM) in 2025. Half of the production growth is expected to take place in South Asia, mostly from India. Regional supply will increase by 45% to 327 mill t milk (ECM). While Eastern Europe will increase by 16% and provide 17 mill t milk (ECM) more, Western Europe will increase production by 9%, and additionally increase by 13 mill t milk (ECM).

**There will be 405 mill dairy animals in the world in 2025.** On a global level, the growth of the number of dairy animals will slow down from 13% (2005-2015) to 9% (2015-2025). However, South Asia will increase its number of dairy cows and buffalos up to 177 million and Africa will have 80 million milk animals. Together they will represent 63% of the total dairy animal population in 2025. EU-28 will decrease the number of dairy animals by 3%. An additional driver for milk production growth is the milk yield per dairy animal. This is expected to increase by 14%, reaching an average of 2.5 t/ milk animal/ year. Most of the growth in India in near future should come from increase in productivity per cow. Productivity enhancement should get a top priority to ensure sustainable use of feed and land resources and environment.

**Fewer farms, but larger farm sizes in 2025.** In the next 10 years, the number of dairy farms will decrease to 103 mill, so fewer farms will produce a greater amount of milk. Merely in Africa, more dairy farms will emerge (+11%). South Asia will lose 17% of its farms but increase its average milk yield by 31% per milk animal. Average world milk production per farm has been increasing by 16% in the last 10 years and it is expected to increase further by 47%. The trends of decreasing household farms is very fast, especially in emerging nations as wages rise, and generation shifts. There should be a policy in place to account for the gaps in supply due to the general tendency of farmers to stop household farming, which is still the backbone of Indian Dairy Industry.

### d. Perspectives for future dairy farming development in India

The above analysis on farm level and sector level long term outlook clearly shows the

need for a clear policy strategy to develop the future dairy farms in order to ensure that the predicted challenges can be overcome and India is able to embark upon its path of dairy self-sustaining or even an export status. The following section gives a few perspectives and direction in which the policy makers could work upon to meet the challenges in the near and long term future:

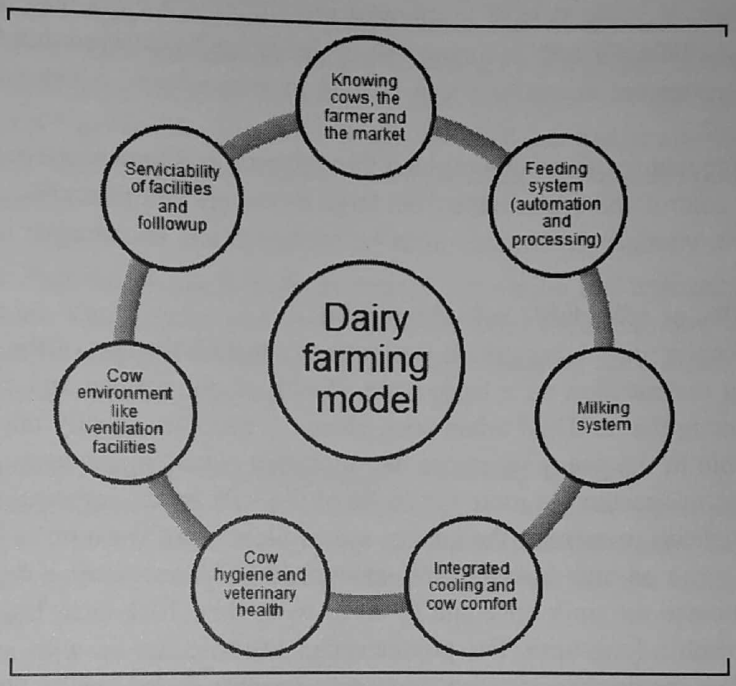
**i. Developing new India dairy farming model:**

