WASTING HARVEST AND WORSENING FOOD SECURITY IN INDIA

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Abstract: *India has been facing a paradoxical situation of decaying harvest in one side and starving poor on the other. Lack of adequate cold-chain infrastructure and a supportive food processing industry leads to wastage of about 30 percent of all food produced; cause India to experience some of the highest food losses in the world. Reduction of post-harvest losses become the component of food security, the current scenario in Indian agriculture poses a threat to the successful implementation of the National Food Security Act (NFSA) in India. This paper aims to examine the issue of post-harvest losses in Indian agriculture in the context of NFSA enacted in India in 2013. The foremost reasons for post-harvest losses and its solutions are discussed.*

Key words: *Post-harvest losses, Food security, Agriculture, Warehousing. Food processing.*

1. INTRODUCTION:

India can claim an impressive collection of rankings in terms of food production. Globally, India is the third largest producer of cereals, with only China and the USA ahead of it. India occupies the first position in milk production and is the second largest producer of inland fisheries, fruits, vegetables and tea and the third largest producer of fish in the world. India ranks first in respect of cattle and buffalos and second in goats, third in sheep and seventh in poultry population in the world. Given this record, it becomes a little difficult to explain why it does not have a place in the top-ten list of food exporting countries. It is here that the real revolution needs to start, because India has one of the most fragmented post-harvest infrastructures in the world. Lack of adequate cold chain infrastructure and a supportive food processing industry leads to wastage of about 30 per cent of all foods produced (Viswanatham and Kameshwaram, 2013); cause India to experience some of the highest food losses in the world.

Food grains undergo a series of operations such as harvesting, threshing, winnowing, bagging, transportation, storage, and processing before they reach the consumer, and there are appreciable losses in crop output at all these stages. The post-harvest losses in India amount to 12 to 16 million metric tons of food grains each year. With an average per capita consumption of about 15 kg of food grains per month, these losses would be enough to feed about 70-100 million people, i.e., about one third of India's poor or the entire population of the states of the Bihar and Haryana together for about one year. The monetary value of these losses amounts to more than Rs. 50000 crores per year (Singh, 2010). It is estimated that 7 percent of the grain rots in fields and open godowns. Annual wastage of fruits and vegetables is estimated to range from 5.8 to 18 percent having value of Rs. 13309 crores. This has been leading to the paradox of decaying buffer stock in one side and starving poor on the other.

Food production is the base for food security (Swaminathan and Bhavani, 2013). Food security, both in terms of availability and access to food, poses a challenge to rapidly growing populations, in environments of dwindling land and water resources. India's population is growing faster than its ability to produce rice and wheat (Sengupta, 2008). Although India is a major producer of horticultural crops, many Indians are unable to obtain their daily requirement of fruits and vegetables and the Human Development Index (HDI) is very low. Considerable quantities of fruits and vegetables produced in India go to waste owing to improper post-harvest operations and the lack of processing. This results in a considerable gap between gross food production and net availability (Choudhary, 2016).

Food availability, absorption and accessibility can be improved by increasing production, improving distribution, and reducing the losses. Thus, reduction of post-harvest food losses is a critical component of ensuring future global food security. In light of the incidence of the huge post-harvest losses and new challenges faced under trade liberalization and globalization, serious efforts are needed to reduce post-harvest losses, especially of fruit and vegetables. Recent studies claim India can easily feed its growing population, plus produce wheat and rice for global exports, if it can reduce food staple spoilage, improve its infrastructure and raise its farm productivity to those achieved by other developing countries such as Brazil and China.

This paper aims to examine the issue of post-harvest losses in Indian agriculture in the context of National Food Security Act (NFSA) enacted in India in 2013. The foremost reasons for post-harvest losses and its solutions are discussed briefly.

2. POOR INFRASTRUCTURE:

Post- harvest infrastructure system in India is very fragile, which lacks cold storage, food packaging as well as safe and efficient rural transport and communication system. This causes one of the world's highest food spoilage rates, particularly during Indian monsoons and other adverse weather conditions.

