UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
DEHRADUN
DISSERTATION REPORT
ON
"A study of supply chain of fruit and vegetables using multi modal transport"

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT OF THE DEGREE OF
MBA (Logistics and supply chain management)
2013-2015

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CERTIFICATE OF ORIGINALITY

This is for the present I declare, with the intention of this report is very original in all senses of the terms and conditions and has a sense of honor and beliefs and shortcuts have not been taken and I remained both meticulous and careful during the prevalence of this research work. I have started on my possible point to keep this so informative and accurate work possible.

It can also be said here that during the preparation of this report a little help is taken from a field of information and knowledge professionally, shared a full description of what has been mentioned in the chapter of this report references.

Dated:

Signature:

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MBA – Logistics and supply chain management (2013-2015)

University of Petroleum & Energy Studies

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BONAFIDE

This is to certify that the project entitled "**A study of the supply chain for fruits and vegetables using multimodal transport"**, presented to the University of petroleum and energy studies, Dehradun, by Vishnu Prasad M, in the partial execution of the master of business administration (logistics and supply chain management), is a work of good faith made by it under my supervision. This work in particular there has been done nowhere else for any other grade. To the best of my knowledge, he has made a serious effort and outside input for this project.

I wish you all the best for your future projects.

Mr. Shubhendu vimal
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Vishnu Prasad M

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I. INTRODUCTION

India is the second largest producer of fruits and vegetables in the world, representing 18% of the exports of the India. Agriculture is a major contributor to the GDP of India, which generates 64% of employment in the country. While our country is the second largest producer of fruits and vegetables in the world, and the second largest exporter of vehicles in the world, participation in world trade in the India is only 1%. The main reason behind this is that inner most production is consumed in our country.

Indian food supply chain leads to wastage and massive inefficiency with a 30-40% of fruit and vegetables in vain. Waste happen along the chain of supply from post-harvest to selling products. A considerable amount of waste also occurs during the transport of fresh products, mainly due to improper packaging, vehicles of low quality, the lack of regard during transportation and storage. There are mainly two types of supply chain in the Indian markets of F & V. One of them is the traditional supply which is still widely followed by over-the-counter retailers. The second is modern or organized supply chain with participation of modern retailers.

1. FRUITS AND VEGETABLES- PRODUCTION SCENARIO

Sr. No.	Fruits/ Vegetables	Production (000 MT)		India's Share	India's Rank
		India	World		
	Fruits				
1	Mango	10000	19215	52.0	1
2	Banana	15073	55787	27.0	1
3	Apple	1200	53672	2.2	10
4	Pineapple	820	11757	7.0	5
5	Papaya	490	5867	8.4	4
6	Orange	2000	59558	3.4	6
7	Grapes	1083	5004	21.6	8
8	Lime	1700	9104	18.7	1

Figure 1 fruits production scenario

Sr. No.	Fruits/ Vegetables	Production (000 MT)		India's Share	India's Rank
		India	World		
	Vegetables				
1	Tomato	4800	84873	5.7	6
2	Onion	4058	36544	11.1	2
3	Brinjal	8026	11981	67.0	1
4	Potato	17942	294834	6.1	6
5	Green Peas	270	5214	5.2	5
6	Cabbage	3300	46656	7.1	3
7	Cauliflower	4800	12725	37.7	1
8	Garlic	350	10401	3.4	3

Figure 2 vegetable production scenario

2. TRADITIONAL SUPPLY CHAIN OF F&V

In the India trade most passes through the traditional route. Farmers who grow, sell their products to a person or collection agency that collects the fresh produce of all the adjacent areas and sells it to a dealer who is in charge of transport and sale to the market to put sellers at the wholesale. These wholesalers then supply the materials to local vendors and other retailers from where the customer purchases the product.

The main problem with the string type is the involvement of people like agent and dealer. Due to their intervention, the farmer receives only 30% of what the customer pays. While in countries such as U.S, the farmer gets 70% of what a customer pays.

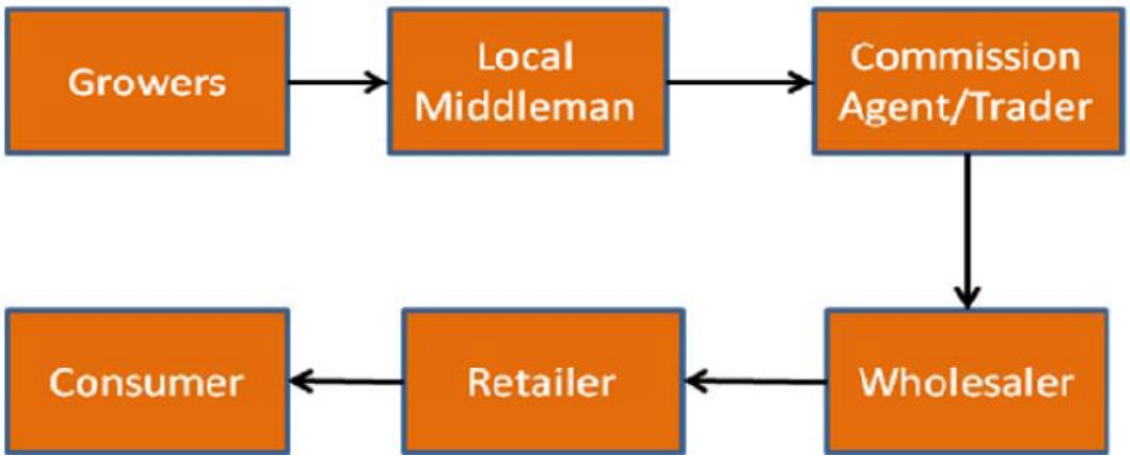

Figure 3traditional supply chain of F&V

3. MODERN SUPPLY CHAIN

Trade retail is one of the world's fastest growing sectors. "Trade at the retail in India is estimated to grow at 13% annually from $322 million in 2006-07 to $590 billion in 2011-12." Although it is expected to grow around 10% a year, self-service sector organized distribution is estimated to grow by 45-50% per year during the same period "(ICRIER, 2008)." However, the organized distribution is only around 4% of the total sales to the retail in India, compared with 75 to 80% in developed countries like United States, Japan and United Kingdom.

The retail market in the India is dominated mainly by the unorganized retail. Non-organized retailers are not a homogenous group. In general, these retailers operate on a small scale. Recent developments in the trade retail is the entry of a large number of organized retailers. There are arguments for and against what allows foreign direct investment in the trade retailer in the India. In this scenario, the country will witness the rapid evolution of retailing. Middle class population in India is high & is growing rapidly with an increase in the number of young couples that work. The consumption of fast foods, packaged foods and those ready to make that food is increasing rapidly. Change in the tastes and habits of consumption of basic foodstuffs, more hours of work, the increase in dual-income families, the increase in exposure to advertising, etc., are leading to a dramatic shift in agricultural supply chains. Increasingly more career minded working couples looking for comfort and convenience and health and hygiene are becoming increasingly more conscious. Rather than the conventional wet markets, people prefer to buy vegetables, fruit and other agricultural products from supermarkets and shops of modern retailers, and this leads to the entry of more and more enterprises in the agro-based business market. The trend that more and more supermarkets are selling fresh produce is determined by changes in consumer demand. Markets with poor environment and poor quality assurance cannot meet the demands of consumers who pursue high quality life. They want to buy desirable food in a comfortable setting.

