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**Framework for Cold Chain Implementation - Vegetable Value Chain Study**

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# Framework for Cold Chain Implementation Vegetable Value Chain Study

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**Summary:** As India gears up for benchmark production of 377 Million tons of vegetables in year 2021, high wastage poses a substantial threat to Indian vegetable industry. Moreover, being an agriculture economy, farmers in India continue to live on meager resources for their livelihood. One of the reasons for this is the involvement of a lot of many middlemen in vegetable value chain. These middlemen govern prices in market and are key decision maker in whole trading activity with little profit for farmers. Farmers add maximum value to the produce, but their share in total profit is not at the par with value added. This is further complemented by high wastages, which further reduce the profit for farmers. This research aims to define control points for implementation of cold storages, which will not only reduce wastages, but also generate high profit share for farmers.



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## KEY INSIGHTS

1. Out of various channels, the channel with least number of middlemen will reap highest profit for farmers.
2. Two most feasible control points for Cold Storages:
  - Village/Block level: Investment by government or formation of cooperatives.
  - District level: Investment by 4-5 district level middlemen together.
3. Channel with least number of middlemen will have highest Return on Investment in Cold Storages.

## **Overview of Vegetable Industry in India**

India is second largest producer of fruits and vegetables in the world. With the current growth rate of 5-6% per annum, India is likely to cross the mark of 377 million tons of vegetable production by 2021. Growth in vegetable production can make India one of the major players in international market. However, low productivity, complemented by traditional harvesting techniques and poor post harvesting management leads to considerable loss. Wastages are as high as 40% of the total production. If India needs to grow as a major player in international market, government needs to take proactive steps and intervene to reduce the wastage and increase the productivity.

## **Vegetable Supply Chain**

Typical Vegetable Value chain in India starts from Upstream Supplier of seeds and fertilizers. These may be very small private players or cooperative societies. The inputs from upstream suppliers are first inputs into the value chain process. Farmers may buy these inputs on credit basis, and pay back the debts after sale of the produce.

Farmers pursue all the activities in the production process, which includes sowing of seeds, harvesting and cultivation. This may take from 6 weeks to as high as up to 12 weeks for some vegetables. All the methods employed by farmers in sowing, harvesting and cultivation are usually traditional. Farmer doesn't have financial capabilities to invest in modern tools and equipment. This results in low productivity level at farm level.

After harvesting, farmers consolidate the production and based on the type of vegetable being produced may make a one time delivery of whole produce, or may do it on a weekly basis. With the absence of Cold Storage facilities, farmers don't have

place to store the produce for a longer period of times and sell their produce as soon as it is cultivated. Farmer sells his produce to village level collector (MM0), to the block level mandi trader (MM1) or to the district level mandi trader (MM2). Various paths for these flows are shown in the diagram. Based on the demand and supply, coupled by the local market dynamics, these middlemen may sell or purchase the vegetables within themselves. For example MM0 may sell to MM1 and MM1 to MM2, or MM0 may directly sell to MM2.

After flowing to Commission Agents or middle men, produce is sold to Wholesalers (WS). At block level, MM1 sells the produce to WS1, who in turn have option to sell the produce to district level wholesalers through MM2 or may directly sell to block level retailer (WM). Various factors like transportation, market information etc. decides the distances that produce can be moved to by farmers, MM0 and MM1. If no constraints exist, farmers and Middle men may like to move their produce as downstream as possible if better prices are available.

Wet-markets (WM) may procure the produce from Wholesalers (WS1) of foreign market to serve local customers. MM2 deal with higher volumes by procuring the produce not only from local farmers & wholesalers (WS1) but also from neighbouring mandis via WS2'. Big retailers, hotels, restaurants and food processors may procure from WS2 or WS1 and sell these to final customers or consumers of processed or packaged food (PCo).

All these activities are mapped as value chain master map in diagram below.