Farming areas in this century are confined only to the very interior areas of rural villages. Increased distances between production areas and markets, brought about by urbanization, necessitate the transit of produce over long distances from rural to urban centers, to feed the constantly increasing populations in these centers. Proper road infrastructure, appropriate transportation infrastructure as well as proper packing and packaging technologies are critical to minimizing mechanical injury during the transit of produce from rural to urban areas. While "farmers' access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation" (World Bank, 2008). Cold storage vehicles are required to transit the fruits and vegetables and dairy products. Also important is the vehicle with proper coverings withstanding the bad weather and excessive sun-shine and cold while transition of the farm products to the markets or *mandis*.

Last, but not least important is the good rapport between the farmers and the sellers. By maintaining timely communications and contacts between producers and sellers we can reduce the spoilage of farm produce to a considerable extent. Farmers should be aware about the trend of the market, what all commodities market required in each period, etc., these all informations can be given by the sellers in the market or *mandis*. Accordingly, the farmers can produce by reducing the problems of overproduction and underproduction.

Good rapport between the farmers and sellers also reduce the length of the waiting period of the farm products at the farm gate in search of markets. Today the farmer's groupings and joint farming initiatives are very common. So by get in touch with the sellers (wholesalers or retailers) and also by collective pressurizing, farmers can fetch good market for their produce at a fair price.

3. WAREHOUSING:

Though India is the world's largest producer of fruits and vegetables, about 280.9 million tonnes in 2014-15 (GoI, 2016b), it has a very limited integrated cold-chain infrastructure, with only 6891 stand-alone cold storages, having a total capacity of 31.82 million tonnes (NCCD, 2015). It constitutes barely the 11.32 percent of the annual produce of fruits and vegetables to store safely for a limited future period because of the high perishability of the nature of such products.

Warehousing plays a vital role in the complete value chain and forms approximately 20 percent of the total logistic market. Over the time and with the changing role of the sector, traditional warehouses have transformed to collection and storage points, where raw material, intermediate and manufactured goods are collected, assorted, stored and distributed to the point of consumption/sale. The warehousing market in India is expected to grow at a rate of 35 to 40 percent annually, displaying high potential for growth over the next few years.

Currently, the sector is highly fragmented with small players holding small units distributed across states with many challenges. Almost 92 percent of the market is dominated by unorganized players, while 70 to 75 percent of the organized market is being controlled by Public Sector Undertakings (PSUs) such as Central Warehousing Corporation (CWC), the Food Corporation of India (FCI) and State Warehousing Corporations (SWCs).

The current capacity of the organized warehouses, controlled by corporate, cooperative and private sectors, is 108.75 million metric tonnes (MT), of which the private sector has only 18 million MT (see Table 1), while Public Private Partnerships (PPP) are yet to start off in the sector.

Table 1: Storage Capacity of the Organized Warehouses in India (as of December 2015)

Sl. No.	Name of the Organization/ Sector	Storage Capacity (In Million MT)
1	Food Corporation of India (FCI) Central	32.05
2	Warehousing Corporation (CWC)	10.07
3	State Warehousing Corporations (SWCs)	21.29
4	State Civil Supplies	11.30
5	Cooperative Sector	15.07
6	Private Sector	18.97

Source: Ministry of Agriculture, Government of India (2016a), Assocham (2016)

Even though the warehousing facilities are in some areas, the facilities are very meager and pitiable. Warehouses with cold storage facilities fit for keeping the fruits and vegetables and dairy products are lacking in most of the areas. Even in the case of grains and pulses, a sizeable share is rotting and putrefying even in the government food corporations without proper storage facilities.

Most of the cold storages are stand-alone normal cold storages. Cold chains are essential for extending the shelf life, period of marketing, avoiding over capacity, reducing transport bottlenecks during peak period of production and maintenance of quality of produce. The development of cold chain industry has an important role to play in reducing the wastages of the perishable commodities and thus providing remunerative prices to the producers.

India is bestowed with a varied agro climatic conditions which are highly favourable for growing a large number of horticulture crops such as vegetables, fruits, aromatic plants, herbs and spices, etc. India is among the

foremost countries in horticulture production, just behind China. However, despite the rise, India is way behind its nearest rival in per-hectare yield and processing of horticulture products. India stores only two percent of its horticulture products in temperature-controlled conditions, while China stores 15 percent and Europe and North America stores 85 percent of their products in such conditions (ONICRA, 2014). Adequate cold storage facilities are available for just about 10 percent of India's horticulture production (GoI, 2016b). Of the total annual production, 30-40 percent is wasted before consumption (GoI, 2016b). During the peak production period, the gap between the demand and supply of cold storage capacity is approximately 32 million tonnes (NCCD, 2015).

