

Supply Chain Management of Indian Agriculture Industry: An Exploratory Study

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Abstract

Indian Agriculture/Agro Industry (IAI) is an integral part of Indian society and economy. Approximately half of the total population relies on this industry as a principle source of income and it contributes around 14% of India's GDP. Indian food business has increased to US\$ 250 billion in 2015 as compared to US\$ 220 billion in the year 2009 and expected to grow further rapidly in the next ten years. Indian Agriculture is a world leader in terms of production of many product categories. As a result, on one hand engagement of huge population, rising demand, farm mechanization, increase in global markets, etc., offer huge potential for this industry. On the other hand, it faces many severe problems. Producers of agro products are getting merely 30–35 per cent of the market price in most of the cases due to lack of supply chain practices. Annual wastages of agricultural output are also very high which in monetary term sums up to around Rs 90,000 Crore. This wastage is mainly due to inadequate supply chain infrastructure. The objective of this paper is to highlight the present scenario of Indian Agricultural Industry in terms of prospects and explores various supply chain related issues of this industry.

Keywords: Agro Industry, Indian Agriculture, Real-Time Information, Supply Chain Management, Supply Chain Network

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1. Introduction

In India, Agriculture is the basic unit of Indian society and around 600,000 villages consisting of roughly 65% of the total population is engaged in the agriculture making it the backbone of Indian economy⁴. Also Agriculture sector in India is that largest sector in which more than 110 million farmers are engaged. This sector has significant contribution in the GDP and export earnings too whereby its data amounts to 26% and 1/6th respectively²¹. Presently, India is following China, the largest food producer of the world and becoming a leading producer of many product categories worldwide.

Indian agriculture has immense possibilities of growth. Implicitly, India can become the food basket of the world. In spite of being a major contributor in the economy, Indian agriculture is the most mishandled, highly unorganized and largely fragmented sector. It has been suffering from poor supply chain management from the time immortal. The term Supply chain can be defined as a process where all members of the value chain i.e., the customers, vendors and all third party logistics service providers are interrelated and integrated in such a way that the goods and the information are made available at the most suitable time. This information travels smoothly from the inception point to the consumption point and finally ensures a superior value to all the

network members¹. In Indian agriculture there is too long supply chain network due to the presence of many intermediaries who create long gap between the consumers and the farmers (producers). As a result, the producers (farmers) are unaware about demand and receive the distorted information, being created at the consumption side (known as Bullwhip Effect) thus depriving them of real time information. In principle, availability of real-time information is the key to success of any supply chain model. Further, existence of a substantial number of channel members pick-up the major portion of the pie. As a result, farmers get very less price; there is price escalation at every links thus ruining the whole supply chain. Indian agro and foods industry is also loss and wastage prone. The study has shown that around 14.8%, which further amounts to Rs 90,000 crore is wasted annually by passing through each and every supply chain levels and finally the retail level. Indian Agriculture is also cursed with problems like low productivity, huge post-harvest losses, and excessive exploitation of farmers by middlemen, unreasonably low price of agro products received by farmers, too much post-harvest wastage, etc. These problems have an adverse effect on the attractiveness of the industry.

This paper identifies some of the above problems of the Indian Agriculture which are primarily due to absence of adequate supply chain infrastructure, non-availability of real-time information to farmers about market price of their agro products, existence of too long supply chain network, poor logistics infrastructure etc.

2. Literature Review

Indian Brand Equity Foundations (IBEF, 2017) in its report advocated the importance of agriculture in Indian economy¹⁸. It states that over 58% of the rural households depend on agriculture as the principle means of livelihood". Mehta et al., states that "agriculture along with its allied industries like fisheries and forestry is one of the largest contributors to the Gross Domestic Product (GDP) which accounts for nearly 14% of it and approximately 11% of India's export"²². It is also an important source of raw materials to number of industries. According to Singh India is the eighth biggest exporters of agricultural products along with United States and the European Union³¹. According to the report of The Central Statistics Office (CSO), "Agriculture along with its allied sectors contributes significantly to the GDP of the country. For example forestry and fisheries have large contributions which were 15.35 per cent of the Gross Value Added (GVA) during 2015–16 at 2011–12 prices". Singh further added that in the year 2012 annual percentage increase in India's export was 22 per cent and it accounted for 2.6 per cent of total world agricultural export³¹. Currently, the production of food grains in India is about 245 million tons which is going to rise by 25% i.e. 307 million tons by the year 2020.

