



Challenges of Agri-Start-ups in Post-Harvest Cold Storage Technologies

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ABSTRACT

Agri-startups are developing new products through a value chain, supply chain solutions, packaging, processing systems, infrastructure, warehousing, logistics, protection of foodstuffs, communications, e-commerce, delivery and retail models. The study aims to document the challenges of Agri-startups working in post-harvest and storage parameters of fruits and vegetables. To get the insight, primary and secondary survey was carried out and data was used to provide suggestions to capture the customer and market. The data indicated that different units required different temperature range to store a different kind of commodity in their cold storage unit. 86.15 per cent of units were using the backup generators. 53.84 per cent of units were getting the commodities directly from farmers, 30.76 per cent from traders, 9.24 per cent from both and 6.15 per cent from others. 50.76 per cent of units were desired to get low electricity bill and 10.76 per cent of units were desired to come out of usage of generator whereas 32.3 per cent of units were willing to get both i.e. low electricity bill and without dependency on generator and 6.15 per cent of units were willing to reduce other costs like operation cost, maintenance cost etc. 70.76 per cent of cold storage units having a cooling tower.

INTRODUCTION

India has created a thriving start-up community and has solidified its status as the world's third-largest start-up ecosystem. This is evident in our food processing sector and environment, which has seen a surge in entrepreneurship with innovative and forward-thinking ideas, especially in the last five years. Technology and logistics support enhanced the self-life of products which add more income to the pockets of the entrepreneur. To take maximum benefit of the existing infrastructure and to build a robust business model, a transformation among the traditional farmers /youth is inevitable (Chandraker et al., 2021). Agriculture is the one of the oldest economic sector in the world and serves as a primary source of livelihood for about 58 per cent of the Indians Population (Dutia, 2014). The Indian Council of Agricultural Research estimates that

in 2030 demand for food grains would rise to 345 million tons and it is necessary to increase the production of food grains (FICCI, 2018). The Indian government has realized that Indians are hard to work, but only a promising start is necessary. Many people want to start their own business but are unable to do so because of financial or other similar problems (Patel, 2019). A successful Startup cannot start a business just with passion and an idea. It faces many challenges too. So, to cope up with the problems of startups, one should have a high level of leadership skills with a clear understanding of the market and excellent communication skills. It is believed that fostering start-ups, which add dynamism, creative thinking, and job creation, is critical to India's economic future. It is essential to understand the complexities of the start-up world to seize the opportunity for the industry. In the global start-up community, India has made a strong name for itself. India is among

the top five countries in the world concerning the number of start-ups (Munshi, 2019). The good harvest of many producers in developing countries does not translate into profit as most are lost after harvest (Arah et al., 2016).

Young entrepreneurs are more likely to take a risk and try innovations and strategies that could overcome the barriers and limitations (Kobba et al., 2020). With new strategies for agricultural growth and development, there is a need to explore the areas of rural entrepreneurship development in agriculture and allied sectors. The profit-making ability can be delineated with the help of the net profit of the enterprise (Kharga et al., 2021). For fruit quality during storage, post-harvest technologies such as chemical and non-chemical treatment are used. For example, the chemical therapy for the preservation of mango fruit quality with 1-MCP and Nitrogen Oxide (NO) has been demonstrated as efficient (Bambalele et al., 2021). Postharvest cooling is critical for providing the best quality products to the customer. Refrigeration with or without a changed oxygen-carbon dioxide atmosphere will prolong the postharvest life of fruits. The study focuses on challenges faced by Agri-startups for post-harvest management of fruits and vegetables in India.

METHODOLOGY

The study was purposively conducted in Maharashtra, Andhra Pradesh, Telangana and Karnataka due to availability of Agri-startups for post-harvest management of fruits and vegetables in this region. The purposive and random sampling procedures were followed to select the samples from cold storage units, wholesalers and food processing units and a sample size for this study was sixty-five units. The sample consisted of start-ups associated with the food production value chain to develop new products, supply chain solutions, packaging, processing technology, infrastructure, storage and logistics, food protection, communications, e-commerce models, delivery, and retail. Primary and secondary survey were conducted to find the solutions to the challenges. The primary data were collected with the help of semi structured interview schedule through personal interview method. The data thus generated were analyzed with suitable statistical tools like percentage and mean. The data was then used to make better suggestions to the institutions about how to join the market and capture the consumer and market.

