

# LEAN START-UP MANAGEMENT (MGT1022)

## DIGITAL ASSIGNMENT – 2

*SUBMITTED TO:*

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# VIT<sup>®</sup>

**Vellore Institute of Technology**  
(Deemed to be University under section 3 of UGC Act, 1956)

**Q1. Vegetables from the nearby villages of Vellore are sold for a very cheaper price; if they are taken to cities like Chennai or Bengaluru, the farmers may get a very good price. Present a comprehensive plan and a business model to help the farmers.**

## **1.1. INTRODUCTION**

Farmers fulfill the basic need of human kind by producing food. About a century ago, farmers used to produce food commodities mostly for self-consumption or for exchange with others (cash or kind) mostly in the same village or nearby places. They were primarily self reliant. But, now the production environment has changed considerably from self-reliance to commercialization. Technological advancement in the form of high yielding varieties, use of fertilizers, insecticides, pesticides, farm mechanization has led to a substantial increase in farm production and consequently the larger marketable and marketed surplus. The improved production is accompanied by the increasing urbanization, income, changing lifestyle & food habits of the consumers and increasing linkages with the overseas market. Today consumers are not limited to rural areas where food is produced. Further, increasing demand for processed or semi-processed food products requires value addition in the raw agricultural produce. These developments require movement of food commodities from producer to consumers in the form of value added products. Agricultural marketing brings producers and consumers together through a series of activities and thus becomes an essential element of the economy. The scope of agricultural marketing is not only limited with the final agricultural produce. It also focuses on supply of agricultural inputs (factors) to the farmers.

Agricultural marketing comprises all activities involved in supply of farm inputs to the farmers and movement of agricultural products from the farms to the consumers. The agricultural marketing system includes two major sub-system viz. product marketing and input (factor) marketing. The product marketing sub-system includes farmers, village/primary traders, wholesalers, processors, importers, exporters, marketing cooperatives, regulated marketing committees and retailers. The input subsystem includes input manufacturers, distributors, related associations, importers, exporters and others who make available various farm production inputs to farmers. The agricultural marketing system is understood and developed as a link between the farm and non-farm sectors. The marketing system should be such that it may bring about the overall welfare to all the segments (producers, consumers, middlemen and traders) of society. Government acts as a watch-dog in ensuring the interest of all the groups associated in the marketing. The subject of agricultural marketing includes marketing functions, agencies, channels, efficiency and costs, price spread and market

integration, producer's surplus, government policy and research, training and statistics on agricultural marketing and imports/exports of agricultural commodities.

The overall objective of agricultural marketing in a developing country like India is to help the primary producers viz. the farmers in getting remunerative prices for their produce and to provide the right type of goods at the right place, in the right quantity and quality at the right time and at right prices to the processors and/or ultimate consumers.

## **1.2. LITERATURE REVIEW**

### **[1] Food Supply Chain Management in Indian Agriculture: Issues, Opportunities and Further Research**

Author: Parwez, Sazzad

Journal: Munich Personal RePEc Archive (2013)

In this research paper, the author attempted to explore the problems faced by Indian agriculture for food security in terms of inadequate infrastructure and highly inefficient supply chain in context of information technology. Due to lack of efficient infrastructure and food processing industry about 30-35 percent of all foods produced in India are wasted.

The objectives of the study were to assess the importance of supply chain in Indian Agriculture; and to explore the issues, importance and scope of further research in Indian Agriculture. This paper thus examines the critical issues at each sub-system of agriculture supply chain, starting from the input to the consumer, with a view to integrating them in efficient and effective manner. Investments in cold chain infrastructure, applied research in post-harvest technologies, installation of food processing plants in various sectors and development of food retailing sector are mandatory for achieving gains in this sector.

Paper broadly covers some of important aspects of agriculture supply chain in India-identification of issues at different levels in the supply chain; transformation in the agriculture due to various supply chain interventions; the role of ICTs in supply chain management: and this paper also covers the suggestion to improve efficiency at different levels in supply chain. There is wide research gap in this sector, having such potential and prospectus for overall growth there is not much research in this field.

The paper concludes that efficient supply chain plays very important role for development and contemporary issue for agriculture therefore; government action must address the issue of infrastructure development to achieve the objective of food security for all.

## **[2] Linking small farmers to modern retail through producer organizations – Experiences with producer companies in India**

Authors: Anika Trebbin

Journal: Food Policy, ELSEVIER, 45, 35-44, 2013

Compared to other developing countries, little has been said in the Indian context about what role farmer organizations can play to help smallholder farmers specifically; improve their position in those emerging value chains. In this paper, the author addresses this gap and demonstrate that producer companies are a promising tool to strengthen famers' position in their relationship with supermarket chains in India, but one which needs further improvement.

The results presented in this paper are part of a study on producer companies in India within the frame of the author's PhD thesis in human geography. The main objective of the research was to understand the nature of links between India's smallholder farmers and the emerging modern food retail sector in the country and what role FPOs – and producer companies in particular – play in these relationships. To achieve this, the author applied both quantitative and qualitative research methods, with an emphasis on the latter. The material, on which this paper is based, was gathered over a period of several months in 2010, 2011 and 2012 and through a review of secondary data and literature.

From the discussion on this paper, it became clear that there is scope for producer companies to become part of modern retailers' supply chains in India but that only relatively few have succeeded in doing so to date. On one hand this can be attributed to a lack of capabilities among the producer companies. However, it also has to be taken into account that it takes an average three to five years to build a producer company that can successfully operate its marketing business while, at the same time, managing its internal and production related issues.

Once tested in the field, a respective clause might be included in the producer company legislation. At the same time, and to stir greater interest and motivation among corporate buyers, the legislation on food retail in India might in the future include a clause on a certain percentage of fresh produce that has to be procured from

farmers groups. Here, however, it needs to be stressed that producer companies are not the only possible option of collective action in India and that other well-functioning forms of FPOs should be treated equally.

### **[3] Food Mileage: An Indicator of Evolution of Agricultural Outsourcing**

Author: Paulrajan Rajkumar

Journal: J. Technol. Manag. Innov. 2010, Volume 5, Issue 2, 2010

The aim of this paper was to report the finding from study on distance travelled by fresh vegetables from farming location to consumer in traditional and organized retailing. The focus is on the fresh vegetables and final consumer destination was the city of Chennai. The research was primarily exploratory in nature and research instruments include interviews and survey through questionnaire with players in the fresh vegetable supply chain viz agents, auctioneers, wholesalers, traditional retailers, organized retailers and customers. Additional data collected thorough secondary source, existing literature on Indian retail.

Measuring food miles is a complex task and simplistic concept relating to the distance food travels as a measure of its impact on economical, environmental and social issues associated with transportation cost, pollution, energy conservation and nutrition vale of food products. One of many factors that have contributed to higher 'Food Miles' for organized retailer is the result of wider sourcing of supplies closer to the fresh vegetable harvest which are located far away from retail hubs. Other reasons for increase in food miles: greater product availability at the retail outlets, particularly for seasonal items which consumers now to buy all year round and consumers are exposed to wider range and higher quality fresh vegetables. Organized retailers' business strategy is to reduce for overall cost than distance travelled. Food mileage is one of the factors along with value density (ratio of product value to weight), utilization of vehicle capacity, average payload weight to calculate the efficiency and profitability of the business.

