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Evaluation of Public Private Partnerships in Perishable Food Supply Chain in India

Mohammad Rais*, Arshia Kaul, Akansha Jain*****

**Senior Principal Scientist, CSIR-National Institute of Science, Technology and Development Studies, New Delhi, India. Email: mohammad_rais@hotmail.com*

***Assistant Professor, ASMSOC, NMIMS University, Mumbai, Maharashtra, India. Email: arshia.kaul@gmail.com*

****Project Fellow, CSIR-National Institute of Science, Technology and Development Studies, New Delhi, India. Email: akansha.269@gmail.com*

Abstract

In this study we delineate the role of Public-Private Partnerships (PPP) in the development of cold chain in the Perishable Food Supply Chain (PFSC) in India. We have considered the case of the fruits and vegetables sector to understand the development of the cold chain to handle existing problems from the farm to fork stage. It is our aim to analyze the status quo of the cold chain, the challenges, that exist, the current and future policies which could be formulated to enhance the development of the cold chain.

Keywords: Perishable Food Supply Chain (PFSC), Public-Private Partnerships (PPP), Cold Chain, Policy Implementation

Introduction

Extant research has concentrated on the management of a supply chain (Bag, 2012; Bhatt et al., 2014; Fredriksson and Liljestrand, 2015; Dreyer et al., 2016; Zhu et al., 2018). Fisher (1997) stated that development of a supply chain should be done based on the type of product demanded. When one determines the demand of the products accurately, only then can strikethrough appropriate supply chain be developed. The products could be divided broadly into primarily functional products and primarily innovative products. Primarily functional products are defined as those products which satisfy basic demands and thus have stable demands which are predictable in nature, have a long lifecycle, have low profit margins, and have high competition. These supply chains must concentrate on reducing the cost of production, transportation and inventory storage. On the other hand, the primarily innovative products are those which have higher profit margins and have unpredictable demand, with shorter lifecycles, and usually a high level of product variety. Though food was described by Fisher (1997) as a functional product however, with the changes that have occurred around the world due to globalization, the products of the food market could be considered to have a volatile and unpredictable demand. These functional products have low margins of profits and the returns on investments are not viable. A supply chain must be developed such that there are maximum profits.

Globally the food production as per the records of Food and Agriculture Organization (FAO) report is estimated to grow by 70% which would roughly cater to 9 billion people by the year 2050 (Alexandratos and Bruinsma, 2012). With the growth in production, there is immense pressure for handling such large quantities of produce more so the perishable produce. A Perishable Food Supply Chain (PFSC) is the one which deals with the supply of perishable food from the production stage to the final customers. For better delivery across the PFSC, it must contain a cold chain structure within itself. The primary objective of a cold chain is to keep perishable products under controlled environment to prevent spoilage (Donselaar et al., 2006). It consists of all the equipments and processes involved in this process (Joshi et al., 2011). A cold chain starts at the producer level moving upto the customer level as per Associated Chambers of Commerce and Industry of India (ASSOCHAM, 2017). It includes not only refrigerated storage and transport but also a point

of origin (NCCD, 2015). In this paper we concentrate on understanding the cold chain structure within the PFSC for fruits and vegetables in India. The issue with the Indian PFSC is that many a times there is enough food, but there is limited access to food due to the inefficiency of the supply chains.

As per the Indian Global Hunger Index score of 28.5 in the year 2016, 15.2% population was undernourished, therefore it is imperative that we consider food preservation on top priority. There is an estimated Rs 92,651 crores of loss of agri-produce. Out of the total, perishable products, fruits and vegetables, meat, fish and milk account for Rs 50,473 crores of losses as per the Ministry of Food Processing of India report in 2016 (MoFPI, 2016). As a result of food loss, the inputs for their production like land, water, labour and energy are also wasted. The shelf life of food can be increased by setting up cold chains as a part of PFSC (Negi and Anand, 2015). It will also increase the access of food to market and processing facilities (ASSOCHAM, 2017).

One of the areas for the development of an effective and efficient cold chain structure for the PFSC is that of collaboration. Collaboration in supply chain as a concept has been talked about extensively (Cao et al., 2010; Kohli and Jensen, 2010; Naspetti et al., 2011; Ma et al., 2018). Many authors such as Stank et al. (1999), Barratt and Oliveria (2001) discuss the benefits, returns and risks sharing as the major characteristics of collaboration in supply chain. The questions to deliberate upon are: (i) need for collaboration, (ii) the partners who must be involved in the collaboration and (iii) the activities for which the collaboration takes place (Barratt, 2002).

The aim of this paper is to analyze the role of collaboration (synonymous with partnerships) in the development of cold chain in PFSC in India. One of the major concerns that exist in the PFSC is the problem of Post Harvest Losses (PHL). PHL are the quantitative and qualitative food losses in the entire system (de Lucia and Assennato, 1994). PHL as defined by Kader (2002) is the loss of quantity as well as quality of a particular food production from the stage of harvest to consumption. Quality is defined in terms of the nutrient value, acceptability or the edibility of a given product. PHL are a common occurrence in developing countries. The role of collaboration is considered in such a case to mitigate the major problem of PHL existing in the PFSC in India. There are many challenges that exist in implementing the collaboration in supply chain such as over-reliance in technology (McCarthy and Golocic, 2002); failure in differentiating between the stakeholders one would collaborate with (Sabath and Fontanella, 2002) and lack of trust between partners (Ireland and Bruce, 2000; Barratt, 2004). Yet there is a growing opportunity in this area and it is important to assess the contribution of these public-private partnerships as a case for collaboration for development of cold chains in PFSC in India.