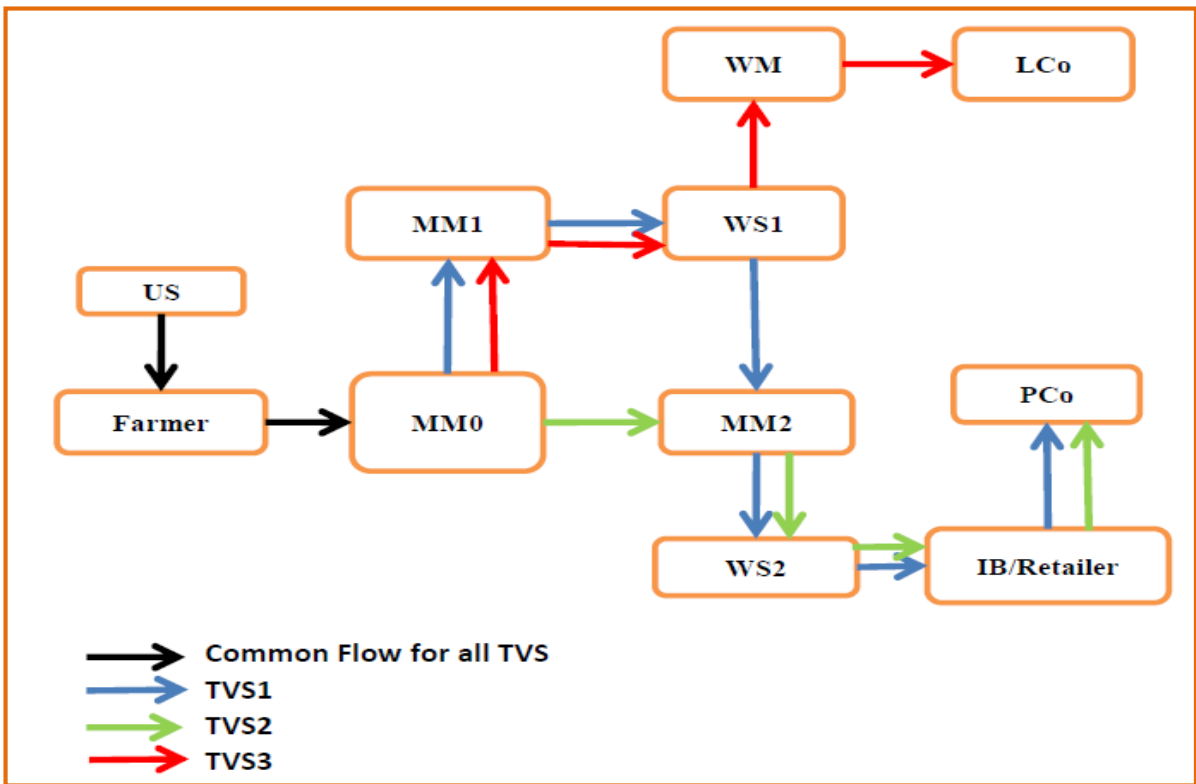


Figure 1: Vegetable Value Chain master map

### Value Added and Profit made by different Actors

Initial analysis shows that despite maximum value being added by farmer across the value chain, profit share of farmers is not at par. To follow further in our research to find reasons for this, more analysis is done for different identified channels along the value chain and profit to added value ratio was calculated for each and every actor of the value chain. Results of the analysis are as shown in graph below for Onion and its three channels, identified as TVS (Target Value Streams 1, 2 and 3).

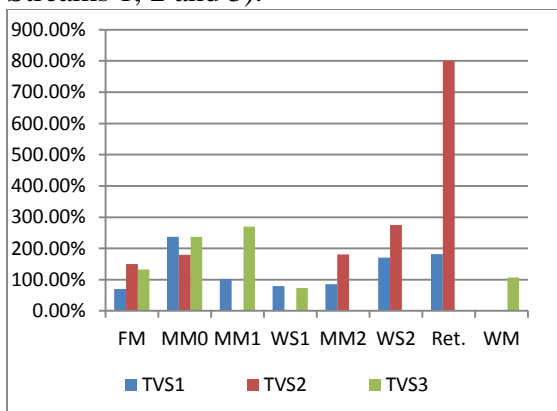


Figure 2: Profit to Added Value ratio for various actors

As can be seen from the graph, farmers are get maximum share of profit or highest profit to Added value ratio in case of TVS2 and TVS3, where farmers are most closely associated with consumers and with few middlemen, as compared to TVS1. Again, in TVS2, farmers are more closely linked to bigger players i.e. MM2 rather than with MM1 as is case in TVS3; this again justifies the higher Profit to Added Value ratio in TVS2 as compared to TVS3.