As shorter food miles is an indicator of near sourcing or rural sourcing and longer food miles of fresh vegetables is an indicator for agricultural outsource. It should be noted that study concentration of only one dimension, "Food Mileage" which is directed to concluding more food mileage is an indication of agricultural outsourcing.

#### **[4] Inclusive development through innovative model: a case of KnidsGreen Pvt Ltd. (India)**

Author: Archana Singh

Journal: Int. J. Social Entrepreneurship and Innovation, Vol. 3, No. 3, 2014

This paper explored the innovative business model of KnidsGreen Private Limited founded by Kaushalendra Kumar, an IIMA graduate. It was engaged in solving problems of poor and disadvantaged people dependent on the informal vegetable sector (resource poor vegetable growers, vendors, farm labourers, among others), and contributing to inclusive development in the Indian state of Bihar. Using grounded theory approach, this case-study identifies how an innovative business model benefits stakeholders resulting in their inclusive development.

The study followed a grounded theory approach (Strauss and Corbin, 1998). The primary unit of analysis is ‘model’, because the study is about the innovative model adopted by the organisation. Whenever a business enterprise is established, it either explicitly or implicitly employs a particular business model that describes the design or architecture of the value creation, delivery, and capture mechanisms that it employs. In other words, ‘business model’ defines the way an enterprise generates value (value creation), delivers value to customers, and how it captures some of this value as profit (value capture) (Teece, 2010).

The profit-making market-driving approach challenges the perception that this is not a dignified and remunerative activity, sensitising and organising beneficiaries, enhancing productivity and marketability by building formal supply chain network through innovations, partnerships and alliances, backward and forward linkages, benefiting farmers, vendors and consumers, generating employment at grassroots level, eventually making profits. Though based on a single case study, the findings are significant for adaptation and replication of this model in all countries encountering similar problems.

The insights and categorisation presented in the study can be a worthwhile starting point for further research with direct and indirect impacts as well as sustainable profit effects to validate the findings and to provide policy recommendations for both policies and business. In addition, replication of such an innovative inclusive business model is highly recommended in other areas for the inclusive development of the country. The present case study will certainly help practitioners interested in adopting similar mechanisms to solve social problems and also to generate sustainable returns, and contribute to inclusive development of the country.

## **[5] A Need For Paradigm Shift to Improve Supply Chain Management of Fruits & Vegetables in India**

Authors: Piali Halder, Simayan Pati

Journal: Asian Journal of Agriculture and Rural Development, 1(1), 1-20, 2011

The authors in this paper presented a study which undertook a thorough review of basic and contemporary literature available and tried to explain the challenges & opportunities in supply chain management to create a bridge between rural & urban market. It also brought out relevant research gaps and overlooked problems in the supply chain.

The main objective of this paper was to understand constraints in Supply Chain Management for perishable goods in our country and explore the various challenges and opportunities evolving in day to day product handling. Rapid entry of corporate into marketing of vegetables and fruits sectors will help the farmers as they are going for direct tie-ups with farmers eliminating the middle men at various levels. The major challenge is how to adopt best practices in supply chain management like collaborative forecasting, data integration, increased usage of IT, demand-based production, incorporating a pull system for fruit and vegetable production rather than a push system sharing risk and rewards by the supply chain partners, etc. What should Firms from established and mature economies are increasingly expanding into emerging markets.

As Indian economy is still based on Agrarian economy, proper supply chain management of perishable goods will play a crucial role in developing the economy & help India to emerge as a global leader in Food Sector. Having a galore of opportunities & resources the hindrance/gap between rural & urban market of India should be collaborated through proper vendor management, warehousing & logistics management.

In conclusion, the direct participation of farmers needs to be increased. Market infrastructure should be improved through storage (go-down) facilities, cold storages, loading and weighing facilities. Improvement in the road network, and cold-chain facilities are also of substantial importance. Greater transparency of the operations through supervision and systems can also help substantially. The market integration and efficiency can also be improved by making upto-date market information available to all participants through various means, including a good market information systems, internet and good telecommunications facilities at the markets. Thus, efforts are needed in the direction to capitalize on our strengths and remove constraints to meet the goal of moving towards systematic supply chain & logistics management which will lead to agricultural growth and development in India.

## **[6] Issues and challenges in the supply chain of fruits & vegetables sector in India: A Review**

Authors: Saurav Negi, Neeraj Anand

Journals: Int. J. Mng. Value & Supply Chains (IJMVSC), Vol. 6, No. 2, June 2015

The Fruits and Vegetables (F&V) sector has been a driving force in stimulating a healthy growth trend in Indian agriculture. Given the rising share of high value commodities in the total value of agricultural output and their growth potential, this segment is likely to drive agricultural growth in the years to come. It plays a unique role in India's economy by improving the income of the rural people. Cultivation of these crops is labour intensive and as such they generate a lot of employment opportunities for the rural population.

The entire supply chain of F&Vs in India is laden with various issues and challenges. To list the possible challenges and suggest a way forward, there was a need to study this supply chain. The purpose of this paper, thus, was to discuss the supply chain of the fruits and vegetables sector in India and explain the issues which are affecting it. Authors also suggested the corresponding mitigation strategies to overcome the identified issues and challenges.

Descriptive research has been used for this study. The supply chain of F&V sector has been explained and an attempt has been made towards identifying the issues affecting the supply chain of the sector. The present study undertakes a thorough review of basic and contemporary literature available and tries to explain the factors affecting the supply chain of Fruits and Vegetables sector in India.

The major factors identified from the study are pertaining to the category of infrastructure, processing & value addition, financial and information. Some of the major identified key challenges are Lack of Infrastructure Facilities, Low Processing and Value Addition, Low farmer income, Supply Chain inefficiency, large number of intermediaries/fragmented supply chain, Poor Quality & Safety standards. Overcoming these issues will benefit the farmers, state government, transporters and food processing unit in the form of reduced losses and wastage, increase in the price share of the farmer, provides employment opportunities to the local people etc.

## **[7] Factors Influencing Smallholder Farmers in Supplying Organic Fruits and Vegetables to Supermarket Supply Chains in Karnataka, India: A Transaction Cost Approach**



Authors: Ravi Nandi, Nithya Vishwanath Gowdru, Wolfgang Bokelmann

Journal: International Journal of Rural Management, 13(1) 85–107, 2017

The authors in this study considers the integration of smallholder organic farmers in vertically coordinated supply chains and factors influencing them. The article draws transaction costs economics (TCE) to develop a model explaining potential TC attributes influencing farmer's decision to participate in supermarket supply chains (SMSC) compared to spot market (SM) in Karnataka, India. This article uses data collected from 127 smallholder organic farmers through face-to-face interviews to identify factors that significantly influence the farmer's decision. A binary logistic regression model was employed within the TC framework. Seven TC attributes were evaluated on farmer's decision.

Attributes such as pre-arranging price, quantity, frequency, and access to market information and finance have significant positive influence on farmer's decision to participate in SMSC. However, attribute payment mechanism has a negative influence. Furthermore, there are significant differences between SMSC and SM supplying groups with reference to variables distance to the market, the general state of the road and age. The results have a policy and managerial implication towards the development of organic food market in the Karnataka state, India.

