

CRITICALLY EXAMINE THE SUPPLY CHAIN OF FRESH FRUITS AND VEGETABLES IN INDIAN MARKET

**Dissertation submitted to College of Management & Economic Studies for the partial fulfillment of the degree
of**

MBA (LOGISTICS AND SUPPLY CHAIN MANAGEMENT)

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April, 2015

DECLARATION BY SUPERVISOR

This is to certify that the project titled “**Critically Examine the Supply Chain for Fresh Fruits and Vegetables in Indian Market**” submitted to University of Petroleum & Energy Studies, Dehradun, by Abhinav Malhotra, in partial fulfillment of the requirement for the award of degree of Masters of Business Administration (Logistics & Supply Chain Management), is a bonafide work carried out by him under my supervision and guidance. This work has not been submitted anywhere else for any other degree.

To the best of my knowledge, he has made an earnest and dedicated effort to accomplish this project.

Wishing him all the best for his future endeavors.

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UNDERTAKING

I hereby declare that the Dissertation entitled “**Critically Examine the Supply Chain for Fresh Fruits & Vegetables in Indian Market**” submitted in partial fulfillment of the requirements for the award of the Degree of Masters in Business Administration is a record of original research work done by me under the supervision & guidance of Prof. Balaram Swamy J and the Dissertation has not formed the basis for the award of any Degree/Diploma/ Associate ship / Fellowship or similar title to any candidate of this or any other University.

Place : Dehradun

Date :

ABHINAV MALHOTRA

ACKNOWLEDGEMENT

First and foremost, I would like to thank my respective mentor “Mr. Balaram Swamy J.” (Industry Fellow - CoMES) for his valuable guidance and encouragement throughout my research project on “CRITICALLY EXAMINE THE SUPPLY CHAIN OF FRESH FRUITS AND VEGETABLES IN INDIAN MARKET”. His expertise, enthusiasm, and dedication for work have been a constant source of motivation for me.

I would like to express my deep gratitude to “University of Petroleum and Energy Studies” for extending the opportunity of undergoing the project and providing with all necessary resources and expertise needed for completion of the project.

I also convey special thanks to “Mr. Neeraj Anand – Head of Department (MBA-Logistics and Supply Chain Management)” for his extended support throughout the project.

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MBA-(Logistics and Supply Chain Management)

EXECUTIVE SUMMARY

1. EXECUTIVE SUMMARY

In India, about 60 percent of the food quality is lost in the supply chain from the farm to the final consumer. Consumers actually end up paying approximately about 35 percent more than what they could be paying if the supply chain was improved, because of wastage as well as multiple margins in the current supply structure. The farmer in India gets around 30 percent of what the consumer pays at the retail store. Compare this with situation obtaining in the USA, where farmers can receive up to 70 percent of the final retail price and wastage levels are as low as 4 to 6 percent. One can easily understand the benefits that could be generated from emulating those practices and tapping that expertise for the supply chain in India.

As supply chain Management involves procuring the right inputs (raw materials, components and capital equipment): converting them efficiently into finished products and dispatching them to the final destinations: there is a need to study as to how the company's suppliers obtain their inputs. The supply chain perspective can help the retailer identify superior suppliers and distributors and help them improve productivity, which ultimately brings down the consumer costs. At the same, Market logistics helps planning the infrastructure to meet demand, then implementing and controlling the physical flows of material and final goods from the point of origin to the point of use, to meet customer requirements at a profit.

Till now most retailers in India have invested majorly into the front end, but relatively little on the back end and supply chain. Even the countries like USA, Germany and England, where organized retail is highly developed, supply chain efficiency is a major concern. The nature of retail sector in India is different from other countries around the world. The organized retail sector in India is highly fragmented and there are huge inefficiencies in the supply chain.

The most important part of retailing business is to find a balance between investing in front end and back-end operations. The channel dynamics is going to change over next couple of years as the retailers start going in size and their bargaining power is likely to increase. Probably that would bring some kind of mutual understanding between manufacturers and retailers to develop strong supply chain network. In such a scenario, both the existing operators and new operators must put collaborative efforts to phase out inefficiencies in the supply chain network.

The report tries to find out what efforts are being taken up by the big retailers in India like Future Group with retail stores like Food Bazaar, Reliance fresh and other retailers to improve the efficiency and

effectiveness of supply chain and logistics. This report also finds out the difference between the traditional supply chain and the retail chain in India of fresh fruits and vegetables.