The Economic Times Intelligence Group (ETIG) in its study of overall scenario of Indian Agriculture revealed several facts according to its report; India has the 2nd largest arable land (161 million hectares) and irrigated land (55 million hectares) in the world¹¹. It has been reported as the largest producers of wheat (72 million tonnes) in the world and contributing around 15% of global wheat production; second largest producer of pulses with the production of 15 million tons. This amounts for 21% of global pulse production. India also earned the pride of becoming the largest producer of milk in the world by producing 96 million tonnes, which contributes to the 17% of global milk production; mango (around 10 million tonnes per annum) from an area of 16 lakh hectares and now India is among the largest growing and exporter of spices in the world.

The list does not end here, India has become the 2nd largest producer of tea which further accounts for nearly 28% of the global tea production. It has also registered its name among the largest producer of rice by contributing up to 22% of global rice production. The sugarcane produced in India also accounts for a large portion of global production which is up to 21%.

According to the FOBICS, as derived from IBEF 2013, "The Indian food industry which presently stands at close to US\$ 135 billion with a CAGR of 10%, is expected to touch US\$ 200 billion by 2015"¹⁴. It includes fruits and vegetables, fisheries, milk and milk products, meats and poultry, alcoholic beverages and soft drinks apart from basic foods like, wheat, rice, maize, etc. A rapid growth in Health food and health food supplement is another growing sector having high potential due to the rise in health-conscious population.

This study also identified the major drawbacks of Indian agriculture. This identifies that inspite of being one of the major food producers of the world, India has less than 1.5% of contribution in the international trade to its credit. According to Department of Land Resources of Govt of India, (2013), the agricultural productivity is currently half of what it is in many other countries²⁶. According to Agrawal, "The foremost issue for the Indian Agriculture is the losses and wastage². As much as 10 to 20 per cent is lost by the time the agro products reach the retail level primarily due to poor supply chain infrastructure. There is a loss of 14.8% on an average amounting to Rs 87, 800 crore a year as exhibited in Table 1".

ETIG¹¹ as well as NMCC⁹ detailed out in their reports that Indian agriculture is suffering from multifold problems of inefficient operations. Approximately, 20% of the total food produced is wasted here (www.etfoodprocessing.com). According to a study conducted in 2015 by CIPHET, a Government agency, it has been reported that production of food in India is high along with its wastage and upto to 67 million tonnes of food is wasted every year in India. This huge wastage is equal to the national output of Britain and enough to feed any large state of India for the whole year¹⁶. Agrawal¹, identifies some of the important reasons for this huge

Table 1. Wastage Levels of Indian Agro and Food Products

Commodity	Present Level of Production			Post-harvest Losses		
	Quantity (mn Ton)	Average Price (Rs/Ton)	Value (Rs. Crores)	%	Quantity (mn Ton)	Value (Rs. Crores)
Durables (cereals, pulses and oil seeds)	230	10000	230000	10	23	23000
Semi-perishables (potato, onion, sweet potato, etc)	40	3000	12000	15	6	1800
Perishables (fruits, milk, fish, eggs, etc)	210	15000	315000	20	42	63000
Total	480	11604	557000	14.8	71	87800

Source: Agrawal, 2005

Table 2. Margin share between farmer and supply chain network members

Supply Chain Network Members	Margin (percent share of final price)
Farmer	35
Village Commission Agent	15
District Commission Agent	10
Wholesaler	10
Sub-wholesaler	10
Retailer	20
Consumer	Not Applicable

Source: Agrawal, 2010²

loss. The inefficiency in handling the produce, inadequate storage facility, poor logistics and transportations, pest infestations etc., are major areas of concern among policy makers. Situation is worse with perishable products as they are more prone to decay and rotting. The danger of pest infestation, unfavorable weather along with the absence of modern cold storage facilities add further to these wastages¹⁶. Identified that one million tonnes of onions get perished on the way to markets as well as 2.2 million tones of tomatoes. In the same way approx. 5 million eggs crack or turns bad due to improper storage facilities. Even marginal reductions in these losses are bound to improve the income level of the farmers. Deloitte, in its study found that Indian agro industry is suffering from many inadequacies such as inefficient storage facilities, poor power supply and lack of sufficient cold storage facilities as a result of which almost 40% of total fruits and vegetables are wasted on their way to the markets. Wastage level has further increased to around 30–35 per cent of the total production which in monetary terms comes to around Rs 85,000 Crores.