The results of the study provide empirical evidence of the statistically significant factors which are influencing as incentives/limitations for smallholder organic F&V farmers supplying SMSC. These SMSCs which are operating in their local area compared to SMs in the different parts of the Bangalore city is more than 30 km from the production area. The hypothesis that TC attributes influence farmers' decision of supplying to SMSC or SM was tested using the logistic regression model.

Knowing the challenges of inclusion of smallholder organic farmers in SMSC, it is proved that there are benefits associated with the smallholders' inclusion into vertically integrated supply chains. Specifically, the tendency of vertically coordinated chains to engage in upfront negotiations and agreements with their producers about price, quality and quantity can reduce the risks involved and cause better planning of the production process. Likewise, payment method needs to be addressed effectively based on the local conditions, which is likely to enhance managerial efficiency.

In addition, large-scale longitudinal studies on the development of vertically coordinated supply chains led by supermarket chains or specialized organic retailers at different locations of the country can also be valuable and help to understand potential setbacks in integrating smallholders and identifying mechanisms to overcome these setbacks on regional basis.

## **[8] The Impacts of Supermarket Procurement on Farming Communities in India: Evidence from Rural Karnataka**

Authors: Bill Pritchard, C. P. Gracy, Michelle Godwin

Journal: Development Policy Review, 28 (4): 435-456, 2010

The rapid expansion of supermarket retailing, with its impact on farmer communities, represents a contentious part of India's recent economic development.

The authors of this article report on three districts of Karnataka, where a survey of 78 farmers supplying fruits and vegetables to Reliance Fresh, a leading supermarket chain, reveals low levels of vertical co-ordination, a lack of written contracts, and highly competitive environments, with the quality parameters used by supermarkets specifying only a limited set of conditions. These findings suggest that supermarket-led restructuring in India has not yet reached a stable institutional situation.

The purpose of this article was to apply the experiences of supermarket-led restructuring in other developing countries to India, and thereby assess the extent to which Indian agriculture may be following the same path. The expansion of the supermarket sector in India is still in its early stages, and these embryonic contexts define interpretation of the data reported here.

The diffusion of the global 'supermarket revolution' to India has garnered significant interest from international researchers on this topic, and has prompted voluble debate in India itself about the social and economic implications of this path. The implicit narrative of India as the 'latest frontier' in the global supermarket revolution slots the country unproblematically into an international diffusion model, characterised by a rapid consolidation of suppliers, the establishment of preferred purchaser arrangements, and the establishment of tightly co-ordinated vertical procurement chains.

This study has sought to document the empirical realities of these processes. All things being equal, the chosen sites in Karnataka would be expected to exhibit leading trends in this phenomenon. These facts being as they are, this research has documented a system of procurement that, when compared with those in other countries, has relatively low levels of vertical co-ordination and focuses on apparent product qualities rather than rigorous testing. Supermarket buyers still tend to procure from a relatively extensive range of suppliers, and farmer participants themselves are not heavily dependent on supermarkets as sites of product destination. The vast proportion of our respondents sold much more of their output through traders than to supermarkets.

Thus, the present scenario seems to reflect a reality where supermarket-led restructuring has not yet converged towards an institutional environment that becomes 'locked-in'. Undoubtedly, as evidence here has indicated, supermarkets are setting up purchasing operations in farming communities and altering the competitive dynamics of agrarian life. But set against global experience, these initiatives are modest. This being the case, our investigations give cause to question the likely resemblance of these processes in India to those found elsewhere. Supermarket-led agricultural restructuring will bring change to rural India, but will not dominate the agricultural scene for the foreseeable future.

### **1.3. DESIGN THINKING**

#### **1.3.1. UNDERSTANDING THE PROBLEM**

Agricultural marketing still continues to be in a bad shape in rural India. In the absence of sound marketing facilities, the farmers have to depend upon local traders and middlemen for the disposal of their farm produce which is sold at throw-away price. In most cases, these farmers are forced, under socio-economic conditions, to carry on distress sale of their produce. In most of small villages, the farmers sell their produce to the money lender from whom they usually borrow money. According to an estimate 85 per cent of wheat and 75 per cent of oil seeds in Uttar Pradesh, 90 per cent of Jute in West Bengal, 70 per cent of oilseeds and 35 per cent of cotton in Punjab is sold by farmers in the village itself.

Such a situation arises due to the inability of the poor farmers to wait for long after harvesting their crops. In order to meet his commitments and pay his debt, the poor farmer is forced to sell the produce at whatever price is offered to him. The Rural Credit Survey Report rightly remarked that the producers in general sell their produce at an unfavourable place and at an unfavourable time and usually they get unfavourable terms. In the absence of an organised marketing structure, private traders and middlemen dominate the marketing and trading of agricultural produce. The remuneration of the services provided by the middlemen increases the load on the consumer, although the producer does not derive similar benefit. Many market surveys have revealed that middlemen take away about 48 per cent of the price of rice, 52 per cent of the price of groundnuts and 60 per cent of the price of potatoes offered by consumers. In order to save the farmer from the clutches of the money lenders and the

middle men, the government has come out with regulated markets. These markets generally introduce a system of competitive buying, help in eradicating malpractices, ensure the use of standardised weights and measures and evolve suitable machinery for settlement of disputes thereby ensuring that the producers are not subjected to exploitation and receive remunerative prices.

### **1.3.2. ANALYZING AND INTERPRETING A PLAN**

The pilot project of Telangana government, “Mana Ooru, Mana Kuragayalu”, intended to boost vegetable supply to Hyderabad city with many villages already supplying vegetables to the city. Under this project, the government provides subsidies and transportation to farmers for bringing their produce to the city. With this system, farmers can avoid middlemen and sell their produce directly to customers. With the elimination of middlemen, farmers can sell vegetables at reasonable prices. Ultimately, the urban population will benefit as vegetable prices will be stable. This can be done in every state but will take a lot of time for planning and execution.

At a lower level we can observe the already popular choice of farmers for selling their produce in the urban cities as mandi. These mandi's are places which are dedicated to selling the produce of farmers directly to the consumer, cutting out the middlemen and increasing revenue for the farmers and giving fresh vegetables and fruits at lower prices to the consumers in the urban cities.

By keeping this already famous way which is reliable and each farmer agrees to it, we can set up a way in which this process becomes easier, more clean and efficient for the consumers and the farmers.

### **1.3.3. IDEATE (imagine, research, ponder)**

Food prices have been on the rise since the last couple of years, reversing a downward spiral, which has led to disinflation and aggravating rural distress. The pick-up in food prices, however, is inequitable across rural and urban areas.

After extensively reading about the problem, and going through several research papers regarding this, we have found that only urban areas are seeing a pick-up in

food prices, while rural food costs remain subdued, showed inflation data released by the GoI.