RESULTS AND DISCUSSION

Start-ups in post-harvest cold storage technologies

According to the data, different units required varied temperature ranges in order to store various commodities in cold storage units (Table 1). 6.15 per cent of the units maintained a temperature of -18 to 0°C, and these units typically store frozen products (fish, meat, poultry, dairy products, and processed fruits and vegetables); 16.92 per cent of the units maintained a temperature of 0°C, and these units typically store temperate fruits such as apple and strawberry; and 18.46 per cent of units kept the temperature between 1 to 5°C and stored fish, chocolates, flowers, snacks etc. 49.24 per cent of units kept the temperature between 5 to 10°C and stored dry chilly, potato, mango, potato etc., 3.07 per cent of units kept mango, copra, etc. at a temperature of 10 to

Table 1. Temperature maintenance for different commodities in cold storage units

S.No.	Temperature ranges	No. of cold storage units	Percentages
1	-18 to 0°C	4	6.15
2	0°C	11	16.92
3	1 to 5°C	12	18.46
4	5 to 10°C	32	49.24
5	10 to 20°C	2	3.07
6	above 20°C	4	6.15

20°C, while 6.15 per cent kept onion, ginger, and garlic at temperatures above 20°C (Table 1).

Use of backup generator by cold storage units

A total of sixty-five units responded about the usage of backup generator in their cold storage units and among these units, 86.15 per cent having backup generators and 13.85 per cent not having backup generators (Table 2).

Table 2. Backup generators available in cold storage units

S.No.	Backup generators	No. of cold storage units	Percentages
1	Available	56	86.15
2	Not available	09	13.85

Customers of cold storage units

The study revealed about their cold storage customers and it was indicated that 53.84 per cent of units received their commodities from farmers, 31 per cent of units received their commodities from traders, 8.5 per cent of units received commodities from both farmers and traders, whereas 5.6 per cent of units received commodities from others (own, research purpose, military application and retailers) (Table 3).

Table 3. Customers of cold storage units

S.No.	Customers	No. of cold storage units	Percentages
1	Farmers	35	53.84
2	Traders	20	30.76
3	Both farmers and traders	6	9.24
4	Others	4	6.15

Requirements of cold storage units to change

The study revealed the requirements and willingness of cold storage units, and it indicated that 50.76 per cent of units desired a low electricity bill, 10.76 per cent desired to eliminate their reliance on generators, 32.30 per cent desired to obtain both, i.e. a low electricity bill and the elimination of their reliance on generators, and 6.15 per cent desired to reduce other costs such as operation and maintenance costs (Table 4).

Cooling tower and its maintenance period in cold storages

A total of sixty-five units responded about the cooling tower, and among them, 70.76 per cent of units had cooling tower whereas 29.24 per cent of units were without cooling tower (Table 5). The

Table 4. Requirements of cold storage units to change

S. No.	Customers	No. of cold storage units	Percent-ages
1	Low electricity bills	33	50.76
2	Without dependency on generator	07	10.76
3	Both low electricity bills & with out dependency on generator	21	32.30
4	Others	4	6.15

Table 5. Cooling tower available in cold storage units

S.No.	Cooling tower	No. of cold storage units	Percentages
1	Available	46	70.76
2	Not available	19	29.24

cooling towers are maintained once a month by 43.08 per cent of the units, 32.30 per cent of the units maintained once in two months, 10.76 per cent of the units maintained once in three months, 6.15 per cent of the units maintained once in four months, 6.15 per cent of the units maintained once in five months (Table 6).

The cooling tower maintenance cost was responded by the units, and 13.84 percent of units spent more than Rs. 10000, 20.0 per cent spent between Rs. 7000 to 10000, 24.61 per cent spent between Rs. 4000 to 7000, 33.84 per cent spent between Rs. 2000 to 4000, 3.07 per cent spent between Rs. 1000 to 2000, and 4.62 per cent spent less than Rs. 1000 (Table 7).

SWOT analysis of leading agri-start-ups in post-harvest cold storage technologies

Entrepreneurship is a feasible approach for upward mobility, as a 1 per cent increase in entrepreneurial activities decreases the poverty rate by 2 per cent. Among the many characteristics of entrepreneurship development, the profit-making ability of the enterprise also plays a vital role in its sustainability and well-developed linkages among stakeholders lead to profit-making (Singh et al., 2014). Lee & Tsang (2001) suggested that most studies confirmed a positive relationship between the entrepreneur's prior experience and the survival of their businesses. Singh et al. (2016); Nain et al., (2019) also suggested institutional support for

Table 6. Maintenance period of cooling tower in cold storage units

S.No.	Maintenance period	No. of cold storage units	Percentages
1	Once in a month	28	43.08
2	Once in two months	21	32.30
3	Once in three months	7	10.76
4	Once in four months	4	6.15
5	Once in five months	4	6.15