The Economic Times Intelligence Group¹¹ (ETIG) report further identified that the supply chain network of Indian Agriculture Industry is too long comprising at least 5–6 members in between farmer and consumers namely, village consolidator and/or commission agent, district commission agent/trader,

wholesaler, sub-wholesaler, and finally the retailer. Dasgupta argued that this long chain of intermediaries adds substantial amount of cost at every level, thereby leading to high prices at the consumer level⁷. Moreover this also indulges few middlemen in the act of hoarding and creating artificial supply deficiency in the market. Agarwal explained that at one end consumers have to pay high prices while at the other end, farmers get insignificant prices for their produce¹. Consumers in India spend 3–4 times of the farmer's prices in comparison to the developed countries, where consumers just spend one and a half to two times the farmer's actual price. In this way, major portion of the agro and food products prices paid by Indian consumers is distributed among the channel members in between. Dasgupta further identified that wholesalers, retail traders and food processing companies are sometimes debarred to buy output directly from the farmers⁷. The brokers in between delay payments to farmers for weeks, the middleman at mandi charge commission from both the sellers (farmer) and the buyer (the urban retailer/food processor). All these finally brings hike in prices at the final consumer level. Generally, farmers get around 35 per cent of the market price of their produce in most of the cases.

Distribution of margin among supply chain network members is depicted in Table 2 (ETIG)¹¹.

The worst part is that food products actually cost more in India, which has an abundance of food, than in other economies where food is a scarcity. The existence of a sizeable number of supply chain network members, intermediaries, there is major deterioration of quality, increase in wastage level due to poor handling and farmers get only a very small portion of market price of their products. It has been found that most of the price increment happens in the hands of this large number of intermediaries². Supply chain inefficiency is common to Indian Agriculture. These inefficiencies are common at every stage from production to distribution to marketing to infrastructural development. Moreover, there is absence of constructive connections between agricultural research, extension programs, development of crop, real time market information etc. There is also lack of constructive framework in the overall agricultural value chain. One cannot find any sustainable model for agricultural credit and finance which is again important for growth and development of the industry.

In the light of given structural lag and the system complexities, there is a need to develop commercialized agriculture equipped with high technical knowhow with availability of effective credit facilities and market interferences. This position can be achieved big corporate houses along with other successful agri-business houses come forward to invest in this sector. This is therefore believed that a demand driven agriculture developmental strategy is the need of the hour. Such strategy has the potential to utilize the positive aspect of supply chain thereby increasing farm incomes. There is a great opportunity for farmers to capture the increasing demand and increase their income level. Vertically integrated farms and markets have lots of potential to grow.

In a study conducted, by Fa champs et al., it was reported that “that little information circulates about unobservable crop characteristics¹². Little information was found to be traded on varieties, planting time, pesticide and fertilizer use. Growers do receive a price premium for observable characteristics of the crop such as drying, grading and packing. These attributes serve to reduce transactions costs to traders, consequently they are only valued by traders and do not translate into unit price premium further down the value chain. Vertical integration was not found in this research group in India except for small isolated pockets”.

There is a wide gap in terms of availability of information, knowledge, working relationships, technological development for farm mechanization, characteristics of market, etc between the farmers and the markets. These gaps have a lot of negative impact on farmers as well as consumers and the most benefitted group of people is only middlemen (supply chain network members) between farmers and consumers. Due to the presence of many network members, there is further distortion of available information. Many researchers have established that the key to

success of many supply chain is the smart use of information¹⁷. It is also established that Information Technology (IT) has the potential to link farmers and consumers directly.

The success of modern agriculture depends upon real time information flow and knowledge sharing. Each member of the supply chain largely depends upon timely and accurate information for various decisions²⁹. That is why; organizations like Indian Council of Agriculture Research (ICAR), National Informatics Centre (NIC) in India and world organization like FAO (Food and Agriculture Organization) have been striving to provide quality information services to support the agriculture sector for speed and reliability, better communication; removing geographical boundaries; social networking; and enhanced cheaper accessibility as compared to print media.

