International Journal of Scientific Research in Multidisciplinary Studies
Vol.3, Issue.9, pp.1-6, September (2017)

Review Paper
E-ISSN: 2454-9312
P-ISSN: 2454-6143

Cold Chain Supply and Public-Private Partnership: A Proactive Interaction

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Available online at: www.isroset.org

Received 14th Aug 2017, Revised 28th Aug 2017, Accepted 18th Sep 2017, Online 30th Sep 2017

Abstract-Cold chain Supply is comparatively a newer concept in Indian economy. Although, it is a need of current time to think and develop a network of the cold chain for better storage and supply of food and other perishable products. As the economy has evolved, the government's focus has shifted towards service sector. Hence, the condition of food safety has deteriorated over time. GoI has continuously been trying to explore the field of cold chain supply and trying to identify the concerns and opportunities to modernize the supply chain in India. Many small actors are playing important role in complete distribution chain of agro-products. It has now become of high importance to recognize the proactive relationship (Interaction) between the cold chain supply and public-private partnership approach for storage and distribution in India. Public-Private Partnership (PPP) has been proved to be advantageous for executing the same world over. This study would focus on identifying the significant characteristics of Cold Chain Supply, and PPP and also, the ways of managing PPPs in Cold Chain Supply.

Keywords- Cold Chain Supply, Public Private Partnership (PPP), Proactive interaction Managing PPPs, and Food Safety, Challenges and Opportunities for PPP in Cold chain Supply**.**

I. INTRODUCTION

Efficient Supply Chain Management (SCM) is an essential feature that is responsible for the fast growth of any county's economy. As the competition has increased globally, developing countries have now shifted their focus to producing non-traditional agriculture goods. This change has improved not only their export capacity but also the enough availability of food within the country. Despite having such an increased agricultural capacity, a huge part of Indian population is still struggling to fulfill their basic needs. The actual concern that has to be addressed is not the food producing capacity but the capability of storage and distribution. This has led the governments of many countries to think about the various means of food safety. This would also enable the government to give away the benefits of revenues through agricultural products to the farmers. The farmers in many developing countries including India usually come across many challenges in identifying and accessing the economical ways of diminishing the risks to their produces and stand in the match with the big food producers who can produce in moderate quantity. Such a jeopardize condition leads to the increased requirement for efficient supply chain management. Cold Chain Supply is the best possible option to fulfill this requirement.

II. COLD CHAIN SUPPLY (INDIAN CONTEXT)

Cold Chain Supply is relatively a recently adopted concept in the literature. It is significant to understand the concept appropriately to execute the operations of Cold Chain Supply (CCS). The literature defines the CCS or also known as Cold Chain Management (CCM) as;

"A network of refrigerators, cold stores, refrigerated trucks, freezers and cold boxes organized and maintained so that the perishable items are kept at the right temperature to remain fresh and intoxicated during their transportation, storage, and distribution from factory to the point of use."[1]
"An environment controlled logistics chain, ensuring an uninterrupted care from source-to-user, consisting only of the activities related to storage, and distribution in which the inventory is preserved within predetermined environmental parameters. The Cold Chain does not alter the essential characteristics of the produce or product handled."[2]

[1]Taken from Mid-Level Management Course for EPI Managers, Module 8: Cold Chain Management, World Health Organisation, 2004
[2] Taken from the report "National Center for Cold-chain Development (2015). All India Cold Chain Infrastructure Capacity Assessment of Status & Gap. NCCD, India."

The cold chain supply has proved to be a suitable and uninterrupted storage & distribution model for food safety concern of the nation. Every year, a huge quantity of perishable goods, i.e., food, vegetables, flowers, meat, fruits, and medical drug/vaccines, etc. gets wasted only because of unavailability of on-time storage and distribution capability in India. Cold Chain Management/Supply (CCM/CCS) has a significant impact on farmers, and the companies working in food Industry. Modernized cold-chain development with controlled temperature generally focuses on one supply chain and not on the network of channels (Figure 1). As shown in fig. 1, CCS is a separate series of storing and supplying activities leading to scheduled delivery of the product to end consumers, and consequently satisfy them.

