

## **ANALYSING COLD STORAGE INFRASTRUCTURE IN INDIA -- STATISTICAL APPROACHES TO THE SUPPLY CHAIN**

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### **ABSTRACT**

India is facing an acute agrarian crisis that takes the shape of paradox and harms stakeholders at various levels. High levels of food wastage are accompanied by high rates of malnutrition and the oppression of farmers engaged in food production. This is caused because of the gap that exists between the demand and supply of agricultural produce. This paper has explored the precise causes behind this agrarian crisis. Cold Storage Systems refer to the process, science, and technology that enable the storage and transportation of perishable commodities. The development of cold storage systems is imperative to filling these gaps between demand and supply of food. This paper has looked into the reasons behind the lack of development and popular usage of cold storage systems in India. The lack of necessary supportive infrastructure and the lack of information at the hands of the public about the benefits and usage of these systems are responsible. This paper has provided policy recommendations that could boost the growth of the cold storage industry which in turn is expected to reduce food wastage, increase exports and improve the general availability of food. Hence, the development of cold storage systems is instrumental in mitigating the agrarian crisis that is facing India.

**Keywords:** Cold Storage, Infrastructure, Agricultural Produce, Supply Chain, Farmers

### **INTRODUCTION**

India faces acute levels of food shortage every year. This has adversely impacted the poorest sections of Indian society. India is ranked 102nd out of 117 countries in the Global Hunger Index 2019 (Press Trust of India, 2019). The unavailability of food which causes problems ranging from undernourishment to child stunting is less because of low food production and more because of the wastage of food which occurs due to the absence of an effective storage and transportation system. Every year in India, about 18% of fruits and vegetables are wasted due to the lack of post-harvest storage infrastructure. Research conducted by the United Nations' Food and Agriculture Organisation found that, annually, 40% of India's fresh fruits and vegetables

which are worth \$8.3 billion perish before reaching consumers. This is even though India is the second-largest producer of fruits and vegetables, producing around 83 million tonnes of fruits and 121 million tonnes of vegetables annually (Sivaraman, 2016). Cold Storage facilities are highly underdeveloped in India and are inaccessible to most primary producers. Only 2% of the primary produce in India is held or transported using cold storage facilities. The development of these facilities has been key to filling gaps between supply and demand in western nations. 85% of the primary produce of the United States is kept in cold storage before it reaches the final consumers (Sivaraman, 2016). This not only reduces food wastage but also helps in making seasonal crops available throughout the year. India is confronting the issue of malnutrition and poverty because of its inability to store or refrigerate food products.

Agriculture plays a very important role in the Indian economy. About 58% of the rural households are engaged in agriculture for employment and it constitutes for more than a fifth of India's GDP (Staija, 2019). Cold Storage involves the transportation of temperature-sensitive products. It is a supply chain that takes place through thermal and refrigerated packaging methods to protect the integrity of the products in shipments. Therefore, it is a combination of surface storage and refrigerated transport. The cold storage sector in India is still in its nascent stage. This is primarily due to the shortcomings of the government. This not only involves the lack of public investment in cold storage technology but also extends to the poor condition of supporting infrastructure such as highways. There are less than 10,000 cold storage vehicles and zero cold storage containers for rail movement despite the economic potential of cold storage usage in agriculture (Statija, 2019). However, due to the increasing urbanization and organization of the food industry, access to cold storage facilities has improved in the past few years. The Indian branch of the Danish company Danfoss has witnessed immense growth in the past few years due to the recent 'boom' in the cold storage sector in India. Its growth rate of 18% per annum is suggestive of the increase in demand for cold storage facilities, especially in states like Tamil Nadu, which hosts some of the largest retailers for fruits and vegetables in India (Ramesh, 2018). This growth is also owed to the introduction of government subsidies that allow primary producers and distributors to access cold storage at cheaper prices.

The lack of cold storage facilities in India not only causes malnutrition and hunger but also leads to the loss of export opportunities which give rise to economic surplus. There is a need to assess the growth of this sector statistically to determine the levels of investment required to mitigate such losses and develop a public policy concerning the provision of subsidies and investment in the cold storage.