To proceed further in research, different Profit to Added Value Ratio was calculated to check the sensitivity of ratio to market price. All three Target Value streams were studied for different prices that prevail in market and Profit to Added Value ratio was plotted for every actor. Graphs are shown in next page for Onion.

One of the key insights developed after looking at these graphs is that distribution of profit along a value chain doesn't depend on the price in the market, but it is inherent character of the Value Chain structure or the channel of flow of the

produce and type and number of middlemen involved.

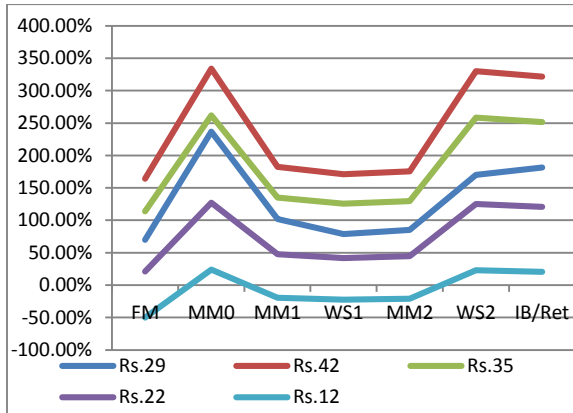


Figure 3: Profit to Added Value for TVS1 of Onion

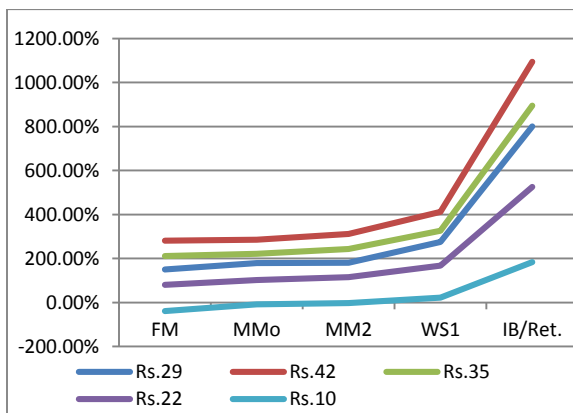


Figure 4: Profit to Added Value for TVS2 of Onion

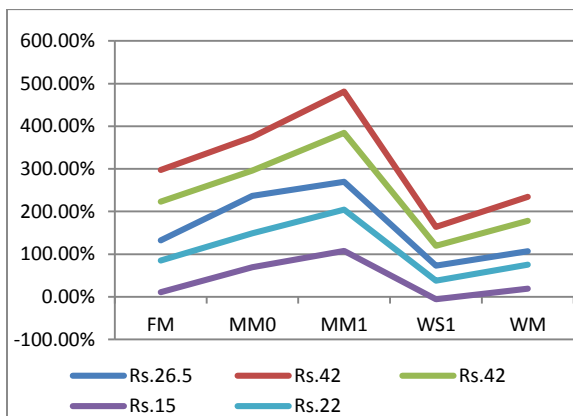


Figure 5: Profit to Added Value for TVS3 of Onion

**Intervention: Cold Storage**

Intervention in the form of cold chain is recommended, which may not only reduce the wastages, but also make business more profitable for actors in the supply chain.

**Initial analysis of Cold Storage intervention**

In this part, reduction in wastage cost or increase in profit in such a scenario is compared with no cold storage scenario. Following are some of the assumptions made:

- Reduction of wastage by 50%. We assume that only 60% of the total wastage is in storage, and remaining 40% in transportation. So, after we implement the Cold storage, we assume storage waste to be reduced by 80%, which corresponds to 50% wastage reduction in total.
- There will be ongoing cost of operation which will be an additional factor of production for the actors in supply chain.

Diagram below shows the ‘Profit to Value added’ ratio with cold storage at each stage for all TVS1 as compared to ‘Profit to Value Added Ratio’ without cold storage, for Onion.