Although cold storage capacity of over 30 million tonnes has been created in the country, the concept of cold-chain is still in its infancy in India. Considering the fact that India is producing about 270 million tonnes of horticulture produce every year, the development of cold-chain networks assumes high priority. Owing to the tremendous pressure on improving supply chain and reducing losses during produce handling and movement, the need for creation of a cold chain network is crucial for perishable food commodities.

Regionally, the existing cold storage capacity is concentrated in terms of both number and capacity in the northern region (see Table 2). Uttar Pradesh and West Bengal contain over 65 percent of the cold storage units in the country and the rest are spread across India. As per the data available to the government as of March 2014, there were 6891 numbers of cold storages having cumulative capacity of 31.82 MMT (NCCD, 2015).

Table 2: Region wise Number and Capacity of Cold Storages in India (2015)

	Central	East/North East	North	South	West	All India
Number	889 (12.90%)	1034 (15.00%)	3268 (47.42%)	986 (14.31%)	714 (10.36%)	6891 (100%)
Capacity (Million MT)	2.23 (7.01%)	8.03 (25.26%)	16.55 (52.02%)	2.48 (7.81%)	2.51 (7.89%)	31.82 (100%)

Source: Calculated based on NCCD data, 2015

Cold storage in India has been largely adopted for long-term storage of potatoes, onions and high value crops like apples, grapes and flowers. 75 percent of the cold storage capacity is used to store potatoes, while only 23 percent fall in the multi-product category (ONICRA, 2014). Cold storages for meat, fish and dairy items and for other items such as chilies and other spices account for only one percent of total cold storage capacity. These cold storages are also usually smaller in capacity. Much of this multi-purpose cold storage capacity is located in the states of Karnataka, Maharashtra, West Bengal, Tamil Nadu and in the National Capital Region (NCR) of Delhi.

Further enhancement in the cold storage capacity would be very beneficial to both the farmer and the consumer as it minimizes wastages and provides fresher and off-seasonal food items to the consumers. It is worth noting that the price of vegetables, fruits, milk and egg, meat and fish have been rising faster despite of the fact that India is the second highest producer of fruits and vegetables. This is led by inadequate supply-chain and logistics infrastructure and management.

NCCD (2015) study took a consumption driven approach to assess the cold-chain infrastructure needs and captured all components that contribute to setting up integrated supply chains. The key findings of the study are tabulated here (see Table 3).

Table 3: Cold-chain Infrastructure Capacity and Gaps in India (2015)

Type of infrastructure	Infrastructure requirement (A)	Infrastructure created (B)	All India gap (A-B)	% share of Gap to required
Pack-house	70080 nos.	249 nos.	69831 nos.	99.6%
Reefer Vehicles	61826 nos.	9000 nos.	52826 nos.	85%
Cold Storage (Bulk)	34164411 MT	31823700 MT	3276962 MT	10%
Cold Storage (Hub)	936251 MT			
Ripening Chambers	9131 nos.	812 nos.	8319 nos.	91%

Source: NCCD (2015)

The study highlights that integration of cold-chain does not exist due to a large gap in form of pack-houses along with the associated capacity in transport. Further, the study highlights that to fulfil the agenda to establish supply chain links from farm-to-consumer, development focus is required for creation of pack-houses and transport at village level and promotion of cottage industry sized food processing units for handling waste farm produce to create value added products.

An important question should be addressed is that whether these warehousing facilities even with the modern amenities, suppose they are providing by the authorities, are accessible or feasible to the poor and marginal farmers in India, which constitute the majority? These all apprehensions to a considerable extent can be solved by strengthening the farmer folk by grouping them together; it might be in the form of group farming exercises, collective farming initiatives, joint venture groups, etc. Some of these groupings have been existing and functioning very well in some states, where the farmers are grouping together, and share the costs and labour, and also the profit of the produce. They collectively seek out the market for their produce and also share the cost of warehousing.