## **BACKGROUND**

Cold Storage is considered to be a science, technology, and process. It is a science since it requires an understanding of the chemical and biological processes associated with the perishability of different products (grains, vegetables, medicines). It is a technology since it relies on physical means to ensure desired temperature conditions along the supply chain. It is a process as a series of tasks that must be performed to manufacture, store, transport and monitor temperature-sensitive products. Monitoring and testing the commodities at different stages of transportation is required to ensure that they remain consumable. Developing cold storage, therefore, is a nuanced and technical task that requires significant levels of scientific and technological know-how backed by financial investment.

Ice has been used to store perishable commodities such as meat, butter, and cured meats for more than a thousand years by different civilizations across the world including the Persians and the Chinese (Neuberger, 2003). There were a series of scientific and technological innovations in the 18th and early 19th century, led by innovators including Benjamin Franklin and Michael Faraday which led to the commercial availability and usage of artificial cold storage technologies. First used in ships, cold storage became an integral part of the food distribution network in the west. By the middle of the 20th century, refrigeration units were designed for installation on trucks or lorries which have, since then, been used to transport perishable goods, such as frozen foods, fruit and vegetables, and temperature-sensitive chemicals (Freidburg, 2010). Across the globe, cold storages have been instrumental in linking farmers to end consumers and have become integral to the supply chain.

The shortcomings in public policy and administration in India has stunted the growth of the cold storage sector in the country, 96% of which is controlled by private entities. Restrictions and barriers imposed by the government such as poor roads, bureaucratic corruption, the lack of awareness around handling perishable products and the lack of electrical power supplies that are critical for cold storage facilities have contributed to the lack of access of producers to cold storage delivery systems (Sivaraman, 2016). This has caused immense difficulties for the economy and population of India. Despite being one of the largest producers of food, India has the highest number of malnourished people, a paradox that can only be explained by the lack of food delivery systems. Whilst states like Punjab and Haryana produce surpluses in agriculture, states like Jharkhand and Bihar face acute food shortages. This also implies that India wastes a significant amount of its agricultural produce. The development of cold storage facilities has an impact on multiple industries. This affects the availability and prices of commodities including fruits, vegetables, milk, fish, meat, cereals, and pulses. Not only does it lead to higher levels of hunger within India, But Inadequate cold-storage infrastructure has hampered India's food exports as well. Countries across the world have stringent guidelines for the import of agricultural and processed food products to prevent health hazards that arise due to the

consumption of state food. The European Union (EU) has raised more notifications and has issued more rejections for more consignments from India as compared to consignments from other developing countries such as Turkey, Brazil, China and Vietnam (Satija, 2019). Most importantly, at a humane level, this causes the destruction and wastage of food, which is necessary for human growth and development and the deprivation of which is responsible for the deaths of millions in India.

## **DISCUSSION**

Cold storage infrastructure is composed primarily of two parts. The first is the 'Farm Gate Storage' that is deployed close to producing regions for long term storage of farm produce. The second type is located in transit handling points or distribution hubs that feed the market and those that are at the point of consumption (retail outlets), etc. These types of cold stores are more transient in their nature of service. Commodities that are seasonal and have a longer shelf life such as potatoes, apples, and oranges usually use Farm Gate Storage systems whereas horticulture goods, which are more perishable in nature rely on the second type more (Hansa Research Group, 2014). However, the development of infrastructure related to both methods is imperative to ensure lower levels of wastage of food. Presently, cold storage infrastructure in India is unevenly distributed and only carters certain types of agricultural produce. About 68% of the cold storage facilities in India were used to store potatoes in 2019 (Rawat, 2019).

However, research shows that Rs 21,000 crore will be invested between 2019-2023 in setting up or upgrading cold storages to address the problem of stockpiling of perishable commodities (Rawat, 2019). This investment from the private sector is said to be strengthened by government subsidies on cold storage systems. The Ministry of Food Processing Industries provides financial assistance up to 50% of the total cost of plant and machinery and technical civil works incurred in establishing cold storage facilities in General areas and 75% in underdeveloped regions such as Sikkim, Jammu and Kashmir, Himachal Pradesh and the North-East subject to a maximum of Rs.10 crore. This investment is also motivated by changes in consumption patterns of Indian consumers which are characterized by fast-paced lifestyles and changing eating habits as well as the increase in purchasing power and the growth of quick-service restaurants across India. The Indian cold chain industry is expected to grow at a rate of 15.4% over the next four years as per reports through increased investments, modernization of existing facilities and the establishment of new ventures, via private and government partnerships. Even though the current market is extremely fragmented, the increase in demand for cold storage facilities which is derived from the demand of 'fresh and fast foods' has paved the way for the organization of the market (Vijay, 2019). Presently, the annual losses due to the absence of adequate cold storage infrastructure in India are expected to be between Rs. 520 billion and Rs. 960 billion from the agriculture sector