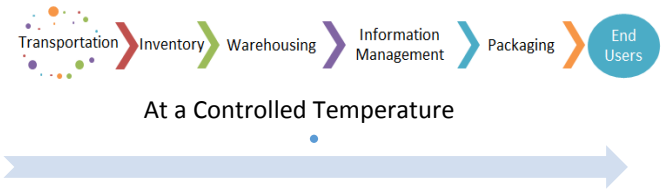

Figure 1: Series of activities involved in Cold Chain Supply
Source: Author

Many researchers had tried to research and define the limits of activities involved in CCS and suggested the cold chain begin at agricultural farm post-harvesting and end up at the consumer's destination. A typical cold chain infrastructure consists of pre-cooling facilities, cold storage, refrigerated carriers, packaging, warehouse, traceability, retailer, and consumers, under the aegis of information management systems (Montanari, 2008). It is a complete chain of operations that are required for delivering the perishable goods at a suitable temperature to the final consumers. Therefore, an optimum cold chain supply management is important to avoid the wastage of food, vegetables, fruits, and other perishable products. It is not as easy as it seems to be; there are many complexities at each phase of operations of CCS. In Indian context also, the cold chain supply has many intricacies at implementation and operational level. There are many small actors like agricultural players, warehouse owner, processing unit/Manufacturing Company, and retailer, etc. who plays an important role at different levels of CCS operation. Hence, it is substantial to appreciate the association and traceability of all the processes that lead to effective cold chain supply management.

Accepting the importance of operational effectiveness in CCS the GoI has also taken many initiatives for encouraging private sector participation in this area. These initiatives are like; permission for 100% foreign direct investment (FDI), allocation of the special fund of INR 2000 crore for 160 designated food parks, grant of subsidies for CCS implementation, etc.[3] The primary thought for attracting the private players to invest in this sector is that they can bring about the operational and managerial effectiveness in cold chain supply management. Efficient Cold Chain Supply Management would not only help the government to eradicate the food safety concern in India but also would contribute to increasing the export of perishable and commercial goods. Public-Private Partnership is the best option through which the big private players can be involved in CCS management.

III. PUBLIC-PRIVATE PARTNERSHIP (PPP)

Cold Chain Supply (CCS) Management can be best developed and operated through Public Private Partnership (PPP) approach by connecting all the small stakeholders in an organizational form. PPP is a cooperative arrangement that brings the public & private sector under a single umbrella to fulfil a common objective. The integrated model of cold chain supply management through PPP approach can not only fulfil the food safety concern but also be helpful for the increased export requirement. In India, the farmed products are generally procured through various means of transportation within the geographic proximity due to their perishability. Cold Chain Supply through PPP approach can help the government to solve this concern and help in distributing such unpreserved products to the distant location. Active imitation of PPP models across numerous manufacturing/distribution centers can lead to the evolution of Indian farming, food processing and distribution chain from inefficient, supply-driven, low-value business scenario to an organized, high-tech, demand-led and high-value orientation.

IV. PPP AND COLD CHAIN SUPPLY: AN EMERGING INTERACTION

Despite having enough resources and availability of food, a lot of people below the poverty line don't have access to their basic need. The farmers who produce these products, who have the first right over the income generated through these farmed goods, do not get their benefits. Understanding the circumstances, the Government of India (GoI) has recognized the need for building the Cold Chain Supply in the country. Not only for food safety concern but also for the innovative success in other sectors like; Supply of health vaccines and medicine supply, Supply chain for fruits and vegetables, fish, and livestock, and flowers, etc., cold chain supply would be beneficial. But the path is not as smooth as it seems. It might not always be feasible for the government to develop such a heavy-technology-capital-intensive supply chain across the country on its own. This increases the role of private sector involvement.

[3] From the presentation on "Ministry of food processing industry's Contribution towards Agriculture Development" by MoFPI, GoI.

GoI has already begun working in this field and had created a dedicated Team of people of the relevant fields / Committee to recognize the methods of promoting / smooth development of cold chain supply in India. Along with the other methods suggested by the committee, one of the significant means was through encouraging private players to develop such cold chain network. The Private Sector Participation for the development of cold chain supply can surely change the current risked condition, and not only drive innovation but can provide more efficient distribution system.