Conceptual Framework and Methodology

The current research concentrates on the assessment of development of cold chain structure in a collaborative PFSC (specifically, fruits and vegetables) in India. Borrowing from Min et al. (2005) the structure of a collaborative supply chain must provide a good return on investment, whereby there is appropriate output obtained in relation to the inputs. Collaboration can be defined in numerous ways of which one definition given by Anthony (2002) states that, 'collaboration the sharing of responsibility of exchanging the common planning, management, execution and performance measurement information by two or more entities'. When two or more entities collaborate, they share information, conduct joint planning, solve the problems occurring in one or more areas, jointly develop resources and skills and measure their performance jointly. In particular, in the current case we concentrate on the role of collaboration in the development of cold chain in the PFSC, for the particular case of fruits and vegetables. In this research, the concentration is on collaboration since it can be observed that the problem in the PFSC is severe. The main aim of the current research is to validate the hypothesis that the PFSC would be enhanced if there were collaborations between different entities throughout the supply chain. Fig. 1 illustrates the conceptual framework which is being developed in this paper.

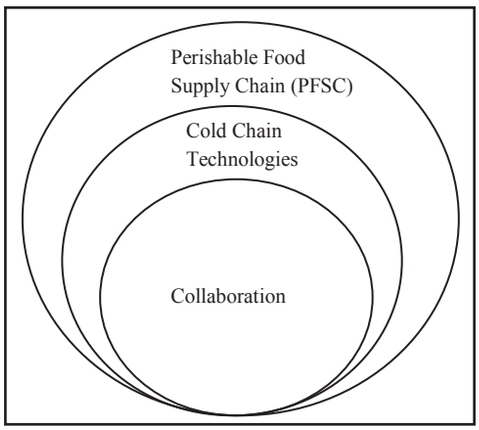
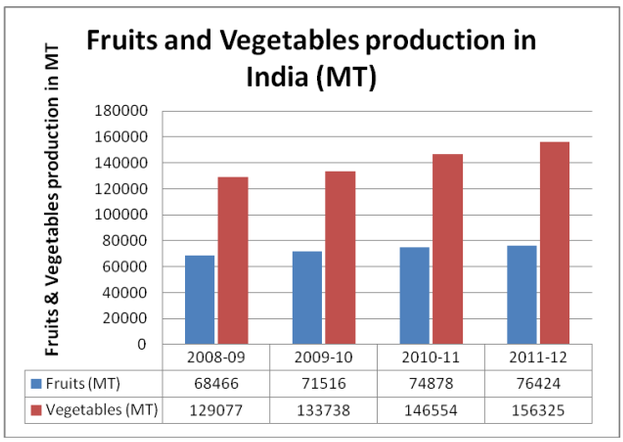


Fig. 1: Conceptual Framework of the Perishable Food Supply Chain (PFSC)

The methodology for assessment of the collaborative PFSC of India in tackling the issues existing at the post harvest stage we utilize the data available from the reports of FICCI, FAO, ASSOCHAM, MoFPI and papers in extant literature over the years. The assessment of the issues is focused at the fruits and vegetables sector. Some case studies and policy interventions have been discussed to understand the status of collaboration in the PFSC.

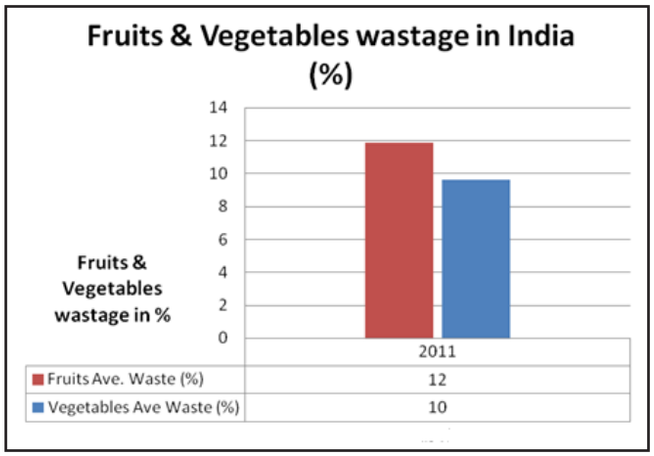
Status of Production and Wastage of Fruits and Vegetables in India

India has a wide variety of climate and physio-geographical regions which suit production of many fruits and vegetables. As per FAO (2018) and National Horticulture Board (NHB, 2013) the country is the second largest producer of fruits (with 81.285 million tonnes produced) and vegetables (162.19 million tonnes) the world over. This contributes to 12.6% and 14% of the production of the fruits and vegetables respectively in the world. 76% of the production is consumed in fresh form and there is 20-22% wastage To get a better understanding of the status of production of fruits and vegetables in India, we present the data in a pictorial representation in Fig. 2 for the duration 2008-2012 in Million Tonnes (MT) (Horticulture Statistics Division, 2017). Fig. 3 on the other hand, highlights the PHL of fruits and vegetables in 2011 (Hegazy, 2013).



Source: Horticulture Statistics Devision (2017)

Fig. 2: Fruits and Vegetables Production in India (in MT)