4. LACK OF COMPETITIVE BUYERS:

Even if we have good infrastructure and warehousing facilities, but we couldn't find competitive buyers, the produce will spoil and also the life of the farmers. There has a host of intermediaries between the 'farm and fork' in India. In most of the cases these intermediaries, comprising the middlemen, wholesalers, retailers, etc. take the opportunity of high profit share and leads to high prices for the produces in the retail market, though the farmers getting a meager share of the actual price. Lack of competition among the buyers of the farm produce leads to lower prices for the produce to the farmers. Sometimes have the chances for glut in the market due to bumper cropping, but farmers fail to find good buyers for their produce offering fair prices. These lead to wastage of the produce. In some areas farmers reluctant to cut the harvest from the farm due to very low prices for the products, even not enough to cover the cost of harvesting. All these circumstances pushing the farmers into the debt traps and the incidents of farmer suicides are not uncommon even today.

In the absence of competitive buyers in the market for the farm produce, the government can take the role of buyer offering a fair price that covers the cost of production and ensuring a reasonable profit margin to the farmers. The minimum support prices (MSP) offered by the government in advance to the farming season is an impetus to the farmers to enter into the farming operations even they fail to find competitive buyers for their produces (see Table 4).

Table 4: MSP for Kharif/Rabi crops in India (Rs. per Quintal) (as on 01.06.2016)

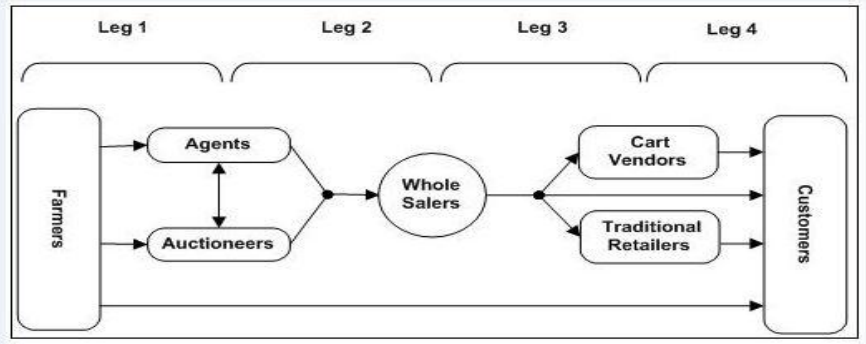
Commodity	2013-14	2014-15	2015-16	2016-17
Selected Kharif Crops				
Paddy Common Grade A	1310 1345	1360 1400	1410 1450	1470 1510
Bajra	1310	1250	1275	1330
Ragi	1500	1550	1650	1725
Cotton Medium staple length Long staple length	3700 4000	3750 4050	3800 4100	3860 4160
Selected Rabi crops				
Wheat	1400	1450	1525	-
Barley	1100	1150	1225	-
Gram	3100	3175	3425*	-
Other crops				
Jute	2300	2400	2700	-
Sugarcane	210	220.00	230.00	-

*Bonus of Rs. 75 per quintal is payable over and above the MSP
Source: Ministry of Agriculture, Government of India (2016a)

5. UNORGANIZED RETAIL SECTOR:

One of the reasons for the lack of competitive buyers is the large unorganized nature of retail industry in India. As we already discussed food travels to the Indian consumer through a slow and inefficient chain of a host of intermediaries. Indian consumers buy agricultural produce in suburban markets known as *'sabzi mandi'* such as one shown or from roadside vendors. The Indian farmer receives just 10 to 23 percent of the price the Indian consumer pays for exactly the same produce, the difference going to losses, inefficiencies and middlemen. Farmers in developed economies of Europe and the United States, in contrast, receive 64 to 81 percent. "Encouraging policies that promote competition in agricultural marketing will ensure that farmers receive better prices" (World Bank, 2011).

Figure1: Chain of Intermediaries between Farmers and Consumers



What we need is an efficient modern retailing structure, which can ensure better prices to the farmers. Efficient modern retailing backed by organized composition leads to healthy competition among the players which will ensure competitive prices to the farmers and better quality and reasonable price from the part of the consumers. Steps are going on India to make the retailing economy more structured and efficient. One of these steps by the government is the permission to allow foreign direct investments (FDI) into the retail market. Even though a lot of apprehensions remain the decision will allow the foreign players to come in Indian retail market and enhance the competitive spirit of the domestic retailers. The ultimate result of competition will be the price benefit to both the farmers and consumers (Aneesh, 2014). They can directly collect the farm produce easily from farmer's groupings by ensuring reasonable prices by eliminating a chain of intermediaries and make it available to the consumers at a cheap rate.