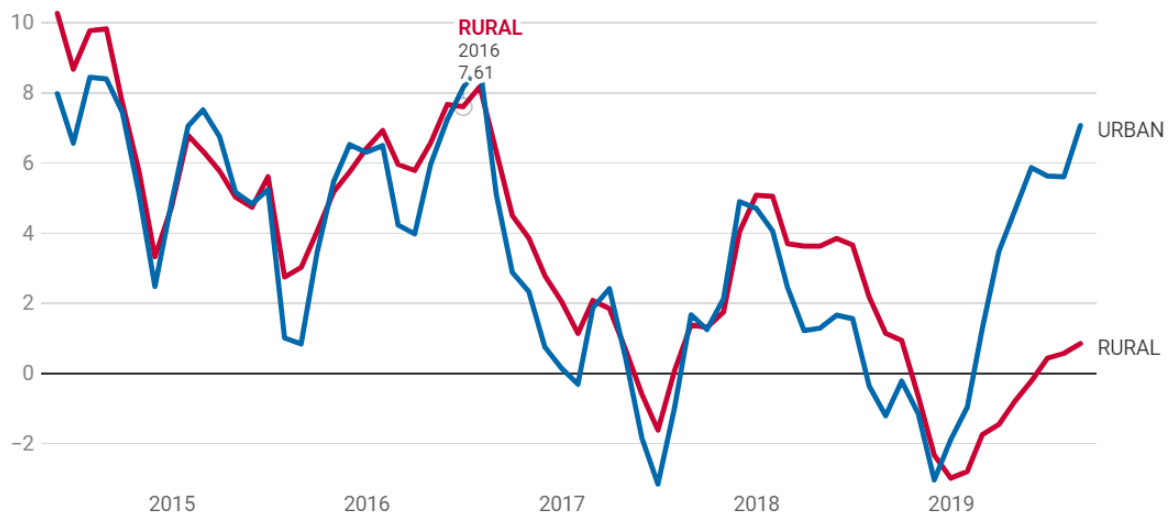


Fig. Major Divergence in Rural and Urban Food Price Growth since 2019

Led by higher food prices, retail inflation rose to 3.21 percent in August, according to data released by the Ministry of Statistics and Programme Implementation. The difference between rural and urban food prices has widened to the highest since the use of the revised series on base year 2012. Urban food prices rose by 7.07 percent in August, while food prices in rural areas rose by only 0.85 percent- a divergence of 6.2 percent.

Within the food basket, fruits, vegetables and pulses, showed steep divergence for rural and urban areas. The commodities have a high weightage in both urban and rural inflation indices and had exhibited a fall in prices through the course of the last couple of years.

Prices of vegetables in rural areas continued to contract albeit at a declining pace while prices in urban areas continued to show a steep rise in prices. Inflation in rural areas for vegetables contracted by 0.13 percent in rural areas, while they rose by 20.5 percent in urban areas.

## Rural Vs. Urban Divide: Vegetables

(In %)



Though the difference in rural and urban food prices is because of the value chain, the divergence is further compounded in the rainy seasons by floods choking supply. August especially is characterised by the end of season before the new harvest, Gulati said. However, even in a bumper harvest, when farmers have to sell at low prices, storage, distribution, transport costs and retailer margins do not justify the high divergence.

Another possible explanation is the weak purchasing power in the rural economy due to an extended period of low wage growth. Purchasing power in rural areas has remained compressed since demonetisation. That, along with longer supply chains in urban areas has contributed to rising divergence between both indices. Among 35 states and union territories, 17 showed a divergence that was higher than the national average of 6.22 percent.

### **1.3.3. APPLYING CREATIVITY TO CREATE A PROTOTYPE**

To create an fast and efficient chain between the famers from nearby villages of a city and the local marketplaces where the city folk have easy access and can depend on for their fruits and vegetable needs we can ask the district magistrate of the area to setup funds for the stalls and favourable environment for the farmers to sit and sell their produce.

This will involve a huge initiative from the office of the magistrate to issue some funds but if successful will create an economic hub in that area for the farmers.

So we can easily have a prototype where the farmers can set up a transportation service on their own or it can be provided to them by the government which will help them to bring their produce from villages to the city in a way where they don't suffer any loss due to transportation.

Upon reaching the hub each farmer will get a stall or booth in which he/she can set up their items for display. At the opening hour of the market the consumers can start coming in and can buy the produce directly from the farmer at a genuine rate in which neither the famer gets underpaid or the consumer buys at a high price.

### **1.3.4. REVIEWING AND REVISING**

Where market linkages are initiated by existing actors, they tend to build on informal structures in which traders or farmer-traders play a critical role, not only to connect farmers to markets but also as de facto service providers. In many cases the trader is a member of the rural community and has specialised knowledge, information, assets and contacts to facilitate not only commercial ties but also social support in times of crisis. Informal linkage models are common throughout the world but little understood. Certainly, knowledge on how to develop business models that leverage these informal linkage systems is scarce. These models rarely receive support from development interventions or attention from researchers due to their informal nature and the strong bias against traders prevalent in many development organisations. This is unfortunate, as these models hold important information and lessons for sustainable market linkages and service provision, especially in areas with weak formal farmer organisation.

The whole vegetable sector is very unorganized and since it is a very essential part of every human being's life, so consumption is there, demand is increasing, but there is no invention, there is no value addition in the field of vegetable production and marketing. So what we are trying to do is create the whole vegetable value chain giving equal benefits to all its stakeholders. It is farmers and vendors at one end and consumers at the other. Even consumers are not getting the proper value for their money in the market. It's because of the poor supply chain (which we have talked about in the next few pages) that allows black marketing, which is possible, because there is no system in the vegetable sector. There is no apex body. There is no defined rule. That is what we are trying to do to benefit farmers, vendors, consumers plus generating employment at the grass root level.

Regardless of whether or not our model is based on existing actors and skills or is induced, these models can be grouped depending on the focus they accord to diverse actors in the chain. Existing models tend to fall into three general categories: a) those that focus on developing and supporting producer organisations; b) those that focus on specialised intermediaries; and, c) those that are driven by buyers. Despite the differences in entry points and emphasis, all the models seek to connect actors to facilitate effective market integration.

## **1.4. METHODOLOGY**

Whenever a business enterprise is established, it either explicitly or implicitly employs a particular business model that describes the design or architecture of the value creation, delivery, and capture mechanisms that it employs. In other words, 'business model' defines the way an enterprise generates value (value creation), delivers value to customers, and how it captures some of this value as profit (value capture). Thus, 'business models' emphasise a system-level, holistic approach to explaining how firms 'do business'.

In order to make an efficient solution for this problem that we need to tackle, we need to consider various factors.

- Vegetable growers farm on a small to medium portion of land.
- They also face problems in marketing of the produced vegetables, lacking transportation facilities to bring them to the market for selling, often bearing losses.



- Most of the farmers are also not aware of simple, but advanced and beneficial techniques of vegetable cultivation or the right quantity of pesticides to use.
- As individual farmers, they do not have bargaining power to buy the agricultural products like seeds, pesticides etc.

Business case for and against procuring from small vegetable farmers:

For	Against
<ul style="list-style-type: none"> <li>• Smallholders' comparative advantages (premium quality, access to land, etc)</li> <li>• Securing supply in volatile markets, spreading portfolio geographically, reducing risk of undersupply as well as localised pest and disease problems</li> <li>• New business, clients for other products and services (Base of Pyramid)</li> <li>• New technologies available (efficient low-scale processing equipment, information technologies for coordination and lower cost traceability)</li> <li>• Capacity to ramp up or ramp down production without incurring fixed costs (contract farming)</li> <li>• Access to donor assistance</li> <li>• Corporate Responsibility</li> <li>• Community goodwill</li> <li>• Political capital</li> </ul>	<p>Costs and risks in organising supply from dispersed producers:</p> <ul style="list-style-type: none"> <li>• quantity</li> <li>• quality</li> <li>• consistency</li> <li>• safety</li> <li>• traceability</li> <li>• compliance with rising standards</li> <li>• packaging</li> <li>• loyalty and fulfilment of commitments by farmers</li> <li>• negotiation time and costs</li> <li>• political opposition to commercialisation of peasant agriculture</li> </ul>

So, keeping these points in mind, we come to the conclusion that we need to make a viable solution which is overall cost efficient and can enable each farmer whether be it small scale or mid scale farmer to sell their produce at a profit in the nearby cities like Vellore where there is demand and the consumer will be able to pay the amount.