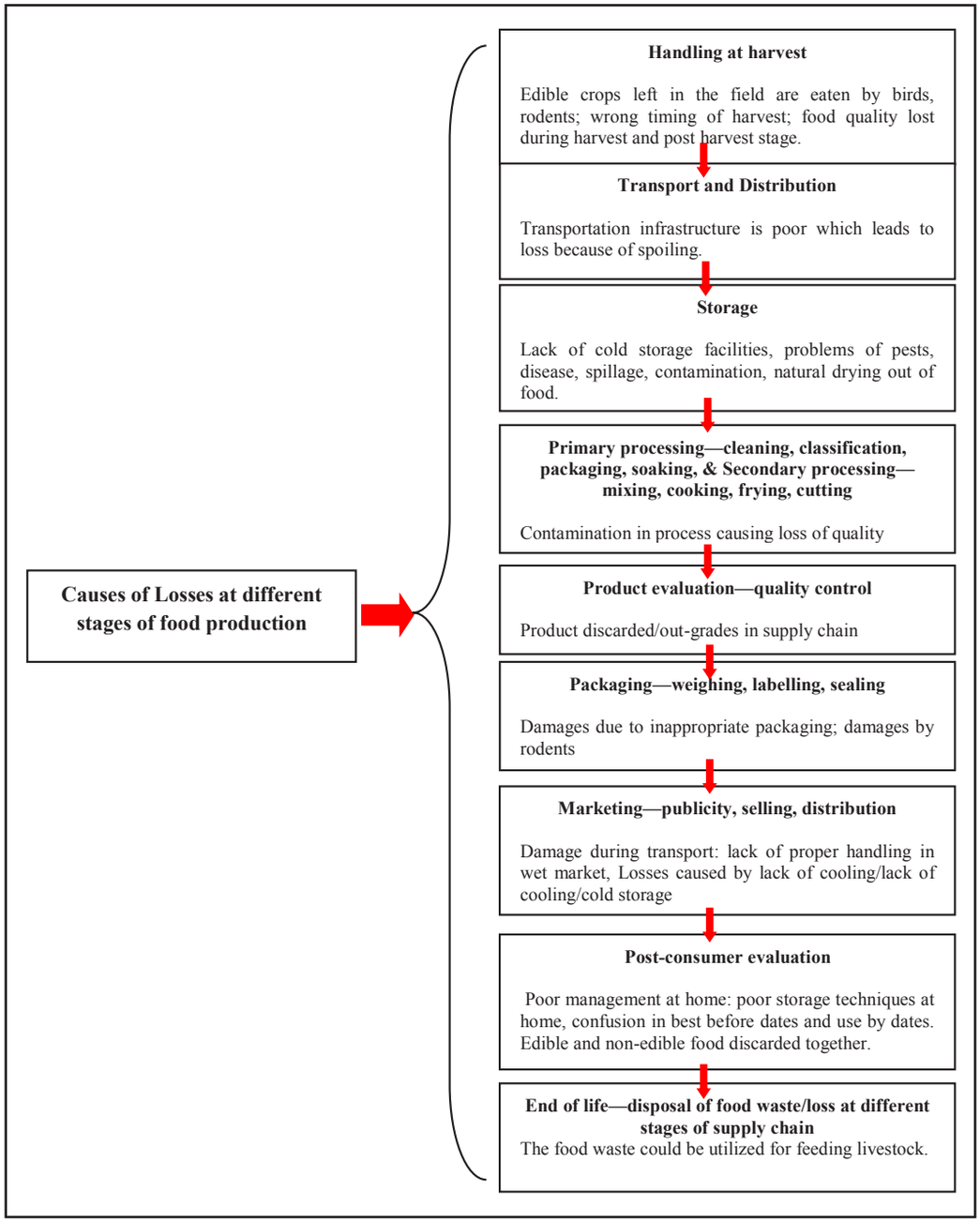


Source: Hegazy (2013)

Fig. 3: Post Harvest Losses of Fruits and Vegetables in India

Causes of Loss in the Perishable Food Supply Chain (PFSC)

The major problem that exists in the PFSC is that of losses. Out of the total production a major portion is wasted. Fig. 4 elaborates the causes of loss of food which would be applicable in the case of wastage of fruits and vegetables at different stages of the supply chain. Food wastage in turn leads to various problems such as wastage of water, manpower and electricity loss in food processing industries.



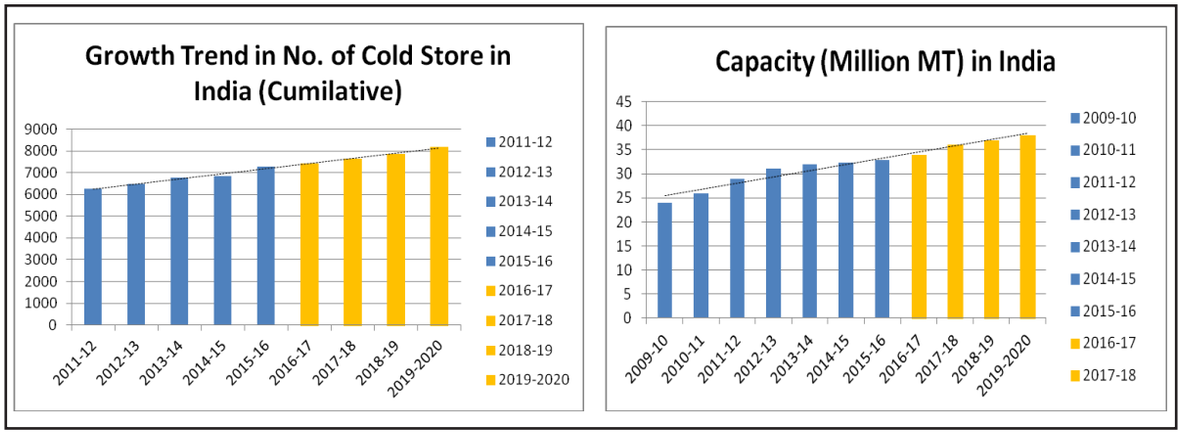
Source: Adapted from Parfitt et al. (2010)

Fig. 4: Causes of Losses at Different Stages of the Food Production

Cold Chain in India

Current and Future Status

The waste management in the PFSC could be done through the development of an appropriate cold chain within the PFSC structure. The first cold chain units in India were set up in 1892 in Kolkata, but the cold chain, industry in scientific terms was established only in 1964. Before 1997, there had been a controlled growth of the industry but later as a consequence of deregulation, there has been tremendous growth in this sector (refer Fig. 5) (NCCD, 2015).