The Government team developed its report on raising the spirit of private players for investing their money in Cold Chain Supply and advised that "the Public Private Partnership (PPP) model with Viability Gap Funding as a suitable method to attract large-scale investments from the private sector in the cold chain. Although, it stated the need to work out the details of such an arrangement."[4] The PPP model, if implemented successfully, can impact the cold chain supply and subsequently on the other related sectors to a larger extent. There are many significant features of PPP model that can be advantageous for distribution of perishable agricultural goods to the end consumer. Some are suggested by Patel, A. et al. (2007) as;

- The PPP model would help the farmers to shorten the cost of cultivation by reducing the post-harvest losses, transportation costs, energy losses by maximizing the optimum use of the available resource, enhancing environmental quality and earning better profit from the better quality product.
- The higher returns can be ensured through high-quality product, off-season availability, and through improving the productivity, which would help the government to meet the issue of food security to a certain extent.
- The level of sophistication is likely increase in the PPP model, which may lead a fair competitive marketplace that works in its natural form where a large number of buyers and large number of sellers participate in transactions and decide price without the monopoly of any dominant market player.
- The present system does not adjust itself to cultural change, technological advancements and professional expertise of different stakeholders. IT applications have opened various dimensions of backward and forward linkages, which will ensure transparency and efficiency.
- Due to the involvement of Research institutions like universities and the private players, the migration of the advanced and the best practices in production and processing would be faster and smoother. Farmers would enjoy the price realization and quality upgradation through PPP approach (Transfer of Technology).

Thus, the PPP model would connect all the small stakeholders and ensure the proactive distributions of risk & rewards throughout the valued cold chain. The development of CCS using PPP model would strengthen the operational efficiency of the complete supply chain. Even the private players would also get profit-earning opportunities because of the systematized arrangement of the marketplace.

V. LITERATURE REVIEW

Mehta and George (2003) identified the worldwide concern for food safety and the increased issue of detention of Indian export and stated that "While the development of food safety standards has reduced the risks from foods, it has often come at the cost of temporary import bans, particularly of LDC food exports to DC markets. During May 1999-April 2000, the number of detentions by the US originating from 52 countries was 9,875, with India accounting for the most detentions. During December 2001-November 2002, 997 detentions from India resulted in 2.6 million dollars' worth of rejections of Indian exports."

Narrod et al. (2005) had dug deeper into food safety concern and listed out the issues faced by poor farmers and explained it as, "The increased food safety standards in both developed and developing countries can potentially exclude small farmers who face four distinct problems: 1) how to produce safe food; 2) how to be recognized as producing safe food; 3) how to identify cost-effective technologies for reducing risk; and 4) how to be competitive with larger producers."

Hatanaka et al. (2005) reviewed the international standards and norms regarding food safety and described that "WTO members adhere to both the SPS and the agreement on Technical Barriers to Trade (TBT). These agreements provide broad guidelines for choice of product standards but accept national sovereignty in adopting standards provided they could be justified based on risk perceptions and scientific assessment. Some nations have moved to harmonize food safety regulations, such as the attempt to harmonize pesticide residue limits under the auspices of Liaison Committee for Caribbean, Africa, and Pacific (COLECAP). Concurrently, there has been a rise in the number of private standards such as Euro Retail Produce Group's Good Agricultural Practices (EUREPGAP), ChileGAP, KenyaGAP, ChinaGAP, Naturane [Spain], New Zealand Fresh Produce Approved Supplier Program, and Mexico Supreme Quality GAP. Besides, major supermarkets have their own standards like Tesco's Nature's Choice and Mark & Spencer's Farm to Fork that require compliance via third party certification."

[4] Model documents for development of integrated cold chain in the country on Public-Private Partnership (PPP) model.