Fruit and vegetables currently represent the 3-4% of total sales of supermarkets for the group, which plans to close the fiscal year in June with sales to the retail of 9.2 billion rupees. Trade organized retail relies heavily on APMC 'mandis' and agents to source most of its stock of fruits and vegetables. Among the large, Reliance Retail seeks to farmers in the majority - around 50% of your daily need of 700 tones.

A team headed by S Radhakrishnan, a veteran of the trade with alomost15 years of experience, responsible for the new company and owns major share in it. Mr. Radhakrishnan helped establish the world for Spencer Retail RPG Group food chain and was head of format value of Reliance Retail business until the beginning of this year. Future group now outsources marketing of fruits and vegetables to vendors, who are authorized to use the space in its stores in Exchange for a portion of their income.

The main segments in trade retailer of the India are foods (77%), clothing (7%), durable consumer goods (4%) and books and music (1%). However, the penetration of the organized distribution shows different trends with current actions of these segments in the organized sectors like food - (20%), clothing (28%), durable goods (10%), and books and music (4%). The main foreign players also are biding their time and testing the waters through joint ventures, Cash and Carry operations research and catering formats market.

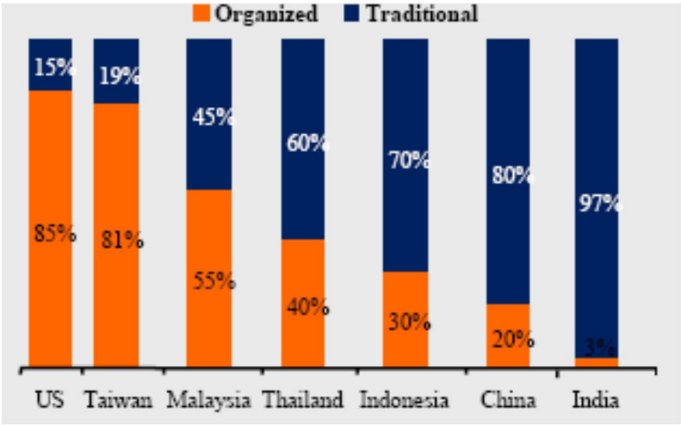

Figure 4 organized vs traditional supply chain

4. SUPPLY CHAIN MANAGEMENT IN F&V MARKETTING

A supply chain is a business union linked together. It is one of the inevitable marketing functions. SCM can be defined as "a holistic approach to address the planning and control of the flow of materials from suppliers to end users. In the current scenario, farmers are not getting the right price for your products in the market. Even most of the price charged to consumers also go to intermediaries. Provided that it is not true that the intermediaries are eating up all the benefit. It is often the inefficiency. Supply chain costing intermediaries, consumers and with more

closely to farmers. SCM is a modern approach to improve competitiveness through the coordination of the different partners. To promote coordination among the different groups of interest, SCM allows each of them to develop beyond what would have been possible if they were in their own individual actors. Supply chain connects players that can cut down costs, improve service to the client, the development of the organizational knowledge, increase performance in the Organization and create barriers to the entrance of the organizations that compete. As a result of continuous trends of expanding the range of products, increase in outsourcing, and continuous advances in information technology, SC management is indeed a complex and challenging task. A large number of possible combinations of relationship exists between the members of the chain that can be analyzed in terms of the way in which they couple or develop partnerships with others. SC helps provide quality products to consumers. In order to satisfy consumers in front of quality, all the actors of the supply chain have to understand the relationship between customer satisfaction and quality parameters that customers are interested in.

In SC, in general, the information flow is opposite to the direction of the flow of material. In order to make SC more competent, it is necessary to make the bi-directional information flow more effective. The generation of demand or an activity at one end flows by the SC until you reach the root from where begins the basic flow of goods. This flow of information enables all intermediary nodes that pass through a way through the chain. The nature of the relationship between supplier & customer can be described by various attributes, such as the level of teamwork, the type of information shared between the players in the chain, the horizon of the relationship, the formality of teamwork and the degree of flexibility. The level of backward integration is the degree to which the companies own the supply chain from raw materials to delivery. Supply chain practices today are indeed active and cooperative that requires foresight and joint planning, exchange of information, joint administration of inventory and joint control to eliminate waste in all sectors of the chain and improve customer service in order to gain a competitive edge. An efficient supply chain promotes the satisfaction of the consumer, the profitability of the sector and facilitates reasonable profitability for farmers. The supply chain involves much more than just the movement of goods along the chain. The main focus of supply chain management is to integrate all activities along the chain

5. DRAWBACKS IN THE CURRENT SUPPLY CHAIN

Currently traditional retailers are linked to farmers through wholesalers or brokers. Sometimes there are more than one broker and wholesaler for the same product to take it to the retailer. The Commission agents and wholesalers of redundant supply chain practices makes it disorganized and more inefficient. The fruit and vegetable sector in the India faces several obstacles. The main limitations in the production and marketing of fresh fruits and vegetables are the non-availability of seed quality, insufficient irrigation facilities, inadequacy in pest management, limited credit availability and the high cost of production, the lack of timely information, huge losses after the harvest, poor quality roads, cold storage, inadequate space, lack of market network and the high cost of transport. Cold chain infrastructure require an investment of about 180 billion rupees to Rs. 200 billion rupees in the next five years investment. A study estimated that the strengthening of the supply chain, the benefits for consumers and producers can increase by 20-25% in the more perishable as tomatoes. Due to the inefficient supply chain, the price received by farmers is only around 24-58% of the sales price paid by the consumer. Technology and postharvest management not only helps to reduce the level of waste, but also makes it easy to add value to the quality of the product and also facilitates stakeholders to obtain better yields.

Difference in prices between the farm and the sale to the retail in the India is highest in the world. The improvement of the methods of handling and resolution of regulatory requirements allow access to more distant domestic markets. Fresh produce post-harvest technology gained enormous momentum to save losses during harvesting, treatment, storage and transport. The magnitude of the loss of fruits and vegetables is around 1000-12000 crore Indian rupees, and the loss of the amount ranges between 10-80% in some fruits and vegetables that are more perishable. 30% of the India's fresh produce of fruits and vegetables will go as waste due to lack of storage chains.

Several initiatives for research and considerable investments have resulted in the growth of the supply and trade in fruits and vegetables cold storage during the last decade, but much remains to be done. The increase in venture, technology and administration resources are essential to minimize post-harvest losses, increases the productivity of farmers and to ensure better income for farmers. This also makes it easier to increase the per capita consumption of fruits and vegetables in the country. Horticulture sector of India has great potential, since it has a large

domestic market, the fertile soil, varied geographic conditions and farmers who depend on horticulture. This can be used as a leverage to obtain a leading position in the global market. In the traditional system of marketing to the wholesale, the brokers and traders dominate the supply chain and are the main deciders of price, and most of the time, farmers have to rely on them for credit. Small farmers do not have the power of marketing and they have a low share in the final price to the consumer. Traditional wholesalers do not have the vision to make the integrated supply chain. The wholesale markets are poorly designed with insufficient infrastructure for packaging, classification, selection and cold storage. Supply chain management needs vision of appropriate business and to build a long-term partnership between farmers and retailers. Supply chain provides services of transport, packaging, selection, classification, cold storage and post-harvest technology. There is a strong need for interaction of the Government on the removal of the limitations of infrastructure such as the creation of distribution centers, cold chains, the roads to markets, guaranteeing the quality and quantity of the products to the stores is another prerequisite for the proper functioning of the supply chain.