The report shows that the main problems of the Indian supply chain of fresh fruits and vegetables is the higher number of intermediaries, the poor infrastructure, the poor handling and packaging and improper Information flow between the stakeholders. Both the primary and secondary studies have been carried out to find the practical issues involved.

The report concludes this that there are many loopholes available in the supply chain which required to be corrected. The poor handling and packaging techniques , the poor infrastructure, the poor sorting and grading technology, the unskilled labour etc. are affecting the supply chain and thus making it inefficient and recommend to improve the same.

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INTRODUCTION

1. INTRODUCTION

India is one country where agriculture contributes a hugely in its GDP. If we see India is the second largest producer of vegetables in the world and also the exports of vegetables are high too from India. Indian Agriculture sector produces 64 percent employment and 18 percent of country's export. India is 2nd largest producer of fruits and vegetables in the world. India is the 2nd largest vegetable Exporter. India's share is only 1 percent of World trade.

India has a huge opportunity to become a leading global food supplier if only it has the right marketing strategies and of course agile, adaptive and effective supply chain. India has diversity in terms of its population with several religious groups with different food habits and culture. This diversity should be used to advantage to become the "Halal Food Hub", the "Organic food hub", the "Vegetarian food hub" the "Sea food hub" among others.

The food supply chain is complex with perishable goods and numerous small stakeholders. In India, the infrastructure connecting these partners is very weak. Each stake holder, farmers, wholesalers, food manufacturer, retailers all work in silos. Also, demand forecasting is totally absent and the farmers try to push what they produce in to the market. Data integration, financial flow management, supply-demand matching, collaborative forecasting, information sharing, and goods movement synchronization through efficient transport scheduling, are very well practiced in high technology industries with immense benefit. These best practices should find their way in to the food supply chains. Cold chain logistics supply chain should take advantage of technology improvements in data capture and processing, product tracking and tracing, synchronized freight transit times for time compression along the supply chain and supply – demand matching. Also, the supply chain used to be designed and built as a whole in an integrated manner with the process of new product development, procurement and order to delivery processes well designed and well supported using IT tools and software.

The food supply chain can be subdivided into a number of sectors. Agriculture, horticulture, fisheries and aquaculture are the primary producers, manufacturers who process the food for ready to eat or cook format together with the packaging companies are in the intermediate stage, and the retailers, wholesalers and caterers are in the last stage of the supply chain. At each stage the value is added by the new ownership such as processors, distributors, packers, etc. and the cost and profit are part of the business. The food items can go to the final consumers from any of the three stages: from farmers in the form fresh produce, to the caterers directly from the manufacturers, and finally from the retailer (small or big) to the consumer. The movement of goods from one stake holder to another is facilitated by the in house or third party logistics service provider. The information management is done by all the stakeholders and there

information systems are all inter connected seamlessly. What we described above is the state of food chain in the advanced countries. In India and other developing countries the state of food chain is more fragmented and primitive.

In today's highly competitive global market place, the pressure on organizations to find new ways to create and deliver value grows even stronger. Gradually, in emerging economies as well as mature markets, the power of the buyer has overtaken that of the customer. The rules are different in a buyer market. In particular, customer service becomes a key differentiator as the sophistication and the demands of customers continually increase. At the same time, market maturity combined with new sources of global competition has led to overcapacity in many industries leading to an inevitable pressure in prices. Prices have always been a critical competitive variable in many markets and the signs are that, it becomes an issue to think upon as commoditization of markets continues. Supply chain management plays an integral role in keeping business costs minimum and profitability as high as possible. There are many factors involved in supply chain management. Flow is the foremost element, the foundation for all aspects of the process. There are three main types of flow, such as the product flow, the information flow and the finances flow. The product flow includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs. The information flow involves transmitting orders and updating the status of delivery. The challenge for us in supply chain management is to maintain all three flows and all three unique in an efficient manner, resulting in optimal results for farmers, growers, wholesalers and customers.

1.1 FOOD SUPPLY CHAIN CLUSTER

Food chain clusters are formed with the participation of all stakeholders such as farmers, seed growers, merchants, transporters, wholesalers, retailers, financial institutions, and insurance companies. Information sharing is essential for generating efficiencies. The internet and mobile communications are used to enable information and financial transfer between the stakeholders. Also, recent advances in RFID technology will have a tremendous impact in the management of the food chain, particularly for source identification and tracking and also in providing supply chain visibility.