Source: NCCD (2015)

Fig. 5: Growth of Cold Chain Sector in India

COLD CHAIN

Packing and Pre-cooling

Function
- Pack-houses are facilities for packing and pre-cooling; deals with sorting, grading, washing, drying, weighing, packaging, pre-cooling and staging.
- This is carried out right after the harvest.
- Reduction of temperature of fresh horticultural produce which depends on the products.

Current Status
- Pre-cooling is practiced at a small scale, followed mostly by dairy, meat and fisheries and no control at farmer end.
- 250 Pack Houses; 99.6% gap which leads to 30% loss.

Future Requirement

72000 pack houses with 16 tons capacity which includes the pre-cooling and staging rooms.

Food Processing

Function
- Increasing shelf life through ripening, chilling and freezing.
- Ripening chambers help in maintaining temperature, humidity, electric control system.
- Chilled products for keeping temperature between 0 to 10 deg. Celsius for extending shelf life.
- Frozen products: keeping temperature below -18 deg. Celsius.

Current Status
- 812 ripening chamber with 91% gap.

Future Requirement
- 8500 with 10 tons per unit capacity of 4-day cycle.

Refrigerated Transportation (Farm transport or cold chain transport)

Function
- Cold transport and warehouses which are available on temporary basis under controlled temperature conditions.
- Types of Transport
  - Reefer Trucks: refrigeration in the trucks powered by integrated diesel motors, many installed with GPS.
  - Reefer Containers: Used where rail-road-air-sea transport are involved; refrigerated containers with temperature control between -25 to +20 deg. Celsius.
  - Reefer Vessels/ships: cargo vessels temperature control between -30 to +12 deg. Celsius.

Current Status
- Temperature control is followed by dairy, meat and fisheries, and temperature control is not followed in most cases.
- Advanced systems like RFID and WSN are still at nascent stages.
- Unskilled personnel and very few providers providing integrated services.
- 9000 reefer units for limited produce and areas.

Future Requirement
- 60000 reefer transport with capacity 10 tons, temperature range -25 to +15 deg. Celsius.

Cold Storage

Function
- Warehousing on a short or long term basis of chilled and frozen foods.

Current Status
- Single commodity storages are available.
- Private Cold Storages are well monitored
- 31,823,700 capacity has been built of cold storage, leading to only 10% gap.

Future Requirement
- 1000 units of cold storage with 360 units of cold hubs building ~5000MT capacity for bulk and 2500 for hubs.

Retail

Function
- Refrigerated or freezer storage in wholesale and retail markets and other food service outlets.

Current Status
- Only modern retail stores have proper infrastructure.
- Manpower of the stores does not have understanding of the quality and safety.
- Lack of previous knowledge of handling prior steps.

Source: Adapted from ASSOCHAM (2017)

Fig. 6: Status of Infrastructure at Each Stage of the Cold Chain

To understand in detail what has been done for the development of cold chain in India, it is necessary to understand what is the current status. Further, keeping in mind the current status it is essential also to understand what can be done in the future. Fig. 6 elaborates the current status and the gaps that exist at each stage of the cold chain in India in general and for the particular case of the fruits and vegetables sector.

Advantages of Cold Chain

As per the ASSOCHAM (ASSOCHAM, 2017) the investments made in the cold chain specifically in pre-cooling and transport refrigeration equipment have the following advantages:

Availability: The efficient delivery of the fruits and vegetables produced throughout the year due to the cold chain development. Cold chain helps in increasing the shelf life of fresh produce by days, weeks or sometimes even by months. This is because in a cold storage, temperature, humidity and atmospheric pressure can be controlled and is stabilized to maintain an ideal environment for storage. As a result, the availability of the product increases and along with this, opportunities for expanding market reach also multiplies.

Affordability: Price fluctuations and affordability is a major concern in today's market. Price normalization can be achieved by the development of an integrated cold chain structure. The cold chain reduces PHL thereby giving uninterrupted supply.

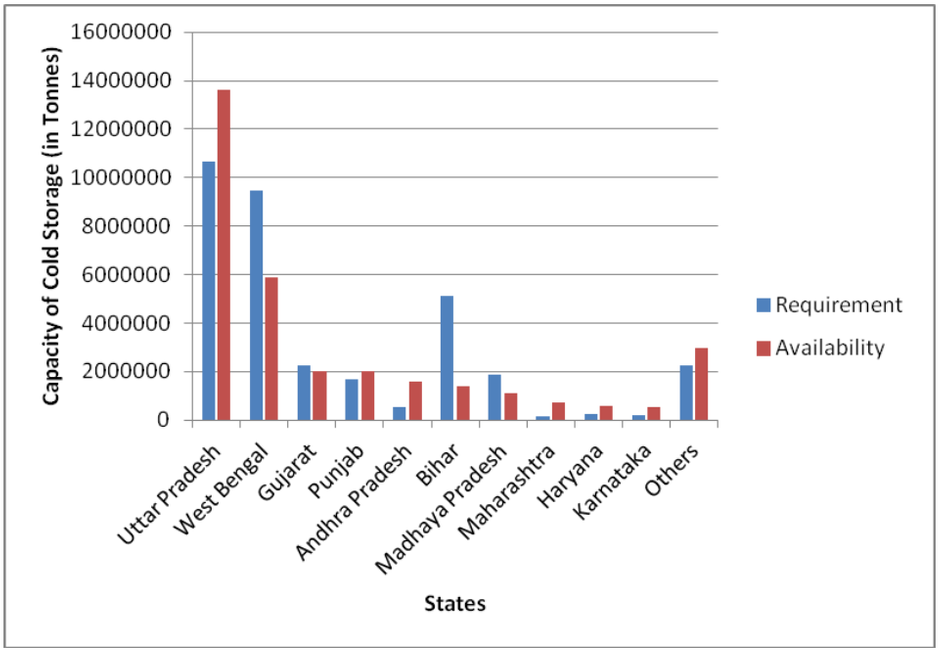
Accessibility: The crops can be supplied to areas in which they are not cultivated. The farmers will be able to reach a higher number of local and national markets apart from local markets through the development of the cold chain. This would help in achieving one of the major goals of Vision 2022 "doubling farmer's income".