Fruits and vegetables supply chain has traditionally been fragmented. Structural changes are required to maintain and build the supply chain infrastructure. For example, traditional retailers do not have scale of operation to build its own supply chain. It is necessary to integrate them with all emerging modern day retailers, when it comes to supply chain. Business process reengineering can be a response to many of these problems. In order to make effective supply chain, it is necessary to segment the different customers. Catering, hostels, small town retailers, traditional retailers, organized retail and fruits & vegetables processors cannot be considered as a segment of buyers. To make more effective SC, is necessary to have a different approach to all these actors.

The demand for F & V planning is difficult and challenging. Farmers, wholesalers, food manufacturers and retailers are not working with the philosophy of the integration. Sourcing has been strategic across industries. The cost of hiring, transportation costs, the regularity of supply, the quality of the products, the practical ethics of the producers, the terms and conditions of payment and road connectivity, are important factors influencing the strategic sourcing, which is crucial to the success of the supply chain of fruits and vegetables in the long run. New reference point must be established from time to time for which the supply chain to improve its performance. The biggest challenge for any F & V supply chain to work better is to make

interested parties to perform their function. The responsibility of each actor change with the change of scale of operation, and, sometimes, the interested party perceives that their roles are in conflict.

The B2B relationship between different players makes cost-sharing and collaborating a difficult task. Who has to share that cost is a sticking point in the integration of the supply chain. Who has to share the cost of construction and maintenance of roads? Who has to pay for the cold storage and how much? Who should bear the cost of processing and analysis of information that is useful for farmers and consumers? Incompatible organizational cultures makes it difficult for the different parties concerned to agree to a sized solution. According to the study the major drawbacks of the current supply chain are the number of intermediaries, high-level waste, degradation of quality, poor infrastructure and high cost facilities.

II. LITERATURE REVIEW

Sharma (2006) emphasized the improvement of the availability of fruits and vegetables quality to markets and processing units. Strategies to adopt in the production levels of harvesting and post-harvesting appropriate for the India scenario suggested in the study. Mechanical injury, infestation and poor handling of fruits and vegetables reduce the market price drastically as the quality of the product also degraded. Therefore, it is imperative to develop and follow certain strategies to minimize the damage to fruits and vegetables for the supply to the markets and processing units. Horticulture products need special attention for two reasons i.e. sunlight protection and hygiene in the compound and the need of markets terminals is very necessary. Suryavanshi (2006) carried out a study to identify marketing channels, to estimate the costs of marketing, marketing margin and price elasticity. The study revealed that 80% of the tomato was sold through channels (producer- commission agent cum wholesaler-retailer-consumer). The incurred cost of marketing was the highest (Rs. 187.45) in the channel-I, where was the lowest (Rs. 55.40) on the channel (producers and consumers). And retailers enjoyed higher net margin in comparison with a wholesale cum broker. Marketing efficiency was observed to be highest (9.70%) on the channel (producers and consumers) to achieve maximum benefit and reduce the brokering Commission, when the product is in small amount and if the product is found in large number of channel-II should be selected to safeguard the interests of the producers.

Gilbert (2007) examines the potential contribution of the Global Value Chain (GVC) analysis in the commodity sector and resolves the apparent paradox that the prices to the retail coffee and chocolate have decreased at most modestly in the last three decades, while the production costs of coffee and cocoa have fallen most radically. Both industries are highly concentrated in the stages of processing. However, the development of markets for production and sale to the retail are largely obvious and there is no evidence of falls in the shares of producers as a result of the exercise of monopoly power.

Chains and agro-food networks play an important role in the provision of market access for producers in countries in development, as well as local, regional markets and export. Changes in agro-food systems affect the agro-industrial company's ability to compete; small and large alike, they will have to innovate, reduce costs and be more responsive to the needs of the consumer.

This is where the supply chain management (SCM) can help. SCM is the integrated planning, implementation, coordination and control of all the business processes and activities needed to produce and deliver the most efficiently possible products that meet the needs of the market (Jack et al., 2007).

SCM has grown in importance since the beginning of 1990, although the approach, or rather the concept was introduced in the 1980's (Oliver and Webber, 1982) and has become a very important topic in business research modern. A supply chain is a system whose constituent parts include material suppliers, production facilities, distribution services and connected clients by feed forward flow of materials and feed-back information and financial capital (Stevens, 1989). SCM deals with links in the chain from primary producer to final consumer. It is breaking down the barriers between each of the units in order to achieve higher service levels and a substantial saving in costs (Kearney, 1994). The importance of a dedicated SCM, although very well practiced in the manufacturing sector is becoming more visible than ever on food and fresh produce industry

At the beginning of 1990, the academic first describe SCM from a theoretical perspective in order to clarify what differed from traditional approaches in the management of the material flow and the flow of the associated information (Christopher, 1998). Today, the management and coordination of the supply chain of fresh products have become increasingly important since companies need to minimize the costs of distribution and inventory and maximizing market opportunities resulting from fundamental changes in consumer tastes and preferences. There is an apparent development of competition among supply chains instead of products or companies in the sector of commodities (Boehje, 2000). It is believed that this competition to be conducted by the rules of rigid food security, productivity, efficiency, transparency and the brand that come along with the essential supply chain communication. Mentzer et to the. (2001) classified SCM into three categories, namely, a philosophy of management, the implementation of a management philosophy and a set of management processes.

III. OBJECTIVES OF THE STUDY

1. OBJECTIVES

- ✓ To identify need for more number of efficient cold storage hubs for F & V
- ✓ Identifying methods to increase the profit margin for the farmers
- ✓ Identifying the areas of losses in the entire supply chain of F & V

2. NEED OF THE STUDY

- ✓ The F & V supply chain in India is suffering from great deal of losses mainly in the following areas:
  - ❖ During postharvest
  - ❖ During transit
  - ❖ During sales
- ✓ Low profit margin to farmers:

  In India farmers receive only 30% of what a customer pays, where as in U.S farmers receive 70% of what customer pays.

3. LIMITATIONS OF THE STUDY

While conducting the study the main problem was in collecting the facts and figures that are updated. Also no prior research has been done in the area of increasing the profit margin to farmers.

IV. RESEARCH METHODOLOGY

1. TYPE OF RESEARCH DESIGN

Type of research is secondary research which mainly considers the secondary data supported by primary data collected by market place visits. The research analyses the various losses happening n the supply chain of F&V and suggests an integrated approach to control the existing losses.

2. DATA COLLECTION METHODS

Data is collected by market place visits, physical observation and from corporate media.

3. TOOLS FOR DATA ANALYSIS

- Root cause analysis

RCA-root cause analysis is a popular technique and often used to help people answer the question of why the problem occurred in the first place. This is to identify the source of a problem with a specific set of steps, with associated tools, to find the cause of the problem, so that you can:

- ✓ Determine what happened.
- ✓ To determine why it happened.
- ✓ Find out what to do in order to reduce the likelihood of that happening again.

RCA assumes that systems and events are interrelated. Action in an area triggers an action in another, and another, and so on. To trace back these actions, you can discover where the problem started and how it became the symptom that you are now front. In general, there are three basic types of causes:

- ✓ Physical causes-, the tangible materials failed in some way (for example, a car brakes stopped working).
- ✓ Human Causes - The people did something wrong, or they stopped doing something that was needed. Human causes often lead to physical causes (e.g., no one filled with brake fluid, which led to the brakes fail).