3. Research Methodology

Research methodology used for this study is a judicious blend of an extensive literature survey for identification of various key elements of supply chain related issues and challenges of Indian agro industry and an in depth experience survey of 35 qualitative respondents (farmers, and local agents, brokers, wholesaler and retailers of food grain market of Varanasi) for collection of qualitative information for mapping of fragmented market scenarios; followed by validation and fine tuning of overall picture of IAI's supply chain system and practice.

3.1 Supply Chain Issues and Challenges in Indian Agro Industry

According to Agarwal, “supply chain management can be defined as the process of sourcing and procurement and conversion of products along with all logistics management activities². The essence of supply chain lies in the coordination and association with various channel partners i.e., suppliers, intermediaries, third party service providers and also the consumers. These channel partners catalyze the smooth flow of goods services along with related information throughout the network. In essence, supply chain management integrates supply and demand management within and across firms and all key business processes from the end user for maximization of value to all network members by elimination of duplication or repetition of similar work, elimination of non-value adding network members, prevention wastages and damages, availability of real-time information, etc.” With all these advantages supply chain management can be a powerful tool to address the problems faced by Indian agro industry. Through supply chains, farmers (producers) have real time access of marketing information and knowledge. They make use of this information and knowledge for improving their value-added services. The supply chain management benefits the organization

by reducing the losses and costs, increasing the sales, ensuring desirable product quality and safety. Supply Chain also encourages the dissemination of technology (which is very much desired in Indian agriculture), capital and knowledge among the various channel members. Development of supply chain not only benefits supply chain participants but also brings social, economical and sustainable environmental development by generating more employment opportunities, value addition and a significant decline in the product losses. These advantages when used in agriculture resolve most of the inherent problems. While analyzing the scenario of Indian agriculture, it is apparent that prevailing supply chain systems and practices are largely conventional in nature resulting into unprofessional and traditional mind-sets.

Developing and having a well-articulated supply chains in this industry is complex process and challenge that requires adequate information and technical expertise for building chains and ensuring hurdle free communication and commitment from all the supply chain partners. This needs a proper framework to be built.

On the basis of careful analysis of Indian Agro industry, it is crystal clear that there is significant amount of losses and wastages resulting into deterioration of value. In the supply chain perspectives, such a pathetic and alarming scenario is prevailing due to following reasons:

3.2 Poor Dissemination of Information and Knowledge

The success of any supply chain system requires knowledge and real-time dissemination of all relevant information throughout the chain. To build a successful competitive position the supply chain strategy must be collectively formulated by all the channel partners. It is crucial for every channel partner to clearly recognize the consumers along with the new competitive environment prevailing in the agriculture sector. In other words, there must be full visibility of information among participating members of the supply chain. The important information includes knowledge about demand, marketing, logistics, quality, information flow, specific role of value addition of each member, technology, present stock position, cash flow, etc which must be available on real-time basis for the smooth functioning of chains as a whole.

Above features when applied to Indian agriculture gives a very different picture. Farmers have very little or no knowledge about various aspects of the supply chain. ETIG as well as NMCC⁹ identified that that Indian agriculture is ill fated by large no. of problems¹¹. Its supply chain is traditional and remained unchanged which hinder its efficient operation. Unorganized markets continue to dominate the sector. Only 2% of the total food market in India is organized. The reasons behind this statistics are small land holdings, poor financial position and illiteracy of the farmers forcing desperate selling, lack of knowledge about

market price and market accessibility, lack of bargaining power, absence of forecasting feedback to farmers to adjust crop mix to maximize benefit, etc. Further, supply chain system of Indian agriculture is obsessed with various obstacles like presence of large no. of marginal/small farmers, absence of economies of scale, disintegrated supply chains, unorganized and low level of value addition activities, deficient infrastructure of marketing of agricultural products.etc.

Sajjad²⁹ clearly states that Indian agriculture can be grown through the introduction of efficient proper supply chain infrastructure. This means that all farm produce should be made available to the consumers at right place, time and quantity along with right price. This is only possible when the demands will be properly forecasted and determined. If the farmer fails to predict proper demand it leads to fluctuation of demand between supply chain stages. This fluctuation further incorporates another dangerous phenomenon known as - Bullwhip Effect, in which artificial and unreal demand is shown thereby misguiding all the stake holders involved.