Quality: As mentioned above the cold chain helps in maintaining an ideal environment for storage of fresh produce. In such an environment, the respiration rate is decreased, transpiration reduces and microbial activity also decreases. This leads to the prevention of degradation of the quality of the produce stored.

Social Importance: With the development of cold chains there is a backward integration by improving the standard of living, which leads to reducing the migration to urban areas, by generating opportunities for employment for both men and women in the rural areas.

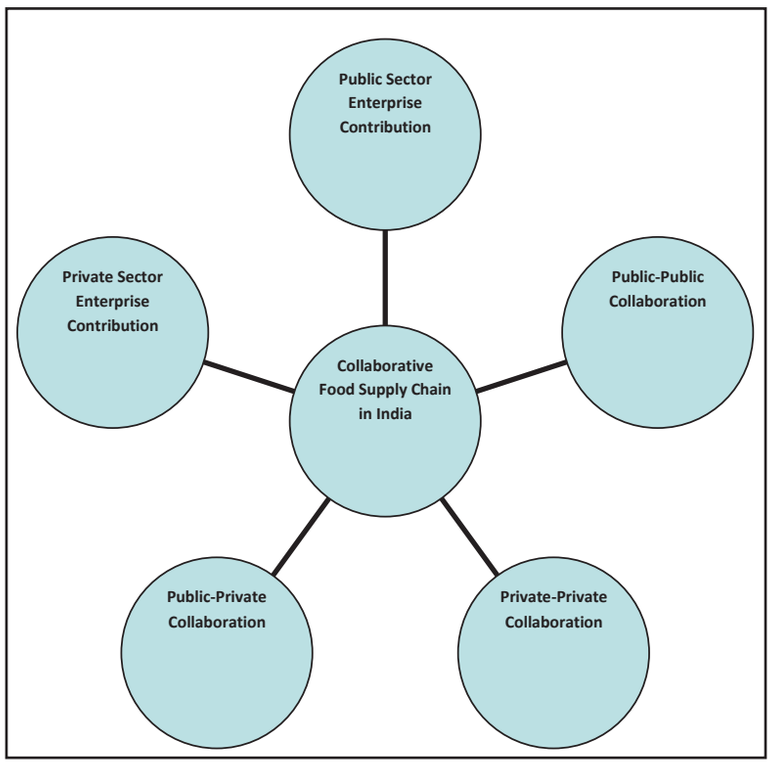
Evaluation of Public-Private Partnerships in Cold Chain

It is reported by Paul et al. (2016) that 61 million tons of cold storage capacity is required in India but only 26.85 million tons is available. One of the primary reasons behind PHL is the lack of availability of cold storage capacity. Fig. 7 shows the required and available cold storage capacity in some of the major states of India (Singhal and Saxena, 2017). Apart from this shortage of storage capacity, there are various other factors like unequal distribution, high cost, poor management, non-accessibility of facilities to poor farmers etc. which lead to PHL (Paul et al., 2016). To tackle these problems, the government is building more cold storages in India. According to a report by MoFPI (2016), the private sector owns and operates 92% of the cold storages in India. By effective and efficient collaboration, these gaps in the cold storage facilities in India can be filled. Fig. 8 demonstrates the various types of collaborations and inputs that can be attained for the smooth functioning of the PFSC in India. In this section we establish the various collaborations which have been developed and those which are going to be developed in the near future to essentially cater to the major problems of the farm to customer sector of the supply chain. Through these partnerships at various levels one would hope to develop a successful supply chain.



Source: Singhal and Saxena (2017)