Patel, A., et. al. (2007) proposed the working forces of PPP model for improved agricultural development and distribution sector and suggested that "Even though the APMCs in Gujarat is working very effectively, the professional efficiency can be added through PPP model. The farmers sell their produce directly through open auction at APMCs where the commission agents play the vital role. The price spread is also wide because the majority of the farmers are unaware of actual ruling prices in other markets. "Integrated Agro-Bridge Center" would be the joint venture of APMCs and Private investors to strengthen the agri-value chain. The APMC would facilitate the land as part of its equity and the private investor would develop other infrastructure. Both the partners would likely to follow the policies by the government in their functioning. The center would get the membership charges from the group of farmers in respective areas. The research institutes, KVKs, Universities, and NGOs would be the knowledge partners of the model. This segment would provide the extension services consistently. The representative of the Farmers groups, the officials from government, APMCs, and knowledge partners, as well as the executives of private investors would organize the governing body of the model."

Narrod, C., et. al. (2007) identified the role of PPP in implementing the network of cold chain supply in numerous developing countries. They stated the same as "Many developing countries have moved into the production of non-traditional agricultural products to diversify their exports and increase foreign currency earnings. Accessing developed country markets and urban domestic markets requires meeting the food safety requirements due to several demand and supply side factors. Food retailers have developed protocols relating to pesticide residues, field and packinghouse operations, and traceability. In this changing scenario where food safety requirements are getting increasingly stringent, there are worries regarding the livelihood of the poor since companies that establish production centers in LDCs might exclude them. Poor producers face problems of how to produce safe food, be recognized as producing safe food, identify cost-effective technologies for reducing risk, and be competitive with larger producers with advantage of economies of scale in compliance with food safety requirements. In enabling the smallholders to remain competitive in such a system, new institutional arrangements are required. In particular, public-private partnerships can play a key role in creating farm to fork linkages that can satisfy the market demands for food safety while retaining smallholders in the supply chain. Furthermore, organized producer groups monitoring their own food safety requirements through collective action often become attractive to buyers who are looking for ways to ensure traceability and reduce transaction costs. This paper compares how small producers of different fruit and vegetable products in different countries have coped with increased demands for food safety from their main export markets. These commodities are Kenyan green beans, Mexican cantaloupes, and Indian grapes."

Joshi, R., Banwet D.K., Ravi, S., (2009) has described the linkage between the many small actors and inhibitors of cold chain supply and have stated that "The end result is a model that establishes the relationships among the identified inhibitors with their respective dominance. The research shows that there exists a group of inhibitors having a high driving power and low dependence with strategic importance and requiring maximum attention and another group includes inhibitors that have high dependence and the consequential actions."

R. J. Hodges, J.C. Buzby and B. Bennett, (2011), tried to compare the amount of food losses in developing and the developed countries and described that "This review compares and contrasts post-harvest food losses (PHLs) and waste in developed countries (especially the USA and the UK) with those in less developed countries (LDCs), especially the case of cereals in sub-Saharan Africa. Reducing food losses offers an important way of increasing food availability without requiring additional production resources, and in LDCs it can contribute to rural development and poverty reduction by improving agribusiness livelihoods. The critical factors governing PHLs and food waste are mostly after the farm gate in developed countries but before the farm gate in LDCs. In the foreseeable future (e.g. up to 2030), the main drivers for reducing PHLs differ: in the developed world, they include consumer education campaigns, carefully targeted taxation and private and public sector partnerships sharing the responsibility for loss reduction. The LDCs' drivers include more widespread education of farmers in the causes of PHLs; better infrastructure to connect smallholders to markets; more effective value chains that provide sufficient financial incentives at the producer level; opportunities to adopt collective marketing and better technologies supported by access to microcredit; and the public and private sectors sharing the investment costs and risks in market-orientated interventions."

Kumar et al., (2012), assessed the changing production trend for agricultural goods and identified the shift towards perishable products and stated that, "Every part of the maize plant has economic value; the grains, leaves, stalk, tassel, and cob can all be used to produce a variety of food and non-food products. In India not only production and consumption of maize have been rising consistently, the consumption pattern has also changed over the years."

Chaudhary et al., (2012), explained the enhancing need for producing the perishable and commercial product by stating that "Maize is an excellent crop in terms of biomass

production. Since ages, maize straw is being used as animal fodder. And in terms of quality, it is considered to be better than many other non-legume cultivated fodders. Unlike sorghum, which contains components such as HCN and oxalate, causing adverse effect on animal health, maize offers a good quality fodder along with good quantity of biomass. In the peri-urban region, particularly around highly populated cities, baby corn has emerged as a good source of income for the farmers within 2 months after its sowing, along with a good quality of green fodder during otherwise lean season."