During the course of experience survey, it has been found that farmers have been restricted deliberately from dissemination of basic knowledge about marketing, logistics and new technologies. They have been prevented from active involvement while responding to changing market conditions in most of the cases. Coupling of Information Technology with modern farming techniques results in multiple benefits.

For example, there are evidences where farmers have been empowered with the help of extensive use of information technology that in turn, addressed many supply chain related problems of farmers. For example, after the big success of E-Chaupal, International Business Division of Indian Tobacco Company (ITC), runs Aqua-Chaupal in Andhra Pradesh for Shrimp farmers. It is a web based platform assisting shrimp farmers of Andhra Pradesh with real time information on weather and modern scientific farming practices. It also equips farmers with the knowledge of prevailing market prices, methods to improve productivity and reduce transaction costs at their doorsteps. This model facilitating farmers in many ways including testing quality seeds and providing them to farmers, sharing real time information on purchase price of ITC as well as other companies, sorting of quality products for export purposes, and filling of information Gap between the farmers and the markets. ITC also runs Soya-Chaupal at Madhya Pradesh, Wheat-Chaupal at Uttar Pradesh and coffee- Chaupal at Karnataka.

Ministry of Agriculture, Government of India runs Kisan Call Centres (KCC) through a toll free number across the country for providing information to the queries of farmers in regional language. It also links farmers and scientists for solutions to their specific problems relating to agricultural and related field problems such as fisheries, veterinary, dairy etc.

In the literature survey, it has been found that losses and wastage level in Indian agriculture is excessively high and around Rs 85,000 Crores mainly due to poor logistics infrastructure more specifically material handling, warehousing, and transport facilities. The part of the supply chain management which helps in the effective and efficient forward and backward flow of goods/services along with its proper storage activities is known as Logistics Management. Logistics is also responsible for the flow of real time information between the origin point to the consumption point ensuring value transfers to the ultimate consumers. Its activities comprises of inbound and outbound transportation, management of fleet, handling of materials, warehousing, fulfillment of orders, designing logistics network, management of inventory, planning of supply/demand, and also to manage (IPL) Third Party Logistics Services Providers.

Logistics in India has to face many challenges due to large size, uneven geographical conditions, large population, absence of essential infrastructure, frequent natural calamities etc. There is absence of professional communities which can bring integrated systems approach to logistics management. Few giant public sector organisations like the Central Warehousing Corporation (CWC) and Food Corporation of India (FCI) have been established by government to provide total logistics solutions to improve the performance of agro supply chain but they are suffering from their own system inefficiencies. According to, “the final cost of procuring wheat and rice by FCI rising from Rs 1,411.9 and Rs 2,039 per quintal (2015–16 estimates) to Rs 2,181.7 and Rs 3,038.9, respectively, Grains which are to be distributed through (PDS) Public Distribution System are diverted³. As the grains move from govt godowns to the fair price shops several leakages arise in between. As a result, cheap grain is diverted into the open market and sold at higher prices by a group of mafia comprising state officials, transporters and ration shop owners.

The current system of grain management is another source of inefficiency of these godowns. Critics argue that by holding on to grain well above the prescribed buffer stock limits, FCI incurs significant holding costs. Further, because of poor storage facilities, these stocks often end up rotting”. Thus, we see that there is a need to pay careful attention towards the areas of logistics and supply chain management in Indian agro industry. This area is being overlooked from long time.

Expenditure on logistics in India is very low as compared to developed countries. It merely spends 3% of its GDP in logistics, as compared to an average of 10 % in other developed countries. Over 50 per cent of cost in India comprises of Transportation and inventory. With the introduction of better Supply Chain Management, the Logistics costs have decreased worldwide from 12.2% to 11.7%².

It has depicted earlier that there is a huge amount of losses in terms of wastages of value. These losses are due to availability

of poor logistics infrastructure and more specifically, improper handling, lack of transportation and storage infrastructure and multiple handling of agro products. Storage is the greatest problem in the Indian Agro Industries.