Figure 1: Food Supply Chain Cluster

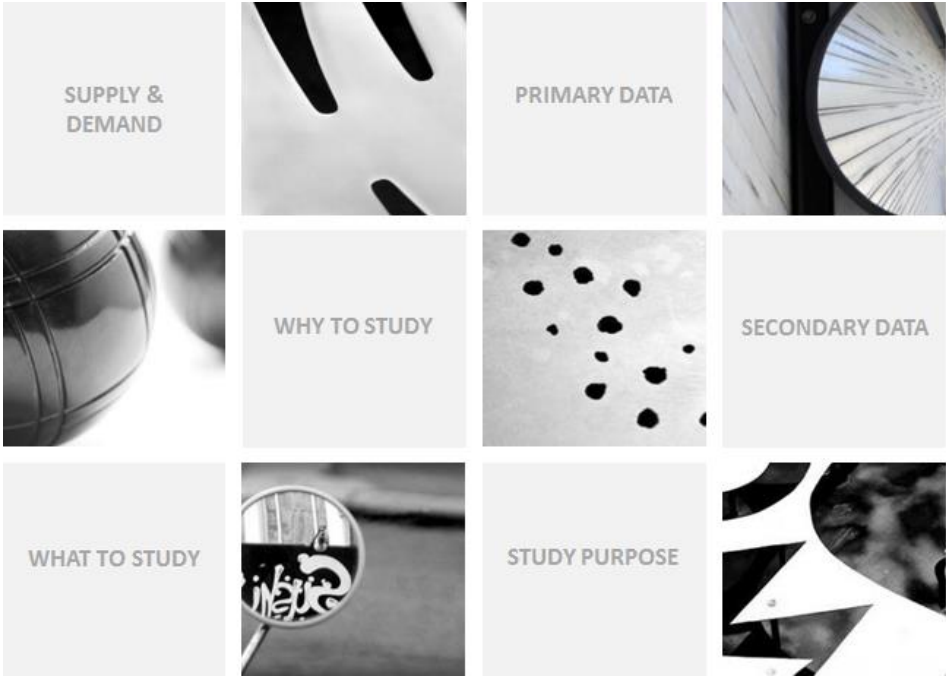
In advanced countries, the retailers (Walmart, Tesco, etc.) have become the channel masters of food supply chain taking over from the food manufacturers. In India, with no superstores, no economies of scale, too many intermediaries, there is a vacuum, meaning there is no real channel master managing the supply demand situation and coordinating the supply chain and managing the logistical activities. This provides a tremendous opportunity for smart players to enter a growing market with a high potential of retail FDI. But one needs to remember that the infrastructure capital outlays are high and the returns are long term. Also there are various risks associated with owning a cold chain. Some of these include country risk, monsoon risk, crop or raw material supply failures due to pests, diseases, etc., partner risk, and numerous others.

LITERATURE REVIEW

2. LITERATURE REVIEW

AUTHOR	CONTEXT	INFERENCE
Paulrajan Raj Kumar	Food Mileage: An Indicator of Evolution of Agricultural Outsourcing	The aim of this paper is to report the finding from study on distance traveled by fresh vegetables from farming location to consumer in traditional and organized retailing.
Pratichhe Kapoor- Associate Vice President, Food Services & Agriculture Aneesh Saraiya- Consultant, Food & Agriculture	Food Retailing: Backbone of Organized Retail Formats	To sum up it can be said that the organized food retail has attained a promising size which is bound to grow manifolds in the coming years.
Surendra P. Singh B.K. Sikka	Supply Chain Management and Indian Fresh Produce Supply Chain: Opportunities and Challenges	Focus: Food Chain Approach
Piali Halder	A Need For Paradigm Shift to Improve Supply Chain Management of Fruits & Vegetables in India	The main objective of this paper is 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.
Vishal K. Patel	Study the Supply Chain of Fruits and Vegetables of Reliance Fresh	Challenges and opportunities in the supply chain.

RESEARCH METHODOLOGY



3. OBJECTIVES

It's necessary for India to find out where exactly India is lagging behind when it comes to managing the supply chain. What are the factors which are affecting India's export and by thus a study of supply chain of fruits and vegetables is been planned to be carried out to analyze whether SC is hindering Indian Export in this particular sector.