- ✓ Organizational causes - a system, process, or policy that people use to make decisions or do their work is faulty (for example, no one was responsible for maintenance of vehicles, and everyone assumes that someone had filled the brake fluid).

RCA looks at three types of causes. It is the patterns of effects research, finding hidden defects in the system, and the discovery of specific actions that have contributed to the problem. Often, this means that RCA reveals more than one cause root.

- ❖ 5 S

5s is a system to reduce waste and optimize productivity through maintenance of an orderly workplace and using visual cues to achieve more consistent operating results. Refers to five steps sort, set in order, shine, standardize and sustain – which is also referred to at times as the 5 pillars of the visual workplace. 5S programs often carry out with small teams that work together to obtain materials closer to operations, just within the reach of workers, organized and labeled to facilitate operations with the least amount of wastage of time and materials. 5S is a good point of departure for all improvement efforts aiming to expel waste from the manufacturing process, and ultimately, improve the profitability of a company by improving the products and services, and reduce costs. Many companies are trying to make operations more efficient, and the concept is especially attractive to older manufacturing facilities that seek to improve their bottom line, reducing their costs.

"A place for everything and everything in its place" is the mantra of the 5S method and systems of storage and workspace that allows you to improve the organization's optimization of the cubic space for higher density storage. The result is an improved manufacturing process and the total cost of produced goods becomes lower.

The 5 pillars of the visual workplace:

Implementing the 5S method means. Clean up and organize work into your existing arrangement. It is usually the first lean method that organizations implement. This lean method

encourages workers to improve their working conditions and helps them learn how to reduce waste, to manage the time and inventory management process.

A typical deployment of 5S would result in significant reductions in the square meters of space for existing operations. It would also place the firm's tools and materials in the place of storage, color-coded and labeled, as well as "kits" containing only what is needed to perform an operation. The 5S methodology is a simple and universal approach that works in companies around the world. Other initiatives like improvement of manufacturing as just-in-time (JIT) production, cellular manufacturing, total quality management (TQM), or six sigma is essentially a support to those and is also an important factor to make that work a better place to spend time.

The 5 main pillars are:

SORT:

- ✓ Eliminate all the elements which are not needed for current operations.
- ✓ Leaves only what is essential: If in doubt, throw it out.

Importance:

- ✓ Space, time, money, energy and other resources can be managed and used more effectively.
- ✓ Reduce problems and discomfort in the workflow.
- ✓ Improving communication among workers.
- ✓ Increases the quality of the product.
- ✓ Improving productivity.

Issues resolved:

- ✓ Factory becomes increasingly tight and difficult to work.
- ✓ Storage of unnecessary items enter the path of communication.
- ✓ The time wasted in search of parts / tools.

- ✓ Unnecessary inventory and machinery are costly to maintain.
- ✓ Surplus production problems.
- ✓ Unwanted items and equipment make it harder to improve the flow of the process

SORT IN ORDER

- ✓ Arrange items so they are easy to use.
- ✓ Product label so thatanyone can find them or put in the trash.

Importance:

It eliminates many kinds of waste, including:

- ✓ Looking for waste.
- ✓ Waste due to the difficulty in using elements.
- ✓ Waste due to the difficulty in the return of articles

Issues resolved:

- ✓ Unnecessary motion.
- ✓ Looking for waste.
- ✓ A waste of human energy.
- ✓ Loss of excess inventory.
- ✓ Waste of defective products.
- ✓ Unsafe residues.

SHINE:

- ✓ Keep everything daily neat and clean.

Importance:

- ✓ Turn the workplace in a clean and bright place where everyone will enjoy working.
- ✓ Keep things in great condition so that it is ready to be used when it is necessary

Issues resolved:

- ✓ Lack of sunlight can lead to low morale and inefficient work.
- ✓ Defects are less obvious.
- ✓ Puddles of oil and water cause slips and injury.
- ✓ Machines which do not receive sufficient maintenance tend to shatter and cause defects.

STANDARDIZE

- ✓ Integrates sorting, set in order and shine as a whole

Importance:

- ✓ By ensuring that the conditions do not deteriorate to its previous state, facilitates the application of the first three pillars.

Issues resolved:

- ✓ Conditions return to undesirable levels of age.
- ✓ Work areas are dirty and messy.
- ✓ Tool storage sites are disorganized and the loss of time in search of tools.
- ✓ The disorder begins to accumulate over time.
- ✓ Kickback occurs.

SUSTAIN:

- ✓ Making a habit of suitably maintaining the correct procedures.
- ✓ Instilling the discipline needed to prevent repetition

Importance:

- ✓ The consequences of not maintaining the line of action is greater than the consequences of keeping the same.

Issues resolved:

- ✓ Unnecessary articles begin to accumulate.
- ✓ Tools and templates not returned to their designated places.
- ✓ No matter how dirty the area becomes, nothing is done to clean it.
- ✓ Products are left in an orientation that is dangerous.
- ✓ Dark, dirty, unorganized work place will lower commitment.

Benefits for the company by the use of the 5S methodology include the increase of the quality, reduce costs, promote safety, building customer confidence, increasing the work place efficiency, and reduces patch-up costs.

The 5S methodology is typically executed by a 3-step process, which includes the formation of a cross functional team (including employees working in associated areas), covering all the areas associated with manufacturing processes which is examined, and brainstorm on how to improve the organization to reduce waste. For example, plants have more than their part of the search for waste. It is not unusual for a routine three-hour shift to include 30 minutes of search. When it comes to reducing the time for radical change (for example, to spend 3 hours and 10 minutes), clearly there is no environment for 30 minutes in search of waste.

(VSM) value chain mapping can be used in the 5S process to analyze the inventory, process, and information flow. The information is used to develop a map of the current state, where it is exposed to how things have been done in the past. Subsequently, the team analyzes the current state map to identify opportunities for improvements in the organization and cleaning of the workplace. A wide range of ideas is considered - while all the ideas is not going to end being viable, all are worthy of research. The key is to observe the non value-added processes and create an environment to promote the work of value added through the elimination of waste.

Finally, the team with the vision of future, based on exercise will starts the execution of the future state. The process is iterative; the future state becomes the current state, and a continuous

improvement process must be used to identify new ways to reduce waste. Waste is defined very broadly, and include things like waste in the movement of material, carrying too much inventory, defects or rework, the production of waste, waiting or unnecessary movement. Some examples include waste of movement, since the person sent to obtain a part or tool could not find it; Search waste, because nobody can find the key to the closed cabinet which contains the necessary tools; the waste of defective products, because defective parts were not properly separated and they were used by mistake; and even the waste caused by unsafe conditions, such as boxes of supplies that have been on a runway, causing someone tripped over and cause injury.