Table 7. Maintenance cost of cooling tower in cold storage units

S.No.	Maintenance cost	No. of cold storage units	Percentages
1	More than Rs 10000	9	13.84
2	Rs. 7000 to 10000	13	20.0
3	Rs. 4000 to 7000	16	24.61
4	Rs. 2000 to 4000	22	33.84
5	Rs. 1000 to 2000	2	3.07
6	Less than Rs. 1000	3	4.62

maximizing farm profits and entrepreneurship development in agriculture. Small businesses play an important role in generating growth and employment in both developing and developed economies (Hoffman et al., 2012). The sudden increase in the investment in Agri-tech companies indicates the increase in awareness of business houses towards the importance of agriculture and food and its life-supporting role. These made significance of the creation of jobs and opportunities for youth in Agri-techs and fuel the Agri-preneurship ideas of young farmers and agriculturists (Horo, 2020). Youths, now turning to start-ups including Ecozen, Cold Star, Promethean and Coolify for connections to solar and hybrid-powered cold storage systems to prevent wasting of the harvest. A SWOT analysis was attempted on few leading Agri-Start-ups in post-harvest cold storage technologies.

Ecozen solutions

Ecozen Solutions, founded in 2010 by Devendra Gupta, Vivek Pandey, and Prateek Singhal, provided to the farmers with solar cum hybrid cold storage technologies. The product is used as backup electricity for solar power and thermal storage. Ecozen's goal is to protect farmers from price volatilities while also serving as a link in the national food supply chain. Ecofrost App collects real-time data using IoT to assist in tracking and predictive maintenance. Customers also connected with them through their in-house built smartphone and web application. Ecofrost had a low maintenance expense since it does not need a chemical battery or fuel. For optimal compressor use, a unique thermal energy-based technology provides up to 30 hours of battery-free backup at a low rate. Coolify is another Agri start up of Rajat Sethi, a MIT undergraduate, co-founded Coolify, a next-generation cold storage system aimed at the back end of India's fruit and vegetable supply chain. It is an IT-enabled solution in which a farmer with a smartphone unlock the storage container and set the temperature, was awarded the most creative business concept by the US Department of Agriculture. Coolify having the Cheaper cost of materials and equipment's, its micro cold storage for less quantity is a great solution, need to increase their brand awareness, whereas high competition exists in the market which is a big threat. Cold Star provide refrigerated storage to international corporations and large farms, who then pass it on to farmers to preserve the quality of perishable produce. Cold Star links the transport network with a network of large-scale storage hubs that cover more than 40 locations. Cold Star Logistics provides tailored cold storage and refrigerated shipping solutions in India. Tuscan Ventures, one of India's only logistics-focused investment companies, promotes Cold Star Logistics. Cold Star's approach is driven by its Construct principles, which identify the basic goals needed to achieve the company's long-term aim of transforming India's cold chain logistics system to obtain a competitive edge. The major strengths are ISSO, FSSAI, Food and Drug Administration certifications, Customized services, specialized warehousing and distribution facilities, Complex handling equipment, Pan India expansion is an expandable business, Non-availability of skilled labour, competition is the threat to the organization. Promethan Power Systems was created in 2007 by Sorin Grama and Sam White to solve a wide consumer need with a groundbreaking approach that benefit millions of citizens.

Promethean is involved in this sector, providing rapid milk chillers to broad dairies like Amul and Mother Dairy, as well as regional players like Chitale in Maharashtra. This technology provides a cooler-supply capacity - from day to day, to energy bills decreased and energy efficiency increased - for areas with inadequate grid power, instant cooling capacity for the quick cooling of fruit, vegetables, milk and other preservatives food products and load shifts. Since 2013, hundreds of village-level collection centers have been equipped with Promethean's systems. Via their Fast and Traditional Chilling solutions, they have successfully helped their customers chill milk without using a single drop of diesel throughout India, Bangladesh, and Sri Lanka. It's Thermal Storage System (Patented), Efficient targeting, Eco friendly, Easy to operate were the major strength of the organization, they have a comparatively less innovative model, and dealing with only one niche market dairy farmers, export, adoption of new technologies and adopting rapidly is a great opportunity, government restrictions existing the market are the threats related to it.

CONCLUSION

Harvested fruits and vegetables require advanced post-harvest processing technology to reduce both qualitative and quantitative losses after harvesting. Postharvest cooling is critical for providing the best quality products to the customer. The study consists of start-ups who work through the food production value chain to develop new products, supply chain solutions for many subtropical and tropical fruits. Most temperate-zone fruits can be successfully stored at 0 to 5 degrees Celsius, but many subtropical and tropical fruits, such as lemon, avocado, banana, and mango, exhibit symptoms of damage from excessive cold storage and fail to ripen properly. Postharvest cooling technology providing quality products to the customer and it help to capture more market share in areas where the farmers are growing the commodities through number of Agri-start-ups involvement. The SWOT analysis of startups helpful for their success areas, failures, opportunities they had and the possible threats, how to handled it. Agri-start-ups, cold storage plants and equipment, as well as technology, must be updated to address the issue of the food value chain, and it opens up a lot of possibilities for creating new technologies and possible solutions for agro-based industries.

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