The primary objective of the report would be a detailed analysis of the supply chain of the fruits and vegetables in India, the different stakeholders of the fresh fruits and vegetables supply chain and the different supply chain models available in the Indian market. And then finding out the factors (supply chain related) which are actually affecting the Indian fruits and vegetables export and suggesting some recommendations to improve the situation.

About 30 percent of the fruits and vegetables grown in India gets wasted annually resulting in instability of prices, farmers not getting remunerative prices, rural impoverishment culminating in farmers' frustrations and suicides. Enough attention has been paid at the pre-harvest stages for bolstering the levels of production by innovative techniques like crop rotation, soil conservation, pest control, fertilizers, irrigation, etc., but, post-harvest issues have not been addressed adequately. Despite having achieved national food security, the lives over 200 million Indian farmers and farm workers and their well-being who have been the backbone of Indian agriculture continue to be a matter of grave concern. Agriculture and its allied industries sector employs 67 per cent of the country's population. By practicing improved supply chain management practices, there will be significant reduction in the wastages of fruits and vegetables which in turn will benefit both the farmers as well as the consumers by means of increased returns and decrease in prices respectively.

PRIMARY OBJECTIVES

- To study the comparative roles played by the intermediaries in the traditional and modern supply chain in vegetable marketing.
- To compare the marketing efficiency between traditional and modern supply chain.

SECONDARY OBJECTIVES

- To compare the factors influencing the effectiveness of supply chain in the modern formats as compared to traditional formats.

- To compare the price received by the farmers vis-à-vis price paid by customer in the traditional and modern supply chain.
- To find out the factors (supply chain related) which are actually affecting Indian fruits and vegetables market and suggesting ways to improve the situation.

Important advantages of supply chain management are:

1. Reduction product losses in transportation and storage
2. Increasing of sales
3. Dissemination of technology, advanced techniques, capital and knowledge among chain partners
4. Better Information about the flow of products, markets and technologies
5. Tracking and tracing to the source
6. Better control of product safety and quality
7. Large investments and risks are shared among partners in the chain
8. Increasing efficiencies and increasing the volume of trade
9. Customer satisfaction

3.1 RESEARCH DESIGN

This is a kind of descriptive research study because it describes what is going on or what exists at the fruit and vegetable market.

3.2 TYPE OF DATA

Primary and Secondary data

3.3 METHOD OF DATA COLLECTION

The study is carried out through secondary sources of data through research papers, industry reports, business journals, published articles, business magazines, newspaper articles etc. In depth analysis of indicator, reporting of inferences and recommendations has been carried out. A primary research was conducted with industry experts to better understand the practical issues associated. No standard questionnaire has been prepared as the people don't feel comfortable to answer formal questionnaire directly.

3.4 METHODOLOGY

The project work is carried out through secondary as well as primary research. In-depth analysis through calculation of indicators, reporting of inferences and recommendations is been carried out. A primary research in the near around Mandi also will be carried out for better understanding of the practical issues associated. No standard questionnaire has been prepared as the people don't feel comfortable to answer the formal questionnaire directly.

3.5 SAMPLING DESIGN

As per objectives of the study; purposive and random sampling technique will be adopted.

3.6 TOOLS FOR DATA ANALYSIS

Simple conventional methods of tabular analysis, observation and also by drawing inferences, this study has been done to understand the need for controlling the supply chain for fresh fruits and vegetables in the Indian Market.

3.7 FRAMEWORK OF THE STUDY

This study has been conducted by studying the available secondary data like research papers, industry reports, business journals, published articles, business magazines, newspaper articles etc. to be able to better formulate different perspectives around the subject matter. In-depth discussions with academic experts and industry operators have been carried out to understand the various practical aspects in the supply chain of fresh fruits and vegetables in the Indian Market.