V. ANALYSIS AND FINDINGS

1. ANALYSIS OF LOSSES OCCURING IN THE SUPPLY CHAIN OF F&V

In order to identify the main reasons for the losses in the F & V supply chain, we use root cause analysis. The Fishbone diagram below gives a glimpse at the major reasons behind the losses in the F & v supply chain

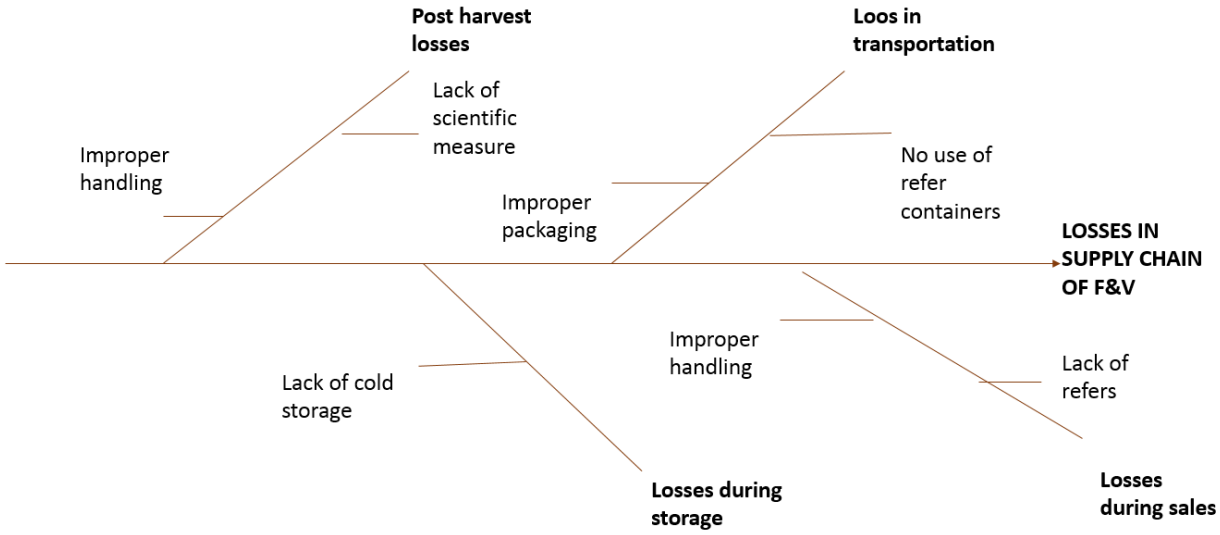

Figure 5 fish bone diagram

Losses that occur in the F & V supply chain can be categorized into 4 main stages:

POST HARVEST LOSSES:

Many factors contribute to the fruits and vegetables post-harvest losses. These include conditions such as heat or drought, mechanical damage during harvest and handling, by improper methods post-harvest sanitation and poor cooling and external factors. Efforts to control these factors are often very successful in reducing the incidence of the disease. For example, the reduction of

physical damage during grading and packaging greatly decreases the chance of post-harvest disease, since many diseases causing micro-organisms must enter through wounds. Chemical products have been widely used to reduce the cases of post-harvest disease. Although it is effective, many of these materials have been withdrawn from the market in recent years because of ecological, health or fiscal concerns. Greater interest in the proper handling of postharvest of fresh fruit and vegetables has promoted the widespread use of rain gutters, water receiving tanks, washing machines and spray, hydro coolers. To save water and energy, most of the processes of post-harvest wet in produce it to recirculate the water once it's been on the product. This recirculated water collects dirt, garbage, and disease-causing organisms. If measures are not taken to prevent its spread, these organisms can infect all product which is processed subsequently. In the past, have used various fungicides and bactericides (alone or in combination with chlorination) to prevent the transmission of diseases. These materials have often been favored on chlorination, since they provide some residual protection after treatment. Currently, chlorination is one of the few options available chemicals are used to help control of postharvest diseases. When used together with other appropriate post-harvest handling practices, chlorination is effective and relatively inexpensive. There is a very little threat to the health or the surroundings.

LOSSES DURING TRANSPORT

Trucks used for the transport of fresh fruits and vegetables: fresh products now moved in road vehicles, with amounts less maritime, air or inland routes. The most commonly used vehicles are the open pickups or larger trucks, either open or closed. Losses may occur due to the following reasons:

- ✓ closed non-refrigerated vehicles
- ✓ open face or half boarded trucks
- ✓ damaged interior of vehicle
- ✓ bad ventilation in the vehicle

LOSSES DURING STORAGE

The main reason behind the losses during storage is the lack of refrigerated storage facilities in the country. India has a cold chain that is highly stable for dairy products, but we are not going to find a cold chain stable for fruits and vegetables.

The answers given by experts is that for F & V cold storage centers are difficult to handle and there is no gain. The only cold storage hub which handles large quantity of vegetables operates in Agra, but the situation is the same over there too. Around 5% of the vegetables get lost there too due to improper handling in the cold rooms

LOSSES DURING SALES

In India majority of sale of F&V happens through local retailers, who are still following the traditional supply chain. Each member of the chain has no idea about the importance of refrigeration, mainly the fact is not considered because it adds a lot of cost to them. Also majority of retailers don't have the facility to run a refrigerated sore since their sales happen alongside road.

The fresh produce which is unsold gets wasted in 3-4 days only due to lack of refrigeration. With high degree of temperature and humidity the fresh produce also gets damaged quiet quickly.

2. METHHODS TO CONTROL LOSSES

Post-harvest handling:

Fruits and vegetables that are fresh and taste good bring repeat sales and can bring higher prices. Products handling directly affects freshness and, with some products, peak flavor is preserved as well.

For most produce, maintain cool temperatures (to curb the deterioration) and high humidity (to prevent moisture loss) are the most effective means to preserve the quality. However, there are several things producers, handlers, and retailers can do to ensure that fruits and vegetables that are going to market or in storage are of high quality.

Collection and handling:

- ✓ Provide soft collection and shipping to avoid cuts, abrasions and bruising damage that allow microorganisms causing caries coming into the tissue.
- ✓ Harvest produce at the peak of quality. This ensures greater value at the time of the goods begins a period of sales or storage for subsequent sale period. Since most produced they begin to deteriorate at the time of the harvest, higher quality product will have the longest conservation.
- ✓ If possible, harvested during the freshest of the day. Since the temperature controls the speed at which produce impaired, harvest when the product is fresh (usually only after the departure of the Sun) will extend its quality.
- ✓ If storage facilities are not available, harvest only the amount of produce at a time as it can be packaged or sold before the quality deteriorates. This also allows to screens in the markets of road to be spare products freshly harvested throughout the day, which ensures the highest quality available for customers.
- ✓ Make successive sowings and use different varieties of different maturity to extend the harvest season. This ensures that the newly collected material will be available for an extended period.
- ✓ The shade is inexpensive and important. Use trees or a cover of shadow in the wagons of field, trucks and market areas. Keep produce in an area of shadow waiting for packing. Perform the operations of sorting and packing in a shaded place. Vegetables exposed to sunlight absorb solar energy and it will heat up more than the shadow. This is especially true of vegetables from neck dark, like Zucchini, eggplant, peppers, melons, green beans and tomatoes, which often are harvested during the middle of the summer, when solar energy is maximum. The workers will feel more comfortable and therefore work more efficiently in a shaded area. Shade can be provided by an open shed, on a simple frame shade cloth, or even by a large tree.
- ✓ In agricultural markets, show only the vegetables of good quality for sale. Those of low quality will not improve and will be at the expense of sales of products of good quality. Common classification to eliminate poor quality material will present the best possible viewing customers. Exhibitors of sale must be out of the direct sun.
- ✓ Remind customers to keep fresh and prevent the loss of moisture during transport and storage in the home.