There are often good reasons for a lack of embedded services in rural areas. Successful services rely on knowing the customer well. Research shows that this knowledge is difficult for non-residents to obtain or interpret. Using tools that strengthen the capacities of informal service providers to identify, provide and improve their embedded services in rural areas is critically important.

## 1.5. PROPOSED SOLUTION

The first step towards mitigating this price divergence between rural and urban areas, so that farmers from the Vellore and nearby regions can go sell their vegetable produce in the urban parts (Chennai, Bengaluru, etc.), can be attributed to establishing a formal vegetable supply chain network.

Supply chain networks can be established to facilitate primary producers (vegetable growers or farmers) to link up with both input suppliers as well as with market and government programs/extension agencies. The supply chain can be made more efficient through professional set up.

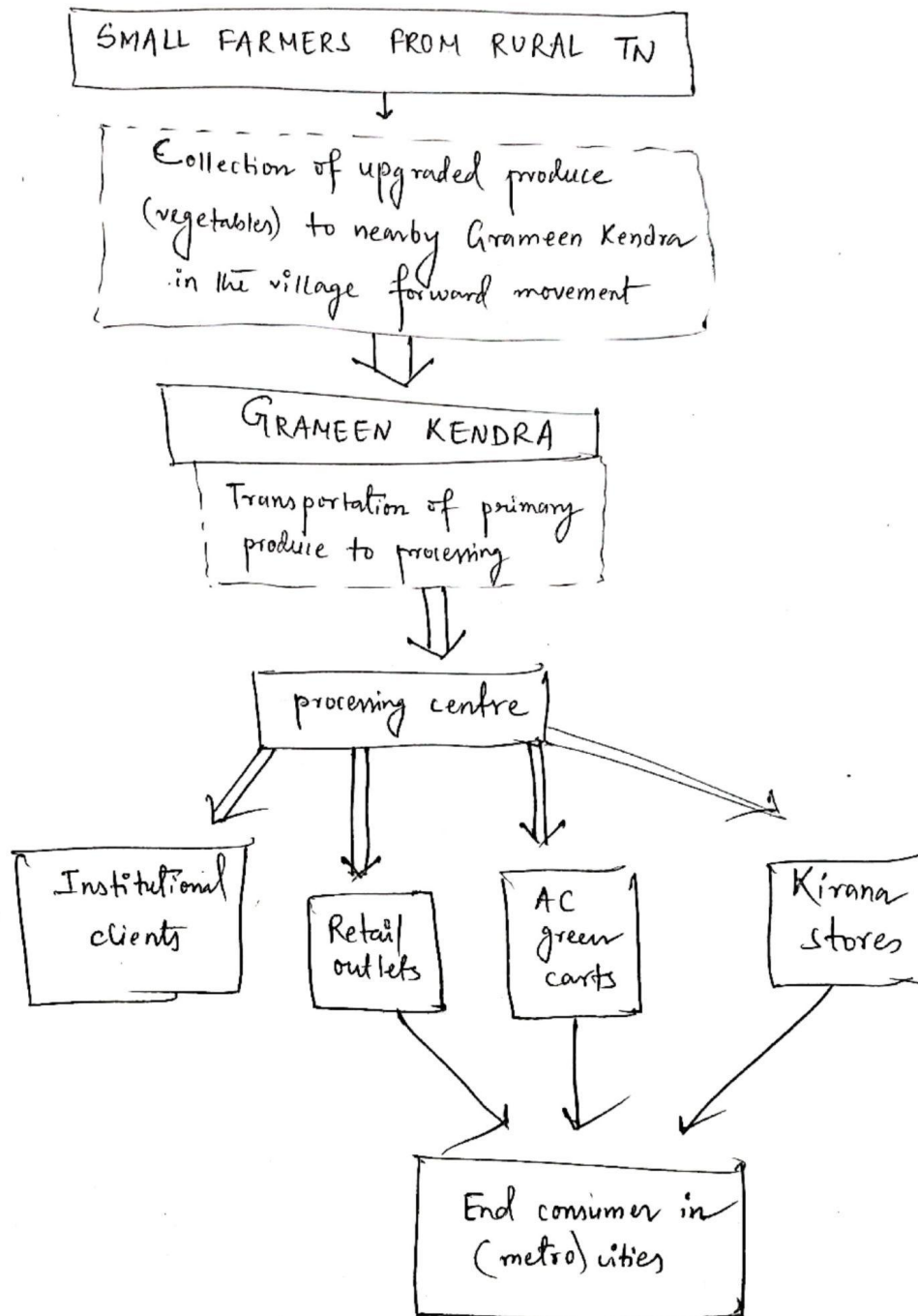
This network can bring prosperity to rural farmers of Vellore and nearby TN regions, as well as to small street vendors, because today, if we go to farmers or vendors, they are living in a pathetic condition. Reason being, no back end support or front end support for the marketing as vendors are considered as an unwanted part of society. They are the people who work 14 to 16 hours a day, but the output, the return which they should get, they aren't getting. So, farmers, and vegetable vendors, both are in trouble. We are trying to give a holistic solution to both... these two parts of the vegetable value chain and trying to re-invent the vegetable value chain.

In our proposed model there's no middleman. Due to direct connection with the input suppliers, market and government agencies, the role of intermediaries have reduced drastically. It's not only about re-inventing the existing vegetable supply chain and establishing a new formal one, but also doing a lot of product innovation, including a small storage structure for storing produced vegetables, made up of bricks and sand. It uses simple technology and does not require electricity to operate. Vegetable growers only need to sprinkle water on sand to keep it wet to ensure cooling. 'Poly House' is another such product which allows farmers to grow non-seasonal products and earn better incomes. It is a protective shade made up of polythene. Temperature, humidity, ventilation of air is controlled by the equipment fixed in the poly house and specific technology like drip irrigation or vermicompost are used to achieve the objective.

The AC green cart is a unique and innovative product for selling vegetables, keeping vegetables fresh and hygienic in Indian climatic conditions. Adoption of technological innovations in agriculture has attracted considerable attention among development economists, because the majority of the population of less developed countries (LDCs) derives its livelihood from agricultural production, and because new technology seems to offer an opportunity to increase production and income significantly.

This model benefits farmers and vendors at the two extremes of the value chain and also the consumers. In addition, it creates employment opportunities at the grass roots level – collection centres, processing units etc.

## 1.6. DIAGRAMMATIC REPRESENTATION



## 1.7. INFERENCE AND CLOSING COMMENTS

There is a sound business case for securing and enhancing small-scale producers' inclusion, which can bring both economic as well as wider development gains. This requires that appropriate business models are applied and, where applicable, that this is done in partnership with producers, the public sector, intermediaries and development agencies. Two big challenges are evident when seeking to apply inclusive models to developing country economies dominated by small-scale producers, either for domestic retailing and processing, or for exporting. The first is organising and upgrading supply from a dispersed producer base. The second is traceability and quality assurance. The value proposition of modern agrifood business and cost structure can be maintained or even strengthened by building in inclusion of small-scale producers and suppliers.