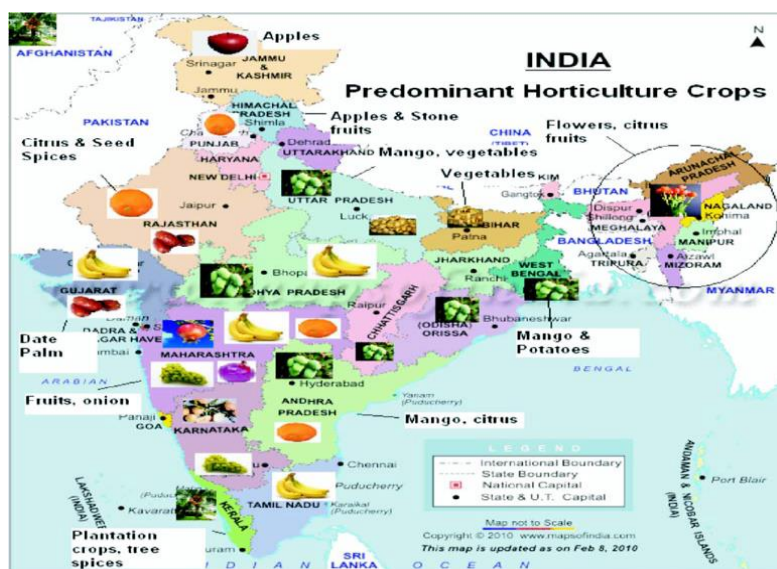
3.8 SCOPE OF THE STUDY

The scope of the project is limited because the study will consider only the supply chain and related issues in Indian market for fresh fruits and vegetables and will not include other factors which are affecting the fresh fruits and vegetables exports directly or indirectly. For the purpose of this study, the global and the Indian logistics industry have been analyzed. The emerging trends, the advancements in technology and their implications on the movement of the industry have also been studied.

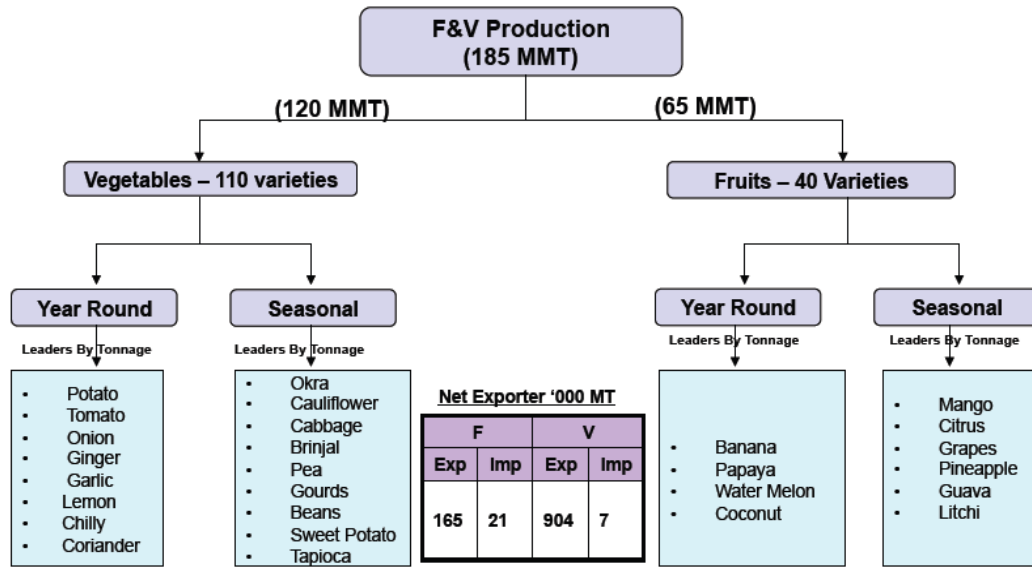
3.9 LIMITATION OF THE RESEARCH

- Primary research has not been conducted in this case due to the wide area of the study, given the cost, time and budget constraints.
- Since the data for study is collected from various sources and studies by different groups, there may be variations compared to actual situation. However, the degree of discrepancies has been kept to the minimum.

INDIAN SCENARIO



The Produce of India – Output



- Second largest producer of fruits & vegetables
- Rising income levels – rising demand for imported/exotic

Figure 2: The Produce of India-Output

AVAILABILITY OF FRESH FRUITS & VEGETABLES IN INDIA

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
FRUITS												
Apple												
Banana												
Grapes												
Guava												
Lime/Lemon												
Litchi												
Mango												
Mosambi												
Orange												
Papaya												
Pineapple												
Sapota												
VEGETABLES												
Brinjal												
Cabbage												
Cauliflower												
Okra												
Onion												
Peas												
Potato												
Tomato												

Figure 3: Availability of Fresh Fruits & Vegetables

Fruits & Vegetables – Indian Consumption