The traditional 2 cow household farm model, which has served as the backbone for the cooperative dairy revolution in India has to find its alternative model keeping in tune with the changing global scenario and developments in the national economy. This would mean a desire and ability to change the policy and institutional framework at the national level for the same. The age old rhetoric that dairying is the main employment base for the landless and marginal farmer has to be replaced by farmers' skill and ability to pursue a resilient, productive and competitive farming. This doesn't mean that India needs very high yielding cows' farm model as in Israel or USA. The resource availability, cost affordability and the social dimensions need to be considered in deciding the ideal dairy farming systems for Indian conditions. The National policy for milk productivity needs to be seen from the lens of carbon emission standards, quantity and quality of water available for better sustainability. This would also need conducting a benchmarking exercise to identify typical farming systems in different dairy regions and assess their cost, social and environmental competiveness. This will serve as a tool to undertake a bigger exercise to identify the optimal dairy farm system in the different dairy regions keeping in account the available technologies, its accessibility and the need to overcome the near and long term challenges. IFCN has the tool and expertise to conduct the same in a minimum resource and in a short time, and has been doing the same in India in North since 2001.

A number of initiatives have already started by the young dairypreneurs in India, who have done a commendable job in putting up examples to emulate from their experiences in seeing the next generation dairy farming in India. Some of the examples are the Boutique dairy farms concept[8] as in Pride of Cows in Maharashtra, Bhagya Laxmi farms at Manchar, Sharda Farms at Nasik, Binsar Farms at Kundli, O'leche in western UP, Rajdarbar farms near Alwar are few of the success stories which have not only developed a strong market linkage but also got control over their volatile farm indices in terms of intercalving period, mortality rate, mastitis cases, age at first calving and AI success rate, etc.

[8] Parag milk foods 2017. RISE OF BOUTIQUE DAIRY FARMS IN INDIA; http://www.prideofcows.com/rise-boutique-dairy-farms-india/

An integrated approach to a profitable and sustainable dairy farming model for Indian conditions would need a systematic review of the options and possibilities of scenarios on each of the 7 key innovative areas as show below starting with knowing cows:




At a recently concluded Global dairy conference on Dairy Development globally in June 2017[9], various stakeholders from the private, government and global institutions come up with the findings that a business approach, right leadership and finding the right fit dairy development model using current economic situation of country, using the right data, metrics and impact analysis is the most crucial to define the right strategy. Investing resources for project design and monitoring are essential for a successful programme. The following points illustrate the salient issues that need to be kept in mind while implementing the strategy to identify the right dairy farming model for India:

**ii. Generation shift and appealing**

With rising commodity prices, favourable seasons and a rise in investment, the future can be bright for family farming. It can capture the oncoming wave in demand, both niche

[9] IFCN June 2017, Dairy development happens everywhere, Outcome from the Dairy Development Day during the IFCN Dairy Conference 2017, Kiel, Germany

and mainstream, and prosper. But the family farms must review how they work, where they invest and who succeeds them.

The family farm is going to have to increase productivity in ways that the sector hasn't seen since the 1980s. Growth in innovation in the sector has slowed due to lower public and private investment in addition to a decline in research and development.

The congealing nature of agricultural land through poor business succession and increasing desire to control and consolidate from large producers will mean that if family farms are to survive, younger generations must be promoted and encouraged in farming.

**iii. Availability of affordable safe clean milk**

Though per capita milk consumption is almost at par with the rest of the world, India is still suffering malnutrition on a large scale. Health of our women and children is poor especially among the rural and urban poor. Hence, it becomes equally important to make milk affordable to the needy to ensure the minimum nutrition standards. Added to this, is the problem of handling of more than 50% of the milk by the informal sector, wherein it becomes difficult to monitor the quality and availability of fresh milk. There has been lot of media news on high level of milk adulteration. The cooperative dairies have been unable to increase the milk coverage by even more than 10% even being in the dairy industry for such a long time. The private sector has to come up with innovative ways to increase the organized sector coverage through viable options using the latest innovations and trends in the market. A number of ventures have shown success in this direction and this needs to be promoted in a big way.

**iv. Urban farming in smart cities**

There have been concepts like urban farming which actually takes care of healthy food requirements of urban population. There have been models wherein for every inhabitation of around 1000 population, 2 acres of land with 80-100 animals and space for organic vegetable production could be considered. In Smart cities such kind of interventions may well be conceived right in the beginning which would not only ensure green environment but safe and healthy foods also without increasing the power and fuel foot print of delivery supply chain/cold chain for such essential products. It would also keep the population close to nature in the emerging concrete jungle scenario.