In early 2001, there were reports that farmers in Punjab dumped their crops near the warehouse and did not claim them at all. There are hurdles in transportation too- with fruits and vegetables travelling long distances from farm to mandi (marketplace) in open trucks and tractors, losing quality, weight, water and numbers along poor roads. Since, potato is a major crop in India, in 2000, India had 297 cold storages with storage capacity of 14 lakh tonnes of potato. 90 per cent of all cold storages were for potatoes. India produced up to 30 lakh tonnes of potatoes in 2001 which has increased upto 480.08 Lakh tones in the year 2014–15. In this regard the Agra Cold Storage Owners Association (ACSOA), has taken an appreciative step in increasing storage capacity of potatoes at Agra. It has the storing capacity of around 2.2 million tones. The district contributes to 7 per cent of the total cold storage capacity available in the country leaving Punjab, MP, Maharashtra, and Karnataka much behind. Moreover this kind of storage infrastructure is not available across the agriculture dominated areas of the country.

The Bhabha Atomic Research Centre (BARC) in Mumbai has practiced irradiation techniques for many years. Irradiation of potatoes can reduce sprouting and spoilage down to 10 per cent. Thus, potatoes can be stored at 15 degrees Celsius, much higher than the 2 degrees Celsius that would otherwise be needed. That is a direct cost saving. Given that 92 per cent of all cold stores in India are for potatoes, the potential for savings just by this technique is enormous.

Some of the hurdles that create problems in the supply chain due to poor logistics infrastructure are

- Lack of storage facility at farm level reducing quality and quantity
- Lack of large-scale transport from farm to trader/mandi resulting into high cost of piecemeal transport
- Shortage of weighing scales, stocking space, manual cleaning and open air storage during most of processes reducing quality and quantity

3.3 Too Long Supply Chain Network Structure

While looking at the supply chain of Indian agriculture, it has been found that different actors are linked in the network to achieve effective and consumer-oriented flow of products. These actors include a good number of members like growers, pickers, packers, processors, storage and transport facilitators, marketers, distributors, wholesalers, and retailers. With so many stakeholders present in the overall chain there is a need to reanalyze the existing pattern of trade along with its peculiar environment of

Table 3. Supply chain members and their functions along with margin addition

Supply Chain Member	Function/Value Addition	Margin Added (%)
Farmer	Production	
Consolidator	Aggregation of produce of small farmers at village level	10–15
Commission Agent	Negotiation, selling to trader and demand-supply matching	10–15
Trader	Consolidation at district/mandi level	15–20
Commission Agent	Large scale demand-supply matching and arranges for sale to wholesalers in city	10–15
Wholesaler	Reselling to retailers	10–20
Retailer	Sells to consumers	20–30

Source: Agarwal, 2010²

product flow, exchange levels, forces affecting the operation of the supply chain such as governmental policies, etc. This reanalysis will help in identifying potential supply chain players and thus the whole system can be regenerated to increase the efficiency of overall supply chain. Success of a supply chain in terms of efficiency, flexibility, innovation, and responsiveness depends on a strong and integrated supply chain network structure based on the different aspects of the supply chains critical success factors.

Through experience survey, it has been identified that India is currently facing lack of logistics infrastructure resulting into more members (seven to eight) in the supply chain network structure by the time agro products reach consumers. Value addition is just in terms of logistics (movement or availability) which may be around 20 percent by network members from the farm gate while reaching in the hands of consumers but farmers (producers) get just about 25–35 per cent of the retail value of the foods as exhibited in Table 3.

Above Table clearly depicts that there are minimum seven members in between farmers who produce agro and food products and final consumer. From supply chain perspectives, such a long chain is resulting into value destroyers and not value-adding supply chain members in India. Neither farmers are getting a reasonable return nor consumers find real value in products in terms of freshness and price. In other basic foods, returns are as low as 25–35 per cent of the final price. In other words, while costs are inevitable and may not be possible to reduce beyond a certain limit, the margins added at each stage can and must be reduced. Furthermore, too long supply chain network structure results in inefficiency and poor market responses because Large number of intermediaries results in large hoarding, more mishandling, increased carrying and production costs and ultimately locking up of working capital. Moreover the long chain is also responsible for lack of coordination, collaboration and trust building which results into poor relationship among the channel members.