What needs to be introduced in the food supply chain are best practices like data integration, financial flow management, supply-demand matching, collaborative forecasting, information sharing and goods movement synchronization through efficient transport scheduling (Viswanadham, 2008).

The food supply chain can be subdivided into a number of sectors. While agriculture, horticulture, fisheries and aquaculture come in the primary-producers category, the manufacturers, who process the food for ready-to-cook or eat format, along with the packaging companies come in the intermediate stage. The retailers, wholesalers and caterers comprise the last part of supply chain. At each stage, value is added by the new ownership such as processors, distributors, packers, etc., and the cost and profits are part of the business. The food items can go to the final consumer from any of the three stages— from farmers in the form of fresh produce, to the caterers directly from the manufacturer, and finally from the retailer to the consumer. Information management is done by all stakeholders and their information systems are all interconnected seamlessly. This is the food chain system followed in advanced countries. In India and other developing countries, the state of the food chain is more fragmented and primitive.

7. LACK OF FOOD PROCESSING TECHNOLOGIES:

As of 2013, India ranks fifth in the world in terms of the value of food processing. The industry is expected to grow to 126840 crore by 2016, growing at 13 percent each year since 2012. The industry is critical from the economic point of view and hence the government has its focus on the development of this industry. With the growth in this end user segment, cold chain infrastructure is expected to get a boost and help in reducing the wastage.

Food processing is an emerging industry in India, which will help to reduce the food wastage to a large extent. Rather than selling the produce as such to the middlemen or wholesaler the farmers can convert their produce into value added products. Value addition ensures more prices to the product and increase the gestation period of the product. Farmers can form small groups and start food preservation, packaging and value addition units with comparatively less capital investments. Government in recent times promoting these types of small and tiny industries by granting high concessions and subsidies. Farmers can transform the tomatoes into tomato chutney, pineapples in to squash or jam, potatoes in to potato chips, milk into ghee or butter, etc. By doing so the value of the produce is increasing more than double. Packaging is one area that has assumed critical importance as shelf-life becomes limited and hordes of products compete to attract the consumer.

The government is taking steps for the sector, such as schemes for capital investment subsidy from the National Horticulture Board (NHB), the National Horticulture Mission (NHM) and the Ministry of Food Processing Industries (MoFPI) for the agri-investors to set up cold chain infrastructure. Government has as well set up National Centre for Cold Chain Development (NCCD) which would help in establishing building standards through international benchmarking and to promote research and development activity in the cold chain sector. The government has also established partnership with Indian Railways to set up cold chain infrastructure.

The required level of investment for the development of marketing, storage and cold storage infrastructure is estimated to be huge. The government has not been able to implement various schemes to raise investment in

marketing infrastructure. Among these schemes are construction of rural godowns, market research and information network, and development / strengthening of agricultural marketing infrastructure, grading and standardization.

8. FOOD SECURITY IN INDIA:

The National Food Security Act 2013 (NFSA, also called Right to Food Act) is to provide subsidized food grains to 75 percent of the total population of the country, covering 90 percent of the rural and 50 percent of the urban population. These are to be further divided into two categories. A "Priority" group comprising 46 percent of rural and 28 percent of urban population, to get 35 kg of food grains per household at Rs. 1 per kg for millets, Rs 2 per kg for wheat and Rs 3 per kg for rice. And a "General" group comprising 44 percent of rural and 22 percent of urban population, who are to get 20 kg at 50 percent of the MSP (Himanshu and Sen, 2011).

Covering this much of a large population with substantial leakages in the produce in the forms of post-harvest losses and wastages is a peril to the food security dream of India. Most of the year's problem is not of adequate food production, but of adequate food distribution due to inadequate logistics and fragile infrastructure. The following table (see Table 5) shows the state wise estimated annual food grain requirement under NFSA and stock position in India in 2014 and 2016. The figures reveal the failure of the distribution system as a biggest challenge to the food security in India.