**v. Small is smart, efficient and resilient**

The traditional family farm can have many processes and pressures simplified to increase

productivity and reduce risks. Everything from sensor technology that can monitor multiple aspects of production to smart devices that centralise information and analysis for farmers can all contribute to giving the smallest family farm a boost in productivity. Small innovations like cow comfort using rubber mats, use of fermented fodder, processing milk and provisions for medical insurance can go a long way in improving milk productivity. Small dairy farming models have been propagated by various private companies **like FiTB[10] up to 25** cows with integrated facilities and provisions for biogas, water harvesting, data management using sensors, housing, milking and other facilities to ensure productivity.

The challenges that the family farm faces require innovation and ingenuity as well as a change in attitude. Our farmers and the government need to look to how they can meet the demands on the horizon whilst cutting costs and reducing risks in the present. Productivity and innovation is what must drive growth.

**vi. Next generation fodder and dairy animal breeding systems**

Fodder crop varieties need to be selected and adapted to thrive when planted in high densities. This makes possible a step change in yield delivered per acre. Paying attention to the environment, biodiversity and the needs of smallholder farmers is key to doing this in the right way.

India had some of the best breeds of cattle in the world, cows such as Sahiwal, Red Sindhi, Gir, Kankrej, Ongol and buffallo breeds like Murrah, Mehsani, Banni etc. A specific mission need to be created to spearhead deployment of genetic engineering to supply pre-sexed, high pedigree frozen embryos and semen of proven bulls by importing from countries like Brazil, which is suitable for our indigenous breeds like the Gir, Kankraj, Ongol, Murrah etc. Case studies on some very good breeding initiatives by private companies globally need to be done. A very good example is the way companies **like Sierra Desert Breeders in California[11] operates,** where breeding policy takes into account measures like efficiency and cow comfort.

**vii. Ensuring / developing Cheap Feed availability sources**

There should be suitable policy measures to ensure that adequate feed resources are made

[10] Tomkins et al. 2017 The smart dairy approach, http://smartdairyinside.com/visit-farm-in-the-box-on-site-india/

[11] Soil Restoration, 2016. LLC, Best Dairy Cows: Sierra Desert Breeders Company Profile; http://advancedsoilrestoration.com/soil-restoration/watch-best-dairy-cows-sierra-desert-breeders-company-profile/

available to ensure that milk production needs for the national market is ensured within the competitive cost ranges. A lot need to be done in setting up compound feed plants with mineral mixtures for better availability of these products at farmer level and particularly in regions and states having low potential for dairy as a primary agriculture activity. Almost half of the country may be considered as a target for such intervention. It is also relevant as the demand of milk is rising in all parts of the country irrespective of its milk potential or not.

**viii. Absence of Scientific management of animals**

The major challenge lies in disposal of unproductive, sick animals and male calves. One of the states has recently launched some program to support Gaushala to make them sustainable. Such efforts are appreciable but it would take a long time before any positive result might come. By that time the poor farmers as well as animals might not survive the economic burden arising out of unproductivity and high cost of survival. The transportation of animals in any manner is not a simple process any more. There is a need to provide green corridor (notional) so that good quality animals could cross borders and reach the place of requirements. Replacement and rotation of animals is an essential activity for sustainability of dairy farm industry.

**ix. Automation and precision machinery**

Drones, sensors, Digital apps and controlling AG bots are all being used with modern agricultural operations to improve farm productivity and quality. The latest equipment takes advantage of networks of smart sensors that monitor the health of the soil along with a plant's water and nitrogen needs. Knowing precisely how much water is needed helps optimize irrigation, conserve scarce resources and maximize yields. Getting the amount of nitrogen and water right is absolutely essential to preserving the environment. For livestock, collars equipped with RFID, biometric sensors, fertility sensors and GPS combine to allow real-time monitoring of the location and health of farm animals, ensuring that ranchers and farmers will be able to respond quickly to any potential problem. Very good examples where such technologies can be reviewed is in the smart dairy model followed by **Afimilk of Israel**[12]. Modern shredders can already ascertain the starch and dry content of the corn during the harvest. This is vital information that helps farmers feed their dairy cows the optimal quality and quantity of fodder. The nutrient value of the corn can vary from field to field, or even within the same field, depending on the soil quality and moisture, sun/shade conditions, fertilization, weather, and variety of corn grown.