- ✓ For products that loses quality quickly and which are sent to the market, special wash postharvest, handling and cooling are necessary to maintain quality. Be careful to avoid bruising the transport to the packing room, during unloading, washing and classification.

3. BETTER MODE OF TRANSPPORTATION- ROLE OF MULTI MODALISM

- ✓ vehicles closed without refrigeration should not be used to transport fresh products, except for very short journeys, as local farmers or wholesale deliveries to nearby retailers;
- ✓ side open trucks or addressed medium can be equipped with a roof in a frame. The open sides can be fitted with curtains of canvas which can be rolled or moved to one side in sections to allow loading and unloading at any point around the vehicle. These curtains can protect them from the elements, but still allow ventilation. Where theft is a problem, the sides and the rear of the truck must be enclosed in wire mesh;
- ✓ a second roof, painted, which can be set as a shield against radiation 8 or 10 cm above the main deck; This will reflect the Sun's heat and help to keep produce cold;
- ✓ For vehicles of long distance air-intakes should be more elaborate, ventilation can be mounted together with lamas, to ensure a positive flow through the load;
- ✓ Rail, road or sea containers, refer trucks can be used for long trips, but the cost of this type of transport makes it uneconomic for small scale operations.

Handling and stowage practices:

Although the shape and condition of trucks are important factors in the transport of fresh products, loading and stowage methods vehicles are relevant to the damage and losses:

- ✓ better load factor must be achieved, which is the maximum load that can be economically under satisfactory technical conditions: load stable and well ventilated;

- ✓ size and package design must provide adequate levels of ventilation of content with the least amount of lost space, and packages must be sufficiently strong to protect content
- ✓ loading and unloading of vehicles must be adequately supervised to avoid careless handling of packages; auxiliary cargo as trucks, roller conveyors, pallets or forklifts should be used whenever possible to reduce handling of individual packages;
- ✓ storage should be carefully carried out to prevent the collapse of the materials during transport; packages should not be stacked higher than the maximum recommended by the manufacturer, otherwise the lower layers may collapse under the weight of those above
- ✓ product packaging must be protected from the sun and rain at all times, even during loading and unloading
- ✓ packages must be loaded in wooden boards (wood parts or castings of slats) storage in the beds of vehicle, or on pallets in order to allow the circulation of air around the batteries during transport;
- ✓ If the load is to be distributed to various places, packages must be loaded in the reverse order so that which will be downloaded, i.e. a duration, in the first place; at the same time that the load it must be distributed evenly on the vehicle.

Although you can take all the necessary precautions mentioned earlier, the driving rules remain a difficult problem. In many cases, drivers are induced to speed in order to make more money for themselves or their employers. Whenever possible, only experienced and responsible drivers must be employed.

Other modes of transport:

The fresh produce is transported by many other media, from road trucks to air freight. In all cases, the same conditions should be observed. Products must be:

- ✓ maintained fresh
- ✓ keep it dry
- ✓ moved to the bazaar as soon as possible.

Rail transport:

In some countries, a large number of products is done by rail.

The advantages are:

- ✓ transport damage to produce while moving is mild compared with the transportation by road
- ✓ costs are lower than for road transportation.

Rail transport, however, requires additional facilities for better handling of the fresh produce

Maritime transport

Inland:

Transport is used in some countries to bring products to market. Much of the production carried out in this way is packed in boxes or bags of local manufacturer. Vessels employed often mingle with passenger cargo ships, and provides special facilities fresh products handling.

Sea:

Short distance transport of fresh produce in small boats without cooling is common in countries of the island communities (for example, Philippines). Ships often accommodated passengers and general cargo, and no special provision is made for fresh products, which can be stored in cellars without ventilation. The losses are high, due to rough handling by caretakers, inappropriate packaging and heating in cellars without ventilation or near the engine room.

There is much room for improvement in this means of transport. A model for the organized and efficient shipping of refrigerated cash crops such as bananas, a modest investment by small scale investor could greatly improve performance.

Air freight:

As with shipping, international trade in air freight of exotic high-value crops is generally well organized. In some developing nations connectivity is poor (for example, Papua New Guinea),

the produce is transported by air from the production areas to urban markets. The costs are high and the losses often heavy due to:

- ✓ poor, not standard packages;
- ✓ careless handling and exposure to the unnecessary elements at airports;
- ✓ shipments abandoned in favor of passengers;
- ✓ Late flight due to weather delays, breakdown;
- ✓ immediate cooling followed by exposure to high temperatures;
- ✓ relatively small shipping produce.

With changes in the packaging and handling, it is not likely that the overall situation will improve very much until road connections are established between producers and consumers.

Cold storage:

Storage is the art of keeping the quality of agricultural materials and the prevention of deterioration for the specific period of time, beyond their normal life. Different fresh products are harvested and stored by various means depending on the end use. Whether that seed will be used for new plantations of the year following, to forage it is processing of livestock feed, or even for crops to be carried out for a special use, the producer must be aware of conditions of harvesting and storage to a quality product. After determining the use prescribed for the harvest, the time for harvesting and storage is important consideration. Together with an assessment of when to harvest, the farmer has to determine the method of collection.

There is a wide range of storage structures used throughout the world to store successful horticultural products. In general, structure must be fresh (refrigerated, or at the least ventilated and shaded) and the product in storage should be high initial quality.

Storage is essential for the following reasons:

- ✓ perishable nature of the agro products
- ✓ Supplying food materials throughout the year
- ✓ available for processing large scale

- ✓ preserving the nutritious quality
- ✓ control and regulation of prices
- ✓ optimization of farmer's profit / economic empowerment of farmers
- ✓ Opportunity for the export market

Storage assemblies:

Ventilated storage:

Facilities with natural ventilation can be used for the storage of fresh produce like fiber crops, root crops, tubers, hard white cabbage etc. the structure must be build as per the location's nature and taking into consideration the factor of sufficient ventilation.

Observe the following essential:

- ✓ the building must be located at a site where low night-time temperatures occur during the required storage period;
- ✓ must orient itself to take maximum advantage of the prevailing winds for ventilation;
- ✓ material covering the ceiling and the walls should provide insulation against the heat of the sun; grass straw in a bush-pole frame can be very effective, especially if it has become wet to provide evaporative cooling;
- ✓ sandwich panel walls will provide better insulation, lowering the cost;
- ✓ white paint applied to the surfaces of the artificial materials help reflect the heat of the Sun;
- ✓ the structure is to be built in the shadow of the trees if they do not interfere with the flow of air that prevails; care with forest fires and falling trees during the storms;
- ✓ provide spaces of ventilation under the floor and between the walls and ceiling to give a good flow of air;

- ✓ If the shop is subject to night-time cold temperatures , louvre blades can be fitted and adjust them to limit the flow of hot air in the tent during the day

Anchors/ clamps:

It's a simple and cheap structure that is used for root crops storage, especially the potato in Europe and Latin America.The potatoes are placed on a bed of straw I - 3 m of width, but not more than 1.5 m wide in warm climates. A ventilation duct should be placed along the bottom. Stacked potatoes covered with about 20 cm of compacted straw that can subsequently be locked up in the soil, applied without compaction of up to 30 cm in depth. The restraint system can be modified for different weather conditions. In warm climates housing extra straw can be used instead of Earth in order to give greater ventilation.