The business models concept is especially useful in helping businesses to understand the reach of downstream decisions on how value is created or lost by supply chain actors, including smallholders. But business models that work for more inclusive market development are not exclusively about procurement. The approach compels us to look to effective alliances and linkages by all chain participants. This rarely occurs spontaneously, given the often adversarial relationships that characterise commercial links in the agrifood sector. As a result, specific actions to clarify and develop plans for collective action at the chain scale are needed.

Another debate is between the importance of 'modern' markets and 'traditional' markets. Many of the models developed around modern restructured chains apply equally well to local and 'traditional' markets. Some emerging modern markets are extremely small, niche and donor-influenced, and a distraction from the priorities of broad-based rural development. Furthermore, even very progressive modern procurement systems can be exclusionary. Producers, intermediaries, buyers and support agencies must evaluate their options very carefully; there may be better rewards in the traditional markets, thanks to the high volume and less stringent standards. We need to know more about the applicability of new business models to trade with traditional markets.

It is an open question as to whether new business models will benefit the poorest, and, if they do, whether they will ever be sustainable. Over-reliance on markets, coupled with voluntary pro-poor initiatives by business, misses the point of market governance, whereby genuinely effective business models work best in a strongly supportive policy environment, both for producers who want to connect to those chains and also for those who cannot. Policy attention will always be required to prevent persistent and engrained abuse of power in asymmetric power relations. Business models do not resolve other key issues such as infrastructure investments that may be critical to upgrade excluded producers. These 'hidden costs of inclusion' are not well accounted for in business models, but failure to include them limits the effects of even the most progressive approaches on the rural economy.

**Q2. Lack of storage facilities has put many farmers into trouble. In the month of October 2021, a Kg of tomatoes was sold for Rs 5. In the month of December the price went up to Rs 160 per Kg. Present a solution to help the farmers.**

## **1.1 INTRODUCTION**

A major problem faced by the Indian agricultural sector is that of storage. Agriculture, being a seasonal activity, makes it impossible to grow crops throughout the year. Crops can be grown during a season in which the crops can grow and then can be stored in warehouses and sold during the off season. In the absence of storage facilities a huge portion of the grown crops go to waste as there is no means to preserve it and it also affects the availability of food during the off season. Hence, it is more desirable to store food in case of excess production.

The truth however is that these means of storage are not easily accessible to everyone and India in fact lacks adequate storage facilities and because of insufficient storage facilities, as much as 16% of our total agricultural produce is simply wasted. Insufficient storage also makes it really difficult to meet the demand during the off season. As a result of this the price of several crops increases. This sudden and sometimes unrealistic hike in the prices is met with unrest and protest among citizens because citizens find it really expensive to put together a simple meal.

To solve this issue we need better storage facilities. We should also keep in mind that the efficiency of the public sector hasn't been great in the past. So one thing that can be done is that we can incentivise the private sector to build better storage facilities . Some of the blame should also be put on the Essential Commodities Act, 1955. According to this act the supply of essential commodities is regulated i.e. farmers can't store more than what the government tells them to. This act is archaic and was ironically set up to prevent hiking up of prices. As we see, the act is doing exactly the opposite of what it is supposed to. As a result of this the price of tomatoes went from a mere 5 rupees to 160 in a matter of 3 months. If the excess tomatoes were stored 3 months prior then we wouldn't have had to face such drastic price hikes.

How did such a steep hike happen? To answer this we must look into the crux of the problem. The problem here is storage. Fortunately the government has decided to do away with stocking provisions and there is no specific upper limit to how much crops can be stored. This helps us encourage storing of crops and we can now come up with better methods to store crops and also prevent price hikes as such.

## **1.2 LITERATURE REVIEW**

### **[1].Reducing Postharvest Losses during Storage of Grain Crops to Strengthen Food Security in Developing Countries**

**Authors:** Deepak Kumar and Prasanta Kalita

This paper provides a comprehensive study of the grain postharvest losses in developing countries, the status and causes of storage losses and discusses the technological interventions to reduce these losses.

Reducing the postharvest losses, especially in developing countries, could be a sustainable solution to increase food availability, reduce pressure on natural resources, eliminate hunger and improve farmers' livelihoods.

Most of the harvested grains are stored in the traditional storage structures, which are inadequate to avoid the insect infestation and mild growth during storage and lead to a high amount of losses. Technology interventions and improved storage structures can play a critical role in reducing postharvest losses and increasing farmers' revenues. Hermetic storage creates an automatic modified atmosphere of high carbon dioxide concentration using the sealed waterproof bags or structures, and significantly reduces insect infestation losses.

### **[2].Cold Storage in India: Challenges and Prospects**

**Author:**Dr. Minakshi Chakraborty

This paper provides a brief study about the measures that need to be adopted for a robust growth in cold storage in India.

Link farmers to value chain- Provision of safe, controlled pre-cooling phase in the production stage will help generate the volume needed to justify cold chain investment.

Create incentives for investment in technology for cold storage and process enhancement, thus lowering the economic barriers for investors and supporting return on investment:

Encourage the formation and operation of industry bodies for supply chain actors in the agro-food industry, logistics companies, technicians and engineering firms specialized in cold chain infrastructure.

Invest in research and development of proper small scale and affordable technologies (i.e. evaporative cooling, small scale mechanical pre cooling and refrigeration

systems), post-harvest handling techniques, with particular attention to the needs of small-scale producers and SMEs.

### **[3].Sustainability through Local Storage Structures**

**Authors:** Jayakumar, Narayanan & Sundaramari, Mariappan. (2014).

The paper gives us a good idea of how traditional storage structures were used in agricultural practices that were prevalent in earlier times. It throws light on the quantum of paddy that was harvested, much before the introduction of the so-called modern technology. Secondly, these structures were built around the living area to provide security for the produce. No travelling, no paper works, always easily available as compared to the recent trend of storing the grains in warehouses.

The cost involved in building such structures is not high and once built could be used for generations. They are made up of locally available materials and amenable to alteration in their size and shape according to the requirements of the users.

The two types of storage structure discussed in this paper are Nell Veedu and Machchu.

These structures are built with durability in mind and can last generations with minimal repair. One thing to keep in mind is that these structures are built for storing grains and might not be as effective in case of storing vegetables and other easily perishable stuff.

### **[4].Changing Crop Production Cost in India: Input Prices, Substitution and Technological Effects**

**Authors:** S.K. Srivastava, Ramesh Chand and Jaspal Singh.

The study examines economics of crop cultivation at the aggregate level over 25 years, identifies sources of cost escalation and evaluates the effects of factor prices, substitution and technological effects on the production cost. The results reveal that a disproportionate change in gross return vis-à-vis cost resulted in varying rate of return from crop enterprise during the 25 years.

Evidence indicates the slow pace of technological improvement in Indian agriculture and underlines the need to accelerate efforts to raise yield at a faster rate to offset the effects of rising cost on corn and maintain a fair profit margin in crop cultivation. It is

therefore necessary to promote efficient and appropriate farm mechanization suitable for small farm situations.