[12] Afimilk 2016. Smart Neck Collar Tags for Cows Provides Data on the Go ; www.afimilk.com/afiblog/smart-neck-collar-tags-cows-provides-data

**x. Data precision technologies**

Open source technology, data sharing and data availability are making the technology cheaper and easily accessible to the farmers. These innovative methods and equipment need to be used to the full capacity and possibilities to meet the challenges faced by the Indian dairy industry and all stakeholders in the most efficient and feasible way.

The power of advanced mathematics is boosting farm productivity made accessible by the processing capabilities in the latest generation of computing hardware and software. This has made it possible to make farm operational decisions in real time, make strategic breeding decisions, or even schedule yearly or even regional dairy operations from a control station. In other words, the mathematics revolution brings to the entire agricultural supply chain the power to make informed decisions about using natural resources wisely.

**xi. Optimizing cheap labour**

One of the key advantage of India is availability of cheap labour due to low wage rates. With proper skill and training, it is possible to optimize the labour use to attain cost competitiveness in a farm needing higher technology and adaptation. A number of dairy farming models as propagated in the developed countries like Germany, USA, Japan and Israel are productive at the expense of high capital and overhead costs. This is to ensure that they are able to substitute human labour through expensive machinery as wage rates are very high. With wage rates being low in India, the solution lies in ensuring higher productivity using the right mix of technologies that is not labour substituting but also ensuring higher productivity and quality standards. It is here that the role of the engineers, dairy economists, dairy technologists, veterinarians, nutritionists, geneticists, and farm managers need to come together to optimize the processes for Indian conditions. A special research forum needs to be established to take care of this major task with highest priority.

**xii. Automation costs**

One of the main constraint in adopting high productive technologies is the lack of capital with the farmer base. Suitable strategies to make risk free capital and technologies available to potential dairy farmers need to be developed to ensure that capital does not become a constraint and hindrance to adoption of next generation smart technologies.

**xiii. Coordination of farmer operations with service providers using digital farming**

One main challenge lies in coordinating the dairy farm operations of the farmers on a frequent basis with the service provider. The farmers need to concentrate on the main task of doing the job of producing milk, taking care of cows so that he optimizes production.

pragmatic manner keeping the global developments and local needs in the long term in perspective. Business as usual attitude, may lead to India becoming a major importer in near future. On the other hand, strategic initiatives as discussed can lead India to being a major dairy export hub as well. Instead of a defensive approach of protectionism, India should embark on a path of progressive development towards facing the global competition by becoming competitive. India has the potential to be globally competitive. The role of monitoring market developments in the global level due to the high volatile nature of price and currency developments is very important. Of crucial importance is farm development strategy that is smart locally and competitive globally to overcome the challenges in near future and in long term. To start with, a special task force needed to identify the most optimal and suitable dairy farming models under Indian conditions. Next are steps to ensure that his model is sustainable with all stakeholders and services in place. Finally, embarking on a time bound mission mode with both public and private partnership to achieve the long term vision of a self-reliant progressive and futuristic dairy industry in India.