Table 5: State-wise estimated annual rice and wheat requirement under National Food Security Act, 2013 and stock position in Central pool of India. (in Lakh MT)

State	Requirement	Rice availability		Wheat availability		Total rice and wheat availability	
		as on 16.6.2014	as on 1.12.2016	as on 16.6.2014	as on 1.12.2016	as on 16.6.2014	as on 1.12.2016
Andhra Pradesh	32.1	43.54	13.54	1.9	0.10	45.44	13.64
Bihar	55.27	0.78	1.79	1.96	0.91	2.74	2.70
Gujarat	23.95	1.13	0.77	5.78	3.61	6.91	4.38
Haryana	7.95	9.72	5.24	77.55	36.40	87.27	41.64
Karnataka	25.56	4.8	4.63	2.05	0.97	6.85	5.60
Kerala	14.25	4.12	3.37	1.00	0.82	5.12	4.19
Madhya Pradesh	34.68	1.79	3.99	82.14	22.90	83.93	26.89
Maharashtra	45.02	7.17	7.42	7.63	7.13	14.8	14.55
Punjab	8.7	85.35	28.00	159.03	53.41	244.38	81.41
Tamil Nadu	36.78	9.11	8.61	4.29	0.96	13.4	9.57
Uttar Pradesh	96.15	10.55	11.56	18.94	10.41	24.49	21.97
West Bengal	38.49	4.71	2.93	4.34	3.81	9.05	6.754
India	549.35	208.73	110.59	408.46	164.96	617.19	275.55

Source: Ministry of Agriculture, Government of India (2016c) and GoI (2013)

Agriculturally rich states like Punjab, Haryana, Madhya Pradesh and Andhra Pradesh food grain stock in 2014 is much higher than the annual food grain requirement under NFSA. While in most of the south-Indian states and eastern states the situation is worse. In the All India level the stock position of grains is in excess of the annual requirement. There has need for good distribution network to tally the benefit to all regions of the country.

Production and acreage of major crops in some states during 2014-15 and 2015-16 have been lower than the previous years on account of delayed/deficient rainfall during monsoon season and untimely rains/hailstorm during rabi season. Despite decline in the pace of growth in agricultural structure due to loss of production and productivity of major crops on account of unfavorable rainfall and weather conditions etc. during 2014-15 and 2015-16, the decline in the production of rice and wheat in the country has not been significant if we compare it with the buffer stock norms.

As on 1st December, 2016 there is a stock of 11.05 lakh tonnes of rice as against the recent stocking norm (1st January) of 7.61 lakh tonnes and 16.49 lakh tonnes of wheat as against the recent stocking norm of 13.80 lakh tonnes (GoI, 2016c).

There should be substantial increase in public investment in agriculture-related infrastructure such as irrigation and drainage, land development, water conservation, development of road connectivity etc. Such investments are specially needed in the poorer and low rainfall areas of the country.

The economic policies should be reoriented to provide adequate support for India's agriculture and its vast rural population. In particular, policies must provide adequate rural infrastructure (including power), and promote employment besides ensuring credit facilities and remunerative prices for produce for our farmers. The unfinished agenda of land reforms must be completed and distribution of ceiling surplus land must be done on a priority basis.

With a view to ensuring assured and remunerative price for produce, the government must expand the Minimum Support Price (MSP) system, based on the cost of production including a reasonable rate of return on investment and ensuring prompt and open-ended purchase for all major crops including food grains other than paddy and wheat. This will serve as an incentive to increase availability and improve access by enhancing the purchasing power of farmers.

9. CONCLUDING REMARKS:

The National Food Security Act enacted in India with a foremost objective of food for all Indian citizens is imperative but it's very success is in question under the above circumstances. Our buffer stock is not at all enough to feed the growing population in India. Adding to that, we are wasting a considerable part of total produce due to our fragile post-harvest infrastructure. The smooth and sustainable running of NFSA requires controlling and reducing this alarming rate of wastages. Then only we can step forward in the field of battle against poverty, hunger and malnutrition especially in the rural pockets of India.

India has practically everything going for it. It has cultivable land, it has all the seasons needed for production of all varieties of fruits and vegetables and it has a well-developed agribusiness system that works in its own, though chaotic, way. The only problem with this system is that a huge gap exists between what is produced and what finally reaches the consumer. By the time, the surplus and fresh produce makes its way to the markets, they have gone through several middlemen, travelled several roads, worsened in quality, increased in price and got wasted. If India has to offer the world a rich and healthy food basket, it has to build proper cold chain infrastructure, invest in applied research in post-harvest technologies, get food processing plants working in various sectors and develop its food retailing sector. Till then, the surplus food produced in India remains out of its food basket.

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