Other simple storage methods:

Wind protections are narrow, wire mesh, the structures of basket on I m wide and 2 m in height, any convenient length, over a high wooden base, and are used for short term storage of dried onions in the field. Onions are covered on the top with a 30 cm layer of straw, which, in turn, held down by a polyethylene sheet attached to the wire mesh. The wind protection is built at right angles to the prevailing wind for maximum of drying and ventilation. Onions can also be woven into braids in Twine and hung in a cool, dry place where it will remain for several months

Refrigerated and controlled-atmosphere storage:

For commercial operations large-scale refrigerated storage can be used in an operation of the cold chain to make regular shipments of the areas of production to urban markets and retailers. This can be a very complex operation requiring the Organization experts and management.

Cold storage can also be used for the long-term storage of seasonal such as potatoes and onions crops. You can extend the shelf life of some fruits, such as apples, through the combination of refrigeration with a controlled atmosphere consisting of a mixture of oxygen and carbon dioxide.

The latter are expensive operations of high maintenance and operating costs, and qualified and experienced management demand. They have relatively little application to small scale production in developing countries.

Apart from the need of storage refers extends up to the square of the market also. The main reason is that all the fresh products don't get sold out in one day. So taking into account the fact of a perishable nature, there has to be an available cold in order to stock up on fresh perishables.

4. CURRENT DISTRIBUTION OF TREND OF FRUITS AND VEGETABLES

Fresh vegetables supply chain:

The actors of the supply chain of fresh vegetables include farmers, collection agent or shippers, traders, retailers and superstores or supermarkets. In the first level of marketing, an important part of the production of the farmers, which is 64% went to wholesalers. Another 26 per cent to collectors / transporters, 7% to retailers, 2% companies of direct selling (for example, reputation) and 1% for superstores. At the level of the collection agent, 59% of collection agents worked with wholesalers, while the remaining 41% dealt with retailers. Of the main traders, 46% ran through other traders, 27% went to institutional buyers and 24% went to retailers. The remaining 3% was for superstores. At the wholesale level, 55 per cent went to retailers, 25% was for superstores, while the remaining 20% was recognized buyers.

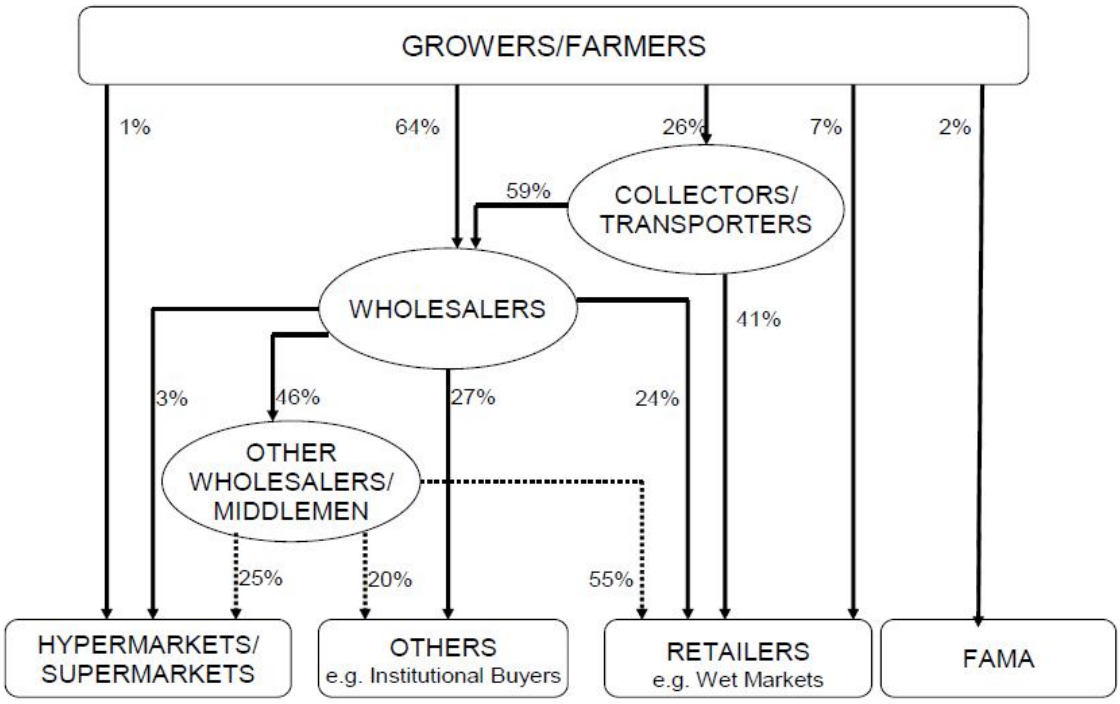

Figure 6 Fresh vegetable supply chain

In the SC of fresh fruits, the main actors also consisted of farmers, collection agent or shippers, wholesalers, retailers and supermarkets or supermarkets. In the first level, a large part of the fruits of the producers (58%) went to traders. Another 26 per cent to collection agent / transporters, 12% of the Federal agricultural marketing authority (FAMA / other, 3% of retailers and 1% for hypermarkets.) From collectors, 70% of the production was channeled to wholesalers while the remaining 30% went to retailers. From the trader, 45% ran through other traders, 30% went to institutional buyers, and 23% went to retailers. the remaining 2% went to the superstores. at the wholesale level, 50% went to retailers, 20% was for supermarkets, while the remaining 30% was institutional buyers.