So it is evident from the paper that technological advancement plays a huge role in the crop production cost and one might say that it is in fact directly proportional to it. If an increase in crop cost is desired to meet the fair price of crops and give the farmers a good profit we should consider technological advancements even at the smallest parts.

## **[5] Storage Potential for Agricultural Commodities in India**

**Authors:** Mr. Moin U Sayyad, Dr. Pramod H. Patil

Farmers store grain in bulk, using different types of storage structures made from locally available materials. Storage losses constitute a major share of food grain loss in postproduction operations. The grains are stored at Producer's Level, Trader's Level and Urban Organizational Storage Level. The method followed for storing the grains are - (i) storage in bags, and (ii) loose storage. Storage in bags is convenient for short term storage, where grain is intended for very early onward movement.

In this paper the researchers discussed on the different segments of farmers in India, to know the production status of various food grains & oilseeds in India, to find out the potential for storage of agriculture commodities.

According to this paper the storage capacity available with country is 117.52 Million ton, which was very limited as compared to India's overall food grain, oilseed and pulses production. It is not feasible to formulate individual storage infrastructure for near about 85% of small and marginal farmers. This can be achieved through supplying storage capacity to farmer groups. This improvement in storage capacity will aid in enhancing country's ability to meet its food security objectives by the year 2025.

## **[6] Agricultural Storage Infrastructure in India**

**Authors:** Dr. Bhartendu Kr. Chaturvedi

The objective of this paper is to summarize the issues and challenges facing the agricultural warehousing, especially in the food grains storage facilities sector and attempt to find possible solutions. In the current year budget announced by the finance Minister, an allocation of 5000 Cr INR has been made for Warehouse infrastructure Fund, keeping in view the urgent need for availability of scientific warehousing



infrastructure. The paper tries to analyze the issues in the food grain storage sector using facts and figures and recommend possible solutions.

In this paper from the foregoing facts and figures, it is concluded that unless some very drastic measures are taken to improve the storage capacity of food grains, the wastage of food grains cannot be curbed which otherwise could be utilized for feeding millions of poor people. From augmenting the existing storage capacity by construction of new ones through various means both public and private including partnerships, the need of the hour is to revamp the existing storage management of food grains in the country and make people and agencies accountable and responsible for their jobs of ensuring food security. Integration of the entire storage business in India through MIS would go a long way in ensuring timely decisions are taken for optimum utilization of the existing facilities.

## **1.3 DESIGN THINKING**

### **1.3.1. Empathize** (connect with users understand their problem):

Speaking about this problem faced by the farmers, if we place ourselves in their shoes for every particular type of crop or vegetables they yield there is a specific season and a specific target amount for that yield, which they further sell directly or through a middleman into the main market to earn their livelihood. Now the problem is faced when there is resistance in the natural course of this lifecycle. By resistance it can be natural calamity, or a pandemic etc, if any of these happen the supply and demand ratio is altered which leads to financial problems to meet the everyday target, suppose if the daily target of a farmer is 1000 crops or vegetables per day, if this yield is delayed for a week due to a natural calamity(i.e flood) , automatically the supply of 7 days is reduced from the market , when this happens the only solution is the stored crops/vegetables that are placed in warehouses as surplus. This makes the supply chain suffer to cover the increasing demands as the storage is limited, which eventually leads to price hike making the farmers livelihood suffer.

### **1.3.2. Define:**

Some insights about the Storage facilities of the Agricultural Commodity of India may add more focus on this situation which are:

- The storage capacity of India is still low as compared to total food grain production of India i.e the total production of food grains in India was 308.65 MT in 2020-21 whereas the total storage capacity was 166 MT

- Regional imbalance in production as well as storage capacity.
- There are large number (85%) of marginal and small farmers, they can not afford to create individual storage infrastructure due to limited amount of production
- The capacity utilization in Public sector warehouses is very Less i.e on an average 40-60% capacity utilization in most of the state.

### **1.3.3. Ideate:**

Steps taken by the government as to address the problem of Storage facilities of the Agricultural Commodity:

- The total storage capacity of India was improved from 117.52 MT(2013-14) to 166 MT (2020-21) including public sector, private and cooperative warehouses.
- The public distribution system is linked with central pool stock available with public sector warehouses hence agricultural warehouses provide linkage between supply and demand for agricultural commodities.
- The storage capacity available with public sector warehouses i.e Food corporation of India (FCI), Central Warehousing Corporation and State Warehousing Corporations, having a countrywide network of agricultural warehouses has been increasing continuously.
- Warehouse receipt is attached with the storage of agricultural commodities in the warehouses which can be used as an option for easy loan and credit.

One way to reduce wastage is to have air-conditioned warehouses where perishable produce can be kept. But there are many issues with that too. Power supply in rural areas is unreliable, with frequent outages. Also, it has been found that as much as 30% of the total expense of cold storage is energy costs.

As a result, India has abysmally low numbers of warehouses where food can be stored at a low temperature. In recent times, however, solar-powered cold storage has started making inroads in the countryside.

### **1.3.4. Necessity of Cold Storage**

The financial condition of the farmers does not permit to establish a cold storage having capacity of 5000 MT which is meant to store 50,000 quintals of the products in the cold storage which require crores of Rupees to establish it. The concept of cold room is to store vegetables, fruits and flowers for shorter duration for which a small and marginal farmer can store products for shorter period and sell it without deterioration of the product. Farmers will also get appropriate value of the product. It will reduce the distress sale. The farmers can establish cold rooms having 10 MT

capacity where the storing of surplus quantities may vary from 100 quintals . Since the investment of such cold room is low a farmer can easily establish a cold room to store his surplus products.

#### **1.3.5. Prototype**

The capacity utilization in cold storage for fruits and vegetables is generally about 70% which is due to short storage life of the produce and availability of produce for storage throughout the year. Generally cold storage operates for 300 days in a year. The cold storage space of the proposed project shall be primarily used for storing fruits and vegetables for short duration storage of around 1-4 weeks. Such cold storage facility would enable them to bargain for a better price of their produce at the bi-weekly /weekly wholesale markets. Foods and many other commodities can be preserved by storage at low temperature, which retards the activities of micro-organisms. Micro-organisms are the spoilage agents and consist of bacteria, yeasts and molds. Low temperature does not destroy those spoilage agents as does high temperature, but greatly reduces their activities, providing a practical way of preserving perishable foods in their natural state which otherwise is not possible through heating. The low temperature necessary for preservation depends on the storage time required, often referred to as short- or long-term storage and the type of product.

#### **1.3.6. Test**

An investigation into the refrigeration solutions for agriculture in India has been made using deductive reasoning based on evidence and case study to arrive at the best possible approach for holistic development of the cold chain .Heat driven refrigeration cycle were deemed most appropriate for the India scenario due to high solar insolation levels throughout the country.

Implementation of the prototype can be beneficial for the farmers as it will cover their daily losses of selling each day's harvest within a stipulated time to recover a profit out of it and moreover they can sell them at their own pace by judging the best price according to the market at the right time to maximise their profits.