There are selective evidences farmers are getting much better price of their agro outputs supply chain network has less members. For example, Marico Industries in the year 2003 set up Marico Innovation Foundations (MIF) to build a long-term relationship with the copra farmers. Marico procures Copra directly from farmers through 8 organisational and 6 social sectors especially in south India. It gives training to the farmers on modern farm practices and further collects the produce through various collection centres established at convenient places for farmers. Along with assuring regular supply to Marico, these collection centres assure fair prices and buying guarantee to the farmers. Marico has also set up a copra portal where vendors and copra suppliers could bid/quote prices online. Approximately 5000 farmers have been benefitted by this endeavour of Marico. Marico is also associated with the Coconut Development Board. As a result of regular training provided to farmers, the vendors have now become more self-reliant and do not have to depend on brokers and middlemen for their dealings. Because of the real-time nature of the transactions, they settle their accounts on a daily basis and manage cash flow efficiently.

Another example is of Gujarat Cooperative Milk Marketing Federation (GCMMF), (which is popularly known as AMUL) has three tier system in which farmers are in direct contact with the company without any intermediary. This pattern is popularly known as Anand Pattern. In this pattern, AMUL forms a village cooperative society comprising of primary producers. This society is under the guidance of a Milk Supply Officer of Co-operative Dairy Union (district level cooperative which owns the processing plant). Any milk producer can become the member. He has just to pay nominal fees and must agree to sell milk only to the society in order to have smooth, steady collection. This further ensures regular marketing of milk and milk products along with achieving economies of scale. In this pattern of cooperative, the farmers with only 2–3 cows also sell directly to the cooperative society. The traditional middlemen (brokers,

consolidators, truckers, wholesalers, etc.) who are so potent in other agricultural products' market, are conspicuously absent in 'Amul Model' resulting into reduction in procurement cost, fair and superior price to milk farmers and quality of milk. As a result, farmers are paid up to 90 per cent of the market price of milk. According to the rate decided in the year 2015–16 farmers are paid Rs. 42.50 per liter for milk containing 7 per cent fat and 9 per cent Solids Not Liquids (SNL) (www.amul.com)

In order to leverage supply chain of Indian agriculture, it is essential to restructure the network by eliminating or disintermediating some of the members from the conventional system. For this purpose, farmers' cooperatives and contract farming should be encouraged by the Government. This adds:

- more value and better return for all stakeholders,
- Faster and better responses to new needs and opportunities
- Leveraging pooling of resources and expertise of all supply chain partners to gain more competitive strengths.

To reduce number of members from the supply chain network, government has already taken initiatives at national level in the recent past. National Agriculture Market (e-NAM) is a pan India unified electronic portal where farmers can directly sell their produce. It connects all the markets formed under Agriculture Produce Committee (APMC). Presently 585 markets are being connected to this portal.

Traditionally, farmers sold their products through the physical Mandis or Bazar Committees which were highly incompetent and levied a number of duties on their products. Under e-NAM, there is only one license for the each State and duty is levied only on one point. Prices are decided through electronic auction. It is now facilitating the conversion of the whole state to one market. The farmers are directly exposed to the markets and available prices. They can finalise the price and then sell their produce. This system is more transparent and has facilitated farmers get better price for their agro products⁶.

4. Conclusions

Having enumerated the problems, issues and challenges faced by Indian agro and food industry with respect to supply chain management and possible solutions that can be adapted at both micro and macro levels, there is an increasing role of the private sector in basic foods, and sustained and determined government efforts for empowerment of farmer and relaxation of regulation—all will be vital, amongst other initiatives. Beyond these steps, an integrated approach to several aspects of the supply chain has to be taken by all stake holders as there is huge scope for supply chain optimization in Indian agro and food industry and so,

organized logistics service industry (3PL) has a great opportunity. Indian food supply chain is too complicated for one single player, so the trend will be towards developing a network of specialized partners and putting together win-win solutions. One integrated flow of information must develop to produce what is required, to reduce costs mainly due to inventories not being visible throughout the chain and to assure demand by negotiation of long-term partnerships. The advantages of the supply chain management approach in Indian agriculture are numerous. It reduces the losses of products during transportation and storage. Supply Chain Management in agriculture increases the sales which further results into better returns to all stakeholders. It brings dissemination of technology and information about the flow of products, advanced techniques, capital and knowledge among the chain partners. In nutshell supply chain brings better control of product safety and quality.

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Annexure-I

SUPPLY CHAIN MANAGEMENT OF INDIAN AGRICULTURE INDUSTRY: AN EXPLORATORY STUDY

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