Fig. 7: Required and Available Cold Storage Capacities in Major Indian States



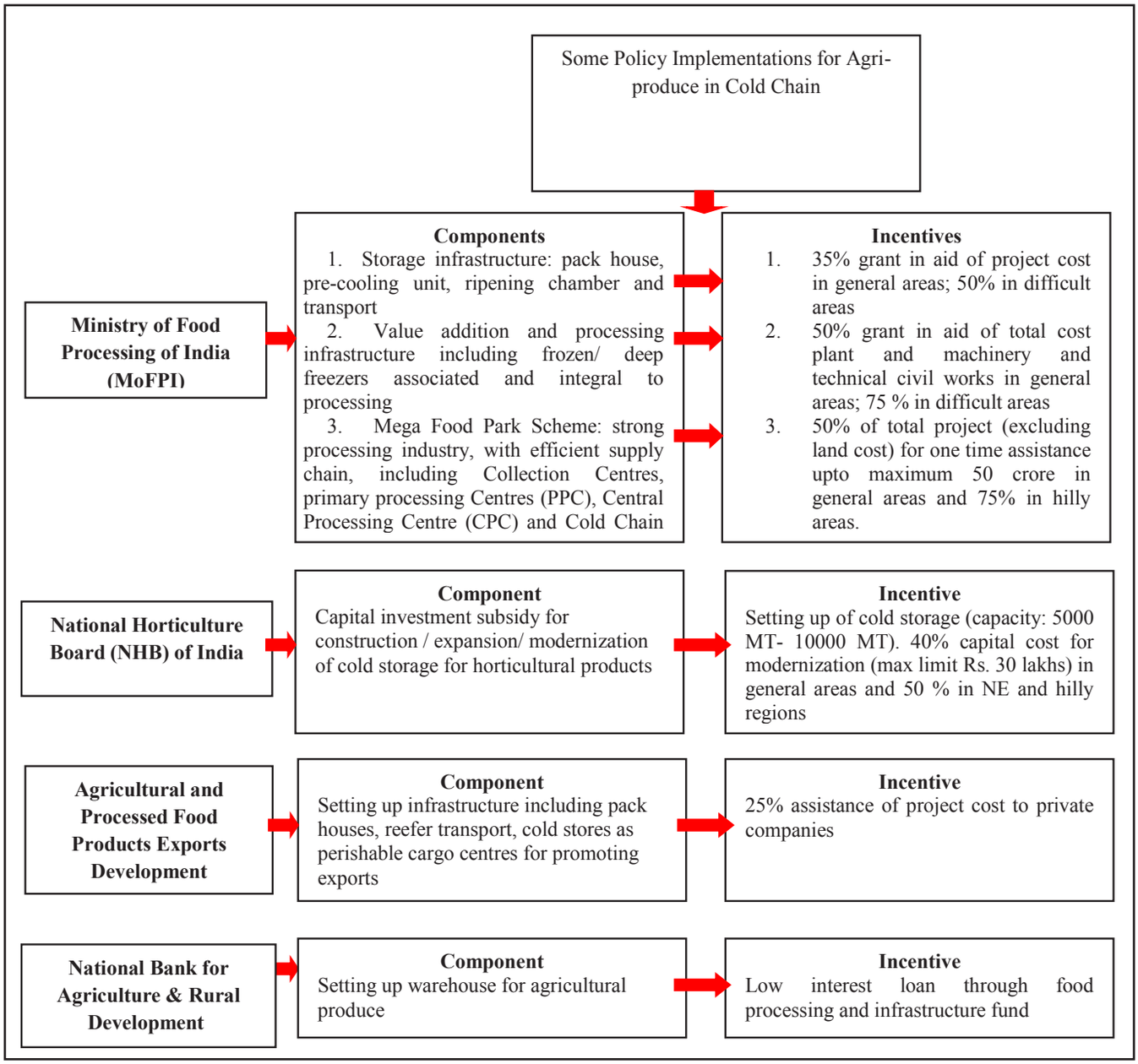
Source: Adapted from multiple sources made by authors

Fig. 8: Partnerships in Perishable Food Supply Chain (PFSC)

Some Policy Implementations in Cold Chain

The aim of such collaboration from the perspective of the government is that the generation of funds is through the private sector. Further pooling of resources, technology, skills and expertise for the enhancement of the cold chain. On the other hand, for the case of the private sector the collaborations are undertaken because it involves lower

risk as compared to independent venture, access to customers for secondary business, competitive advantage and value chain linkages, rates of cost of capital are lowered. These collaborations ensure the efficiency, flexibility and competence of the private sector long-term perspective and social interest of the public sector. The outcomes thus under a partnership are expected to achieve a better output as opposed to individual outputs (FICCI, 2012). Fig. 9 elaborates various policy implementations in the PFSC which includes the fruits and vegetables.



Source: Adapted from ASSOCHAM (2017)

Fig. 9: Policy Implementation in Cold Supply Chain: Fruits and Vegetables

Evaluation of the Mega Food Park (MFP) Scheme

Owing to the major losses the food processing is recognized as the priority sector and the Ministry of Food Processing Industries (MoFPI, 2015) has been set up for the policy making and implementation for the food processing industries. The scheme is evaluated on the basis of the latest guidelines issued on February 10, 2014. In 2005, the ministry brought out the Vision 2015

document for targeting the processing sector. The vision statement was for enhancing the processing of perishable produce, value addition of the sector and increase India's share in global food trade by 2015. One of the major schemes which was set up by MoFPI was the Scheme of MFP based on the cluster approach for developing food processing industries. The MFP Scheme was set up to establish infrastructure which is of a world class level and common user facilities. The scheme was rolled out in 2009-2010 and was in the fourth phase in 2015 (MoFPI, 2015).

Issues That Exist in the Schemes of Development

In this scheme, in the first four phases 42 MFPs were granted approvals of which 17 were cancelled. On analyzing the scheme, certain issues emerged. Table 1 states the issues in the development of MFPs (MoFPI, 2015).

Table 1: Issues Faced by the SPV from the State Government Under the MFP Scheme*

State Government Issues		Examples of MFPs Which Had Issues
Land Related	Acquisition of Land	India Food Park Pvt. Ltd.
	Contiguous Availability of land / 50 acres of land	Bengal Mega Food Park Ltd.
Clearances Related to State Government	Land use change	International Mega Food Park Pvt. Ltd.
	Land sub-leasing	Jharkhand Mega Food Park Pvt. Ltd.; India Food Park Pvt. Ltd.
	Clearances relate to environment	Satara Mega Food Park Pvt Ltd. International Mega Food Park Pvt Ltd.
	Statutory Clearances	Satara Mega Food Park Pvt Ltd.
Single Window System		This issue was faced by all MFPs

Source: Adapted from MoFPI (2015)

* Special Purpose Vehicle (SPV): Responsible for execution, ownership and management of the Mega Food Park registered under the Companies Act

Case Study in Detail: India Food Park in Partnership with Future Consumer Enterprise Limited