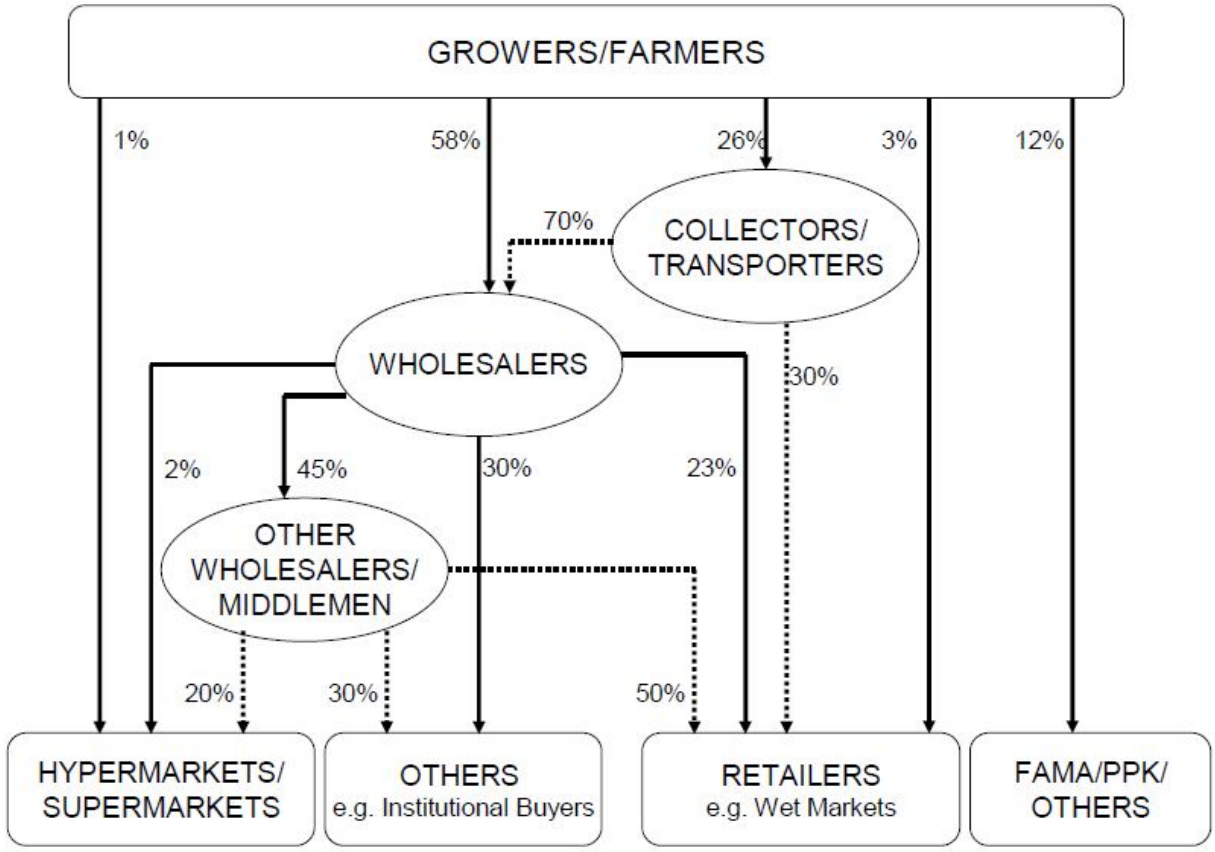

Figure 7Fresh fruits supply chain

5. SUGGESTED FRAMEWORK

After studying the successful business models of the modern day retailers like ITC, mother dairy, Bharati, we apply '5S' methodology on the traditional supply chain in order to build a better chain for the supply of fruits and vegetables

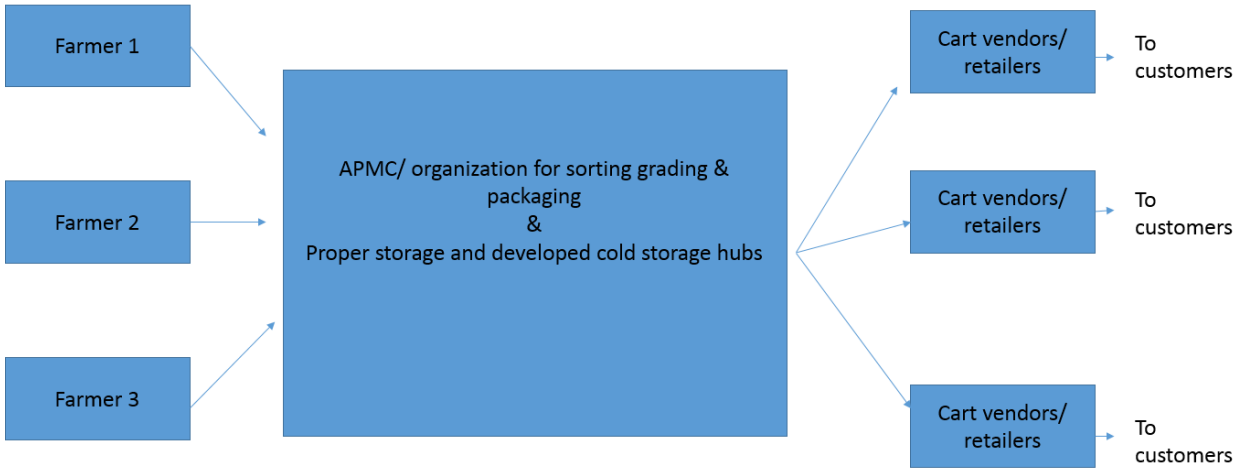

Figure 8 suggested framework

Regulated markets are established in accordance with the provisions of the ' marketing of agricultural products of the Government. Merchandises, with which the market will deal, also declared. Regulated markets aimes at the development of the structure of marketing to ensure remunerative prices for producers and reduce the difference of price between the producer and the consumer. It also aimed at the reduction of the non-functional margins of the brokers.

Basic objectives of regulated market:

- ✓ To ensure rational profit to farmers through the creation of environment in the markets of the forces of supply and demand fair play,
- ✓ To regulate market practices and achieve transparency in transactions
- ✓ Directed to provide appropriate sales method, correct weighing, the prompt payment and various related marketing services
- ✓ Control set up to control and manage the markets

"For the control of marketing activities, there is a ' Committee of market". The Committee is composed of representatives of producers, agents and candidates from the Government.

Role of the market Committee:

- ✓ The complete management of the market rests with the Committee of market ".
- ✓ The Commission grants licenses to the agents of the Commission, weigh men, and other officials.
- ✓ The rate of Commission to be charged is fixed by the Committee.
- ✓ weighing is carried out correctly by men appointed by the Committee

Fig. 4 shows the schematic diagram of supply of fruits and vegetables of the chain in the India. This shows that the number of intermediaries involved in the chain of supply of fruits and vegetables is reduced. Farmers or fruit transportation growers and vegetable cultivation location of shopping centers. Modes of transport are mini-truck, cart oxen, bicycle, tricycle, bike and baskets etc. In the auction (APMC) shopping for wholesalers buy from producers. Then firm must provide the facility with good infrastructure, equipment and new technologies for the classification, the classification of fruits and vegetables. After the proper classification, fruits and vegetables will be packaged in boxes and crates. Then sold. Thus, with the improved model of supply chain, transportation to some extent limits. It reduces inefficiencies in the supply chain, the proper handling, and minimize the wastage rate, thus reducing overhead costs from the supply chain. Minimization of losses recorded during the entire SC of F&V and transport controls prices for the end customer with the right quality of food. So the final cost can be reduced by 20-30% and waste can be reduced up to 10-15%.

VI. CONCLUSION

Vegetables & fruits play a vibrant role in the existence of people and also a very influential role in the economy of the India. Trade through traditional retailer of vegetables are not much organized, around 97% of the total market is extremely localized and highly fragmented with a large number of intermediaries. The process of long transport from producers to consumers, occurs the waste of 10 to 12% of the total, in addition to the cost of transportation. This increases the cost of fruits and vegetables for the end customer also hinders quality. The food supply chain needs the attention of academics, industry and Government. In the traditional business model;

wholesalers are the intermediaries and a predominant link in the logistics chain of vegetables to the retail. In general, all retailers depend inevitably on the sales market to the largest local. The main limitations are poor services transport, lack of availability of storage in cold large scale, there are no clean government and farmers small and fragmented policy guidelines. Analyzed inefficiencies in the above study should be more carefully handled. The factors that affect the supply chain also have to be monitored and development to improve the efficiency of the supply chain has to be carried out in India. Working with suppliers on issues not only generate significant environmental benefits, but also opportunities for the containment of costs and the improvement of the quality of the product.

Fresh fruits and vegetable market has a huge influence on the socio-economic and even political conditions. The existing supply chain is not effective. All players must join forces to improve the supply chain to carry products from farmers to consumers. This would not only improve the economic and social situation of consumers, but it also enables consumers to obtain quality products at affordable prices. Intermediaries and all actors in the supply chain should join hands for the benefit of the improvement of the infrastructure of the supply chain. In a country like India, where the majority of the population lives in country side areas, the benefits of the developed supply chain would have implications on a good number of people. Government needs to collaborate with private infrastructure players that require large funds and long-term and multiple uses, such as roads and communication technologies. India has the potential not only to meet domestic demand, but also to the large global market place

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