# SMART FARMING

## PROBLEMS & PROSPECTS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SUPPORTED BY

LALA LAJPATRAI INSTITUTE OF MANAGEMENT

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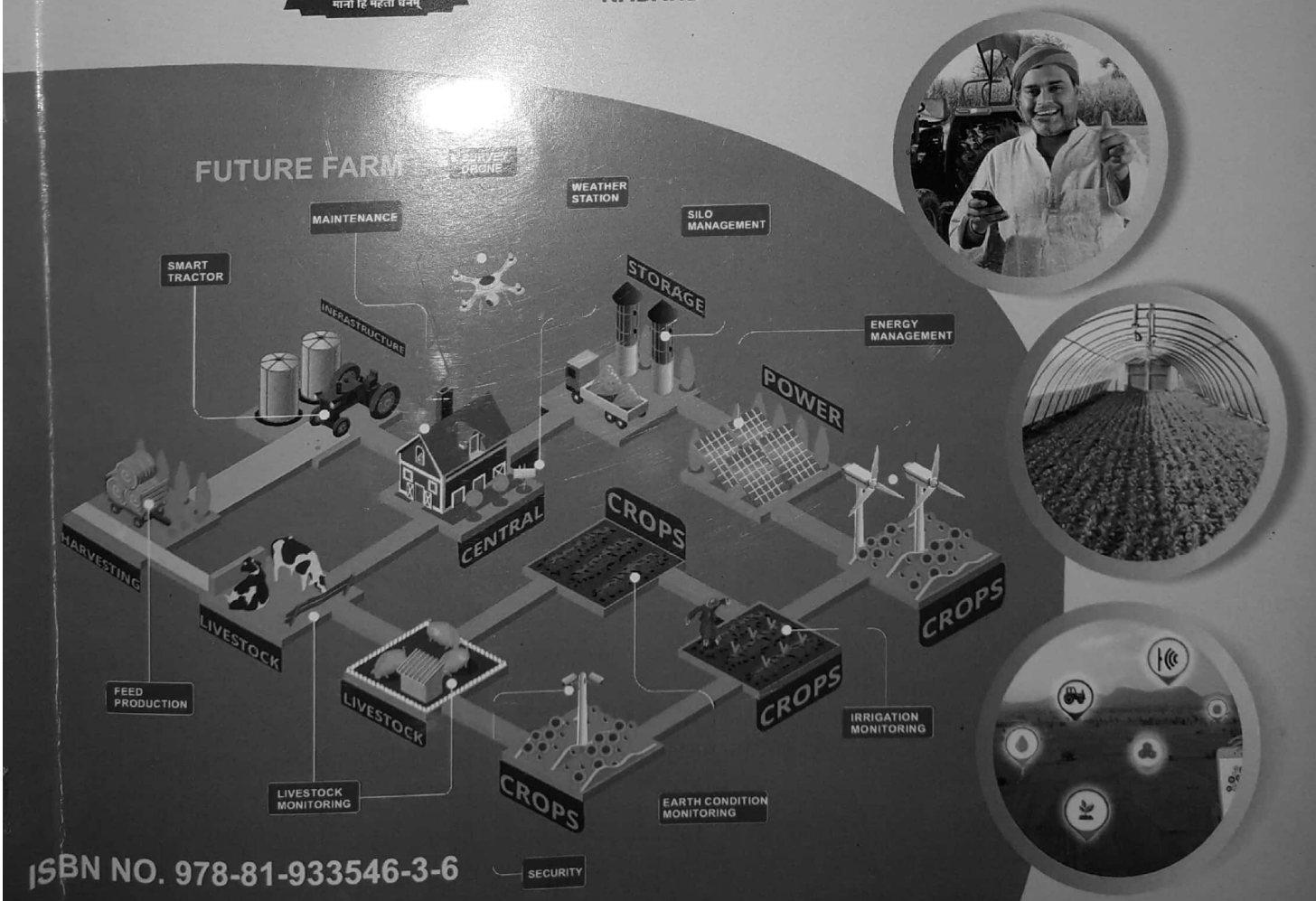
BSE INVESTORS' PROTECTION FUND





ISBN NO. 978-81-933546-3-6

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BOMBAY STOCK EXCHANGE, MUMBAI

GAURANG PUBLISHING GLOBALIZE PRIVATE LIMITED, MUMBAI
CIN No. U22130MH2016PTC287238
UAN - MH19D0008178

SMART FARMING: Problems & Prospects

First Edition : 2017

**Published by:**
**Gaurang Publishing Globalize Pvt. Ltd.**
1, Plot 72, Wadia Chawl, Pandit M.M.M. Marg, Tardeo, Mumbai 400 034.
Mobile: 9969392245
E-Mail: gpglobalize@gmail.com
www.gpglobalize.com
CIN No. U22130MH2016PTC287238
UAN - MH19D0008178

**ISBN : 978-81-933546-3-6**

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Printed at: Anand Mudranalaya, Girgaum, Mumbai-400004.

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