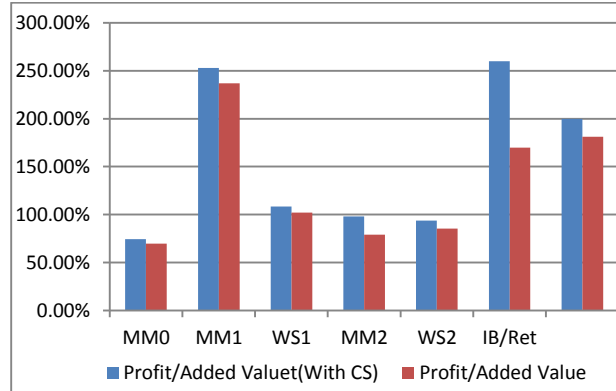


Figure 6: Profit to Added Value Before and After Cost Storage for TVS1 of Onion

Results from initial analysis doesn’t show much difference in profit to value added ratio for value chain actors with the implementation of cold storage. However, building on the overall analysis and objective of the research, following two points are identified for cold storage:

1. Village level
2. District level Middlemen

## Analysis of Investment

To justify the investment on cold storage, investment decision was analyzed. Initial part involved calculation of savings at identified control points through implementation of Cold storage. Below are the results.

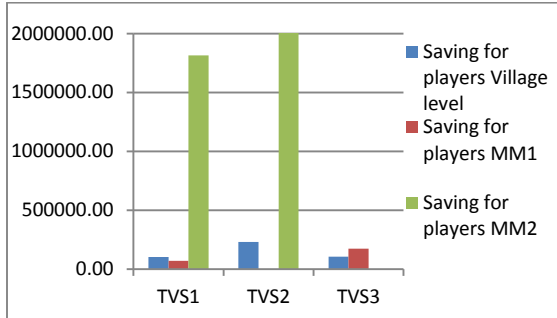


Figure 7: Annual Savings through Cold Storage

In this part payback period was assumed at different points and cluster size was calculated to achieve the return within desired payback period. Payback period at village level was assumed to be 10 years, whereas for private middlemen it was assumed to be 5 years. Diagram below shows the cluster size required in different TVS.

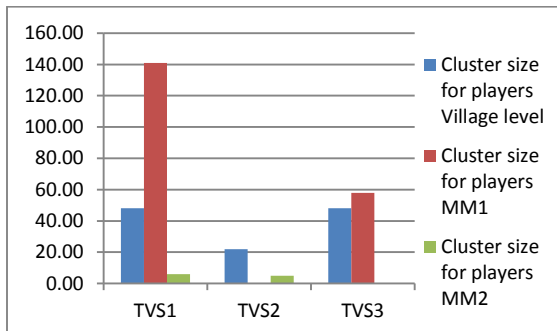


Figure 8: Required Cluster size

## Results of the Analysis

To develop the final results of analysis, savings for farmers through cold chain was plotted for all three TVS under study, as shown in the graph below.

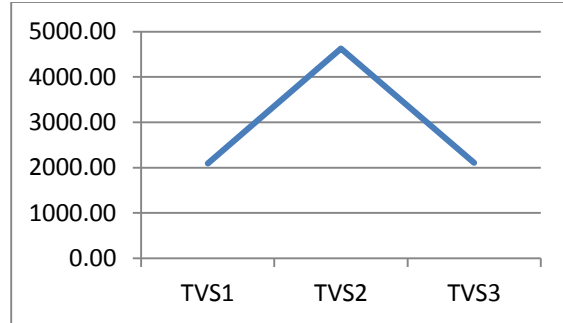


Figure 9: Saving for farmers through Cold Storage

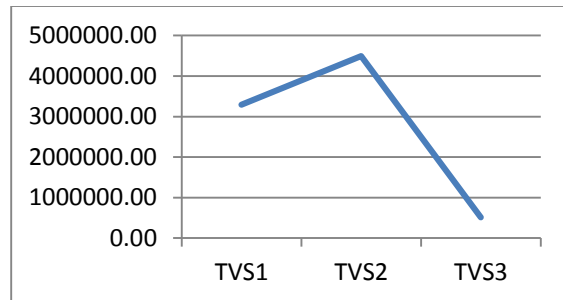


Figure 10: Overall saving across the Value chain

Above analysis shows that farmers will be benefit most if the cold storage is implemented and farmers follow TVS2 to conduct the business transactions. It further indicates that TVS2 is the one which gets most benefited by the implementation of the cold storage.

## Key Take away

1. Ratio of Profit to Added cost is fair, when the number of players between farmers and end consumer is minimal.
2. Further, profit is higher for farmers, when farmers are closer to big players.
3. Saving from cold chain for farmers, as well as across the chain is higher if the volume handled is large, even if the number of intermediaries is same.
4. Control point for cold storage is justified at the point where there is maximum transaction.