Department of Economic Affairs (2017) has developed a "Model framework for Public Private Partnership, which could be made specific to a particular cold chain project being promoted by the concerned implementing Authority. This model framework has considered the creation of cold chain from farm to market with the objective of creating value for stakeholders including investors / operator / developer and enhancing value to farmers."

VI. CONCLUSION

The Cold Chain Supply has become the essential operational field for the food sector. Several countries are today, struggling with two of the common issues i.e. food safety issue and detention in the export rate. Indian government is also trying to increase its food safety standard. However, in developing the food safety standards to decrease the risk of food wastage, the concern of export detention should also be dealt with particularly for LDC food exports to DC markets (Mehta & George, 2003). Thus, it is important for the government to deal with export detentions rate. But the bigger concern is not only to produce safe food but also to be known for producing the safe foods so as to increase the export capability of the country. As mentioned in the same paper by Mehta & George (2003) that "During December 2001-November 2002, 997 detentions from India resulted in 2.6 million dollars' worth of rejections of Indian exports." India as a developing country would have to proactively deal with these export detentions so as to compete in such a highly competitive trade scenario. It would not be an easy task to match with the international food safety standards for many Indian domestic players and small farmers. The key problems that has to be dealt with, by the small farmers and domestic players has been clearly specified as (Narrod et al., 2005); '1) how to produce safe food; 2) how to be recognized as producing safe food; 3) how to identify cost-effective technologies for reducing risk; and 4) how to be competitive with larger producers. This has led the government to explore and search for the solutions to such problems. The government is continuously doing its best to deal with all these issues. Indian government has also tried to attract more private sector participation for developing a distributed cold chain network across country.

One of the big changes that can be seen in many countries' trends of producing agricultural products and their export is the shift towards more commercial products to increase their exports and to better compete in the global competition. In various countries, private sector has also taken part and raised the expectancy of food safety standard with the help of cold chain supply (Narrod, C., et. al., 2007). The Indian government has also started designing the framework for implementing Public-Private Partnership (PPP) that can help in addressing both the issues of food safety and the export detention rate. The cold chain supply (CCS) is comparatively a newer concept to India, therefore managing it through PPP can be most suitable to deal with the challenges that come in its success path. There are many success stories regarding managing cold chain supply through PPPs, across the world. Whilst, India is still legging on many grounds for managing CCS through PPP. Ministry of Economic Affairs and GoI has prepared the PPP model document for PPP for developing and managing the cold chain supply PPPs projects. This would help the government in creating value for different stakeholders of a Cold Chain Supply (CCS) network, including investors / operator / developer (PPP Model Document, DoEA, GoI, 2017). There are a certain number of PPP projects across the world that can be considered as the best practices for qualifying the PPP interaction in CCS sector. GoI is providing different grants and subsidies as a government support for the development and management of cold chain.

On the basis of studying numerous papers, that demonstrate the worldwide concerns of food safety and export detention, it is being suggested that both of these concern can be effectively resolved through interaction of cold chain supply and PPP approach. Bringing in the Private sector participation through PPP has been very fruitful in many cold chain projects. Hence, India has a large number of PPP opportunities in this sector and also there is a huge scope for literature development in this sector that can help government to effectively design and manage the cold chain PPP projects.

VII. SCOPE FOR FURTHER RESEARCH

This research is a review of the literature describing the current situation and concerns, urging for the need for PPPs in cold chain supply sector. The paper not only identifies the infrastructure gap in this sector but also suggests the increased scope for PPP interaction with the cold chain for addressing this gap. The paper advocates that PPP plays a major role in developing a smooth access to the market for the small players and provide fair chance to all the stakeholders. CCS has still much scope for further development in the literature of Cold Chain Supply (CCS), PPP and proactive interaction between the both. There are many opportunities for exploring this field and developing

the frameworks and models that can help smoothening the execution and management of CCS operation in India.

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