The food park set up by Future Consumer Enterprise Limited (FCEL)-India Food Park in Tumkur, Karnataka, on 24, September 2014, has changed the working of the food processing sector (FCL, 2015). FCL along with MoFPI, Government of India has set up this food park in partnership. It was inaugurated by Prime Minister Shri Narendra Modi. The food processing involves various processes like grading, sorting, pulping, packaging and distribution. All of these activities related to food processing are performed in this food park. The food park is spread across a 110 acre land and has a storage capacity of 22,000 tonnes. As highlighted by FCL (2015), 'the park is a single window system for many food processing firms'. Thus, it ensures hassle free contact through a single point instead of contacting multiple vendors which creates too much chaos in the market (FCL, 2015). The park is located in Tumkur district of Karnataka. This district is surrounded by the Kolar and Shimoga districts where farming of millets, oilseeds, vegetables and fruits is done. The primary aim of the development of this food park is to improve the existing line of established brands by focusing on sorting, packaging and distribution. The park has new age technologies and facilities. It can be used to produce a variety of food processing products like branded fruits and vegetables, canola and rice bran oils, frozen and processed food products. There are about 50 units of food processing and plants for manufacturing of Indian Savories and snacks, frozen food products, chutneys, pasta and various other frozen food products. The park aims to provide employment to 10,000 people and will impact the livelihoods of the farmers and producers and agri-entrepreneurs in Tumkur region and beyond. The facility will be fully mechanized and will produce products of the highest quality standards and also help in new food products catering to the needs of the local population. The extensive freezing and cold

chain infrastructure will allow for frozen and ready food varieties in the Indian market, mechanized sorting, grading and thermal ripening facilities for packaged fruit and vegetables. The aim of the India Food Park would also develop the ability to get into innovation and development in food products and also create captive production wastage across the food value chain in India and further get into hygiene (FCL, 2015).

Outputs of Public-Private Partnerships

From the developments that have taken place in this sector and those which are expected to take place in the future, the following are the outcomes that are expected to be noticed (MoFPI, 2015):

Lowering of post harvest loss: With the expansions of cold chain sector, developments of mega and mini food parks there is an expected decrease in the PHL.

Increase in profits: The reduction in the PHL would ensure higher availability of saleable quantities available which would in turn lead to higher profits throughout the supply chain.

Increase in number of job opportunities: With the introduction of more cold chain facilities and food parks there is already a requirement of many more persons to manage these facilities. Further with the new facilities which are expected to be coming up in the future, there is a further expectation of rise in the job opportunities.

Scientific Improvements: The facilities that have opened up are developed using many complex technologies and new technologies.

Better information sharing: To handle the complexities in the new supply chain, the information sharing amongst the entities has improved.

Ongoing Developments: Policies for the Future

Opening up of More Mega Food Parks

The most recent development in this sector can be observed from the article in Economic Times, August 2017 (Bureau, 2017). The central government has decided to support the farmers and entrepreneurs for establishment of mega food parks in Punjab for two years till the time their projects are launched. The food processing industry would get a boost through these policies as per Union Minister for food processing industries Harsimat Kaur Badal. The funds given would be for development of mega parks, integrated cold chains and value addition infrastructure, creation and expansion of facilities of food processing and preservation capacities, infrastructure for agriculture processing clusters, creating both backward and forward linkages, infrastructure for food safety and quality assurance and human resources and institutions. Three food parks will be developed in Fazilka, Ludhiana and Hoshiarpur which would be among the largest of the 42 setup throughout the country. The outcome of these food parks is creation of 5 lakh jobs and processing Rs 1 lakh crore of farm produce. Another benefit of these initiatives would be to take care of the common facilities of the cold chain, warehousing, packaging, sorting and grading at one location.

Conclusion

The aim of this research article was to evaluate the development of cold chain structure in the collaborative PFSC to tackle the existing problem of food waste which is a major one. To do this initially the framework for the collaborative supply chain is elaborated upon and with the same purpose the various policy implementations have been assessed. The PFSC tackles this issue of PHL through the development of the cold chain. The schemes adopted and steps taken and those which are yet to be implemented are discussed to analyze the outcomes of the collaborative supply chain in this field. The policies though developed at various levels, have much scope for development in the future if the roadblocks that have existed till date are addressed.

References

Alexandratos, N., & Bruinsma, J. (2012). World agriculture towards 2030/2050, the 2012 revision. ESA Working Paper No. 12-03, Rome, FOA. Retrieved from http://www.fao.org/3/a-ap106e.pdf (Accessed 15 January 2019).

Anthony, T. (2000). Supply chain collaboration: success in the new internet economy. *Achieving Supply Chain Excellence through Technology, 2,* 41-44.

ASSOCHAM: Associated Chambers of Commerce and Industry of India and National Bank for Agriculture

and Rural Development, (2017), Cold chain technologies: transforming food supply chains [online]. ASSOCHAM and NABARD, India. https://www.sathguru.com/news/wp-content/uploads/2017/05/Cold-Chain-Report.pdf (Accessed 10 February 2019).

Bag, S. (2012). Review of supplier selection models: Key success factors and blueprint of supply chain excellence. *Journal of Supply Chain Management Systems, 1*(1).

Bhatt, S. K., Bector, C. R., & Appadoo, S. S. (2014). Efficiency issues in supply chain management. *Journal of Supply Chain Management Systems, 3*(2).

Barratt, M. (2002), Exploring Supply Chain Relationships and Information Exchange: A Case Study in the UK Grocery Sector, PhD Thesis, Cranefield University, Cranefield, Bedforshire, United Kingdom.

Barratt, M. (2004). Understanding the meaning of collaboration in the supply chain. *Supply Chain Management: An International Journal, 9*(1), 30-42.

Barratt, M., & Oliveira, A. (2001). Exploring the experiences of collaborative planning initiatives. *International Journal of Physical Distribution & Logistics Management*, *31*(4), 266-289.

Bureau E. T. (2017). Government to aid mega food parks for two years, Economic Times [online] 16 August 2017. Retrieved from http://economictimes.indiatimes.com/news/economy/infrastructure/government-to-aid-mega-food-parks-for-two-years/articleshow/60088378.cms (Accessed 7 February 2019).

Cao, M., Vonderembse, M. A., Zhang, Q., & Ragu-Nathan, T. S. (2010). Supply chain collaboration: Conceptualisation and instrument development. *International Journal of Production Research, 48*(22), 6613-6635.

De Lucia, M., & Assennato, D. (1994), Agricultural engineering in development: post-harvest operations and management of food grains [online], FOA Agricultural Services Bulletin. http://www.fao.org/docrep/T0522E/T0522E00.HTM (Accessed 15 January 2019).