## **1.4 METHODOLOGY**

In order to make a storage solution for this problem that we need to tackle, we need to consider various factors. Some of these factors are:-

- Storage capacity
- dimension and size of boxes.(the food will be stored in boxes which will be stacked on top of each other)
- dimensions of the storage facility
- type of crops stored, as the type of crop stored may have a huge impact of the space taken and the type of containers chosen.
- refrigeration capacity of the storage
- heat transfer
- type of refrigeration
- mode of electricity, power source
- power cost estimate
- energy consumption
- cost
- How long can the produce be stored?

So, keeping these points in mind, we come to the conclusion that we need to make a viable solution which is overall cost efficient and the storage can last long. Next we have to decide the best refrigeration method for such a storage system. Also heat insulation has to be kept in mind as in case of poor insulation, the heat may be transferred through the walls and that would not be desirable.

## **1.5 DIAGRAMMATIC REPRESENTATION**

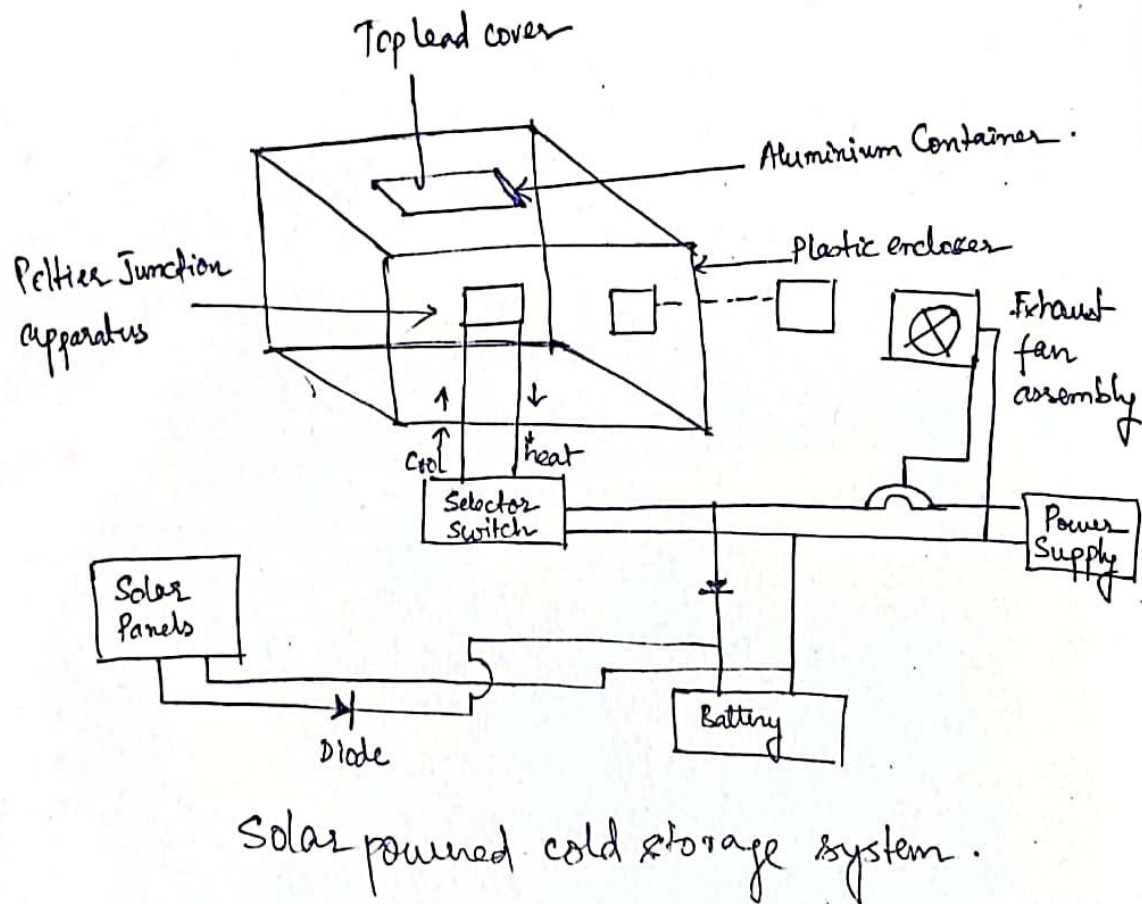


Fig. Schematic of solar cold storage system

## 1.6 PROPOSED SOLUTION

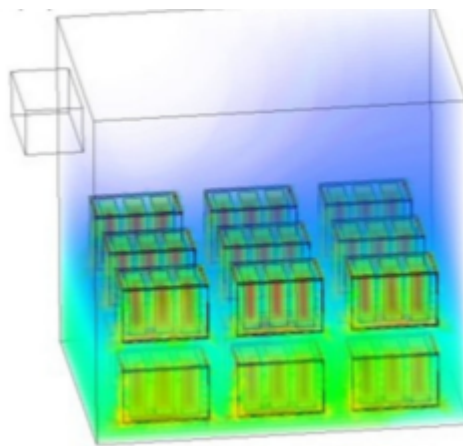
Our proposed cold storage solution will have the following features.

First, the storage system will be solar powered and work from solar panels placed on the roof of the system. During daytime, the cold storage system will be run using solar panels and The excess energy stored in the panels during the day will be stored in the form of Latent Heat Energy to be utilized in the night. This proves to be very efficient as the usage of solar energy will ensure that the cost of energy consumption is minimized and the fuel used is renewable

which in turn means that the farmer doesn't have to worry about power bills and that the source of energy will be ever-lasting.

Secondly, the type of refrigeration chosen will be Vapor-Compression Refrigeration System (VCRS). There are several types of refrigeration systems but VCRS is the chosen go to method because of its efficiency and reliability. Essentially, a vapor-compression refrigeration system is a system that uses liquid refrigerant in a closed system which circulates the refrigerant through four stages in which it is alternately compressed and expanded, changing it from liquid to vapor. As this change happens, heat is either absorbed or expelled by the system, resulting in a change in temperature of the surrounding air that is passing over the unit's components.

As most vegetables are not completely solid and they leave some voids when they occupy space in some containers when stacked. It is known from various observations that the voids take up around 30 % of the volume of the vegetables itself. Thus, the actual volume of vegetables has to be multiplied by a factor of 1.5 .Also we have to take into consideration the space to be left for proper air circulation. As per various experiments done with various capacities and from various established standards, the vacant space can be around 40-50 % of the total volume of the vegetables. Thus, the volume of vegetables needs to be multiplied by a factor of 2.25 to get the final volume of the cabinet.



*Figure: representing the main storage unit. Notice for the corps are stacketes in pellets on top of each other.*

Post-harvest loss is a serious issue to address the challenge of food security. A solar-grid hybrid cold storage system can be developed and designed for on-farm preservation of perishables. Computational Fluid Dynamic analysis can be performed to assess airflow and temperature distribution inside the cold chamber. The system will consist of a 21.84 m<sup>3</sup>

cubical cold storage unit with storage capacity of 2000 Kgs. A hybrid solar system comprising 4.5 kWp PV system, 5 kW hybrid inverter, and 600 Ah battery bank will be used to power the entire system. A vapor-compression refrigeration system will be employed coupled with three cooling pads (filled with brine solution) as thermal backup to store cooling (7 °C to 15 °C). Crops like tomatoes can be stored at 14 °C for a period of one month and the system can be tested on grid utility, solar, and hybrid modes. The average energy consumed by the system should be around 15 kWh.

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