alone. However, the industry is expected to continue to grow at the present rate of 25.8%, which is expected to substantially minimize such losses (Rawat, 2019). This is expected to reduce costs and increase the availability of not only agricultural products but also products produced by the pharmaceutical and fast food industry.

Numerous challenges are facing the growth of the cold storage sector in India. The most important amongst them is the lack of knowledge and awareness required to generate demand and maintain cold storage infrastructure. This is not only limited to producers who are unaware of the benefits of implementing cold storage systems but also people who are engaged in the physical transfer of goods. Goods are often loaded in cold storage transport systems at the wrong temperature or are left at cold storage hubs for abnormally long periods which contributes to the wastage of food. It is imperative to generate awareness about the usage of these systems with respect to storing and transporting temperature-sensitive commodities at the ground level and at the points where people directly engage with them. Secondly, state infrastructure in terms of provision of electricity and maintenance of highways needs to be improved to accompany increasing private investment. Government subsidies have also been effective in promoting and pushing cold storage systems of producers and distributors. However, the benefits of such subsidies exist in concentrated geographical locations within the country. Equal geographical presence and the ability to maintain stores of multiple commodities is a necessary precondition for further investment in cold storage systems.

However, there is a lack of primary data and research about the benefits of the development of cold storage infrastructure. This is not only because the industry is nascent in India, but also because of the ignorance of state agencies. The actual benefits and impact of implementing a comprehensive cold storage system in India are difficult to determine because the government has not accessed these benefits at a micro level, or in a controlled environment. The lack of public knowledge and findings has limited the scope of discourse surrounding technologies that can prove to be transformative in the Indian context. It also leads to lower levels of innovation in the private sector and at grassroots levels. The development of cold storage systems is presently 'top-down', which implies that it is led by Multinational Corporations that operate in India by engaging in FDI (Foreign Direct Investment). Data collection, research, publication and awareness campaigns are expected to lead to a boom in Small and Medium Scale Enterprises operating in this sector which, in turn, leads to the availability of cheaper and more accessible forms of cold storage systems for Indian producers and distributors, who have a limited level of economic capital.

## **CONCLUSION**

There is a need to explore internationally approved industrial standards of cold storage of agricultural products and other food products. This would help in providing people who work on these transportation and storage systems effectively operate them, hence reducing wastage of food. Any innovation and technological advancement at the hands of Indian companies must be at par with international standards to be accepted in the market. Currently, the standards for cold storage established by the International Standardization Organization are the most widely accepted as measures of food safety. Achieving such standards of food production and storage is expected to increase exports and reduce wastage.

The benefits of establishing a cold storage network across India are not yet known. This has been key to solving the problem of scarcity of food in many countries across the world. Many stakeholders, including those engaged in agricultural production, have been reluctant to develop cold storage facilities because it requires significant levels of the initial investment. The long term monetary benefits have not yet been able to incentivize people from undertaking this short term investment. The ambiguity around these benefits owing to the lack of research in this sector is primarily responsible for the reluctance of the Indian private sector. Research into the cost and benefits of introducing such systems followed by government awareness and promotion campaigns is required to generate positive perceptions about them.

India is going through an acute crisis in the agricultural sector. This is characterized by food shortages that cause malnutrition amongst the poorest sections of society and low-income generation for farmers, many of whom have been driven to the brink of suicide due to poverty and compounding debts (Sriram, 2018). Given that India produces enough food to solve both these problems, the shortcomings of the agricultural sector lies in its inability to fill the gaps that exist between the demand and supply of food. The creation and maintenance of a robust network of cold storages and transport infrastructure are required to keep the farm produce remunerative, moderate retail food inflation and maintain the food security of the nation.

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