Donselaar, K., Woensel, T., Broekmeulen, R., & Fransoo, J. (2006), Inventory control of perishables in supermarkets. *International Journal Production Economics, 104*(2), 462-472.

Dreyer, H. C., Strandhagen, J. O., Hvolby, H. H., Romsdal, A., & Alfnes, E. (2016). Supply chain strategies for speciality foods: A Norwegian case study. *Production Planning & Control, 27*(11), 878-893.

FAO: Food and Agriculture Organization of the United Nations, (2018). India at a Glance [online]. FAO in India. http://www.fao.org/india/fao-in-india/india-at-a-glance/en/ (Accessed 15 January 2019).

FCL (2015). Retrieved from http://www.futureconsumer.in/our-business.aspx (Accessed 15 January 2019).

Fredriksson, A., & Liljestrand, K. (2015), Capturing food logistics: A literature review and research agenda. *International Journal of Logistics Research and Applications, 18*(1), 16-34.

FICCI: Federation of Indian Chambers of Commerce & Industry, (2012). Access to market, finance and PPP in agribusiness and food processing, Asia-Africa AgriBusiness Forum. Retrieved from http://ficci.in/spdocument/20376/AAAF-Access-to-Finance.pdf (Accessed 10 January 2019).

Fischer, M. L. (1997). What is the right supply chain for your product?, *Harvard Business Review, 75,* 105-117.

Hegazy, R. (2013). Post-harvest Situation and Losses in India. doi: 10.6084/m9.figshare.3206851.v1.

Horticulture Statistics Division, (2017). Horticultural statistics at a glance 2017, Horticulture Statistics Division, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India.

Ireland, R., & Bruce, R. (2000). CPFR. *Supply Chain Management Review, 1,* 80-88.

Joshi, R., Banwet, D. K., & Shankar, R. (2011). A Delphi-AHP-TOPSIS based benchmarking framework for performance improvement of a cold chain. *Expert Systems with Applications, 38*(8), 10170-10182.

Kader, A. A. (2002). *Postharvest technology of horticultural crops, 3311.* University of California Agriculture and Natural Resources.

Kohli, A. S., & Jensen, J. B. (2010). Assessing effectiveness of supply chain collaboration: an empirical study. *Supply Chain Forum: An International Journal 11*(2), 2-16.

Ma, K., Pal, R., & Gustafsson, E. (2018). What modelling research on supply chain collaboration informs us? Identifying key themes and future directions through a literature review. *International Journal of Production Research,* 1-23.

McCarthy, T. M., & Golicic, S. L. (2002), Implementing collaborative forecasting to improve supply chain performance. *International Journal of Physical Distribution & Logistics Management, 32*(6), 431-454.

Min, S., Roath, A. S., Daugherty, P. J., Genchev, S. E., Chen, H., Arndt, A. D., & Glenn Richey, R.

(2005). Supply chain collaboration: What's happening?, *The International Journal of Logistics Management, 16*(2), 237-256.

MoFPI: Ministry of Food Processing Industries (2015), Report on Evaluation of the Impact of the Scheme for Mega Food Park of the Ministry of Food Processing Industries, MoFPI, Government of India, [online], http://mofpi.nic.in/sites/default/files/ICRIERreportonimpactofMFPS%28Final%29.pdf_0.pdf (Accessed 10 January 2019).

MoFPI: Ministry of Food Processing Industries (2016). Opportunities in Cold Chain Sector in India, MoFPI, Government of India, [online], http://mofpi.nic.in/sites/default/files/OpportunitiesinColdChainSectorinIndia.pdf (Accessed 10 January 2019).

Naspetti, S., Lampkin, N., Nicolas, P., Stolze, M., & Zanoli, R. (2011), Organic supply chain collaboration: a case study in eight EU countries. *Journal of Food Products Marketing, 17*(2-3), 141-162.

NCCD: National Center for Cold-Chain Development (2015), All India Cold-chain Infrastructure Capacity (Assessment of Status & Gap), Delhi, (www.nccd.gov.in), https://www.nccd.gov.in/PDF/CCSG_Final%20Report_Web.pdf (Accessed 17 January 2019).

Negi, S., & Anand, N. (2015). Supply chain of fruits & vegetables' agribusiness in Uttarakhand (India): Major issues and challenges. *Journal of Supply Chain Management Systems, 4*(1), 43-57.

NHB: National Horticulture Board (2013). Indian Horticulture Database 2013, NHB, Ministry of Agriculture, Government of India. Retrieved from http://nhb.gov.in/area-pro/Indian%20Horticulture%202013.pdf (Accessed 10 January 2019).

Parfitt, J., Barthel, M., & Macnaughton, S. (2010). Food waste within food supply chains: quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society B: Biological Sciences, 365*(1554), 3065-3081.

Paul, V., Ezekiel, R., & Pandey, R. (2016), Cold storage in India: Present scenario and future directions. *Process Food Ind., 19,* 25-28.

Sabath, R. E., & Fontanella, J. (2002). The unfulfilled promise of supply chain collaboration. *Supply Chain Management Review, 6*(4) (July-August 2002), 24-29: ILL.

Singhal, R., & Saksena, S. (2017). Performance assessment of the storage and warehousing industry in India. *Journal of Industrial Statistics, 6*(1), 15-40.

Stank, T., Crum, M., & Arango, M. (1999), Benefits of interfirm coordination in food industry supply chains. *Journal of Business Logistics, 20*(2), 21.

Zhu, Z., Chu, F., Dolgui, A., Chu, C., Zhou, W., & Piramuthu, S. (2018). Recent advances and opportunities in sustainable food supply chain: A model-oriented review. *International Journal of Production Research, 56*(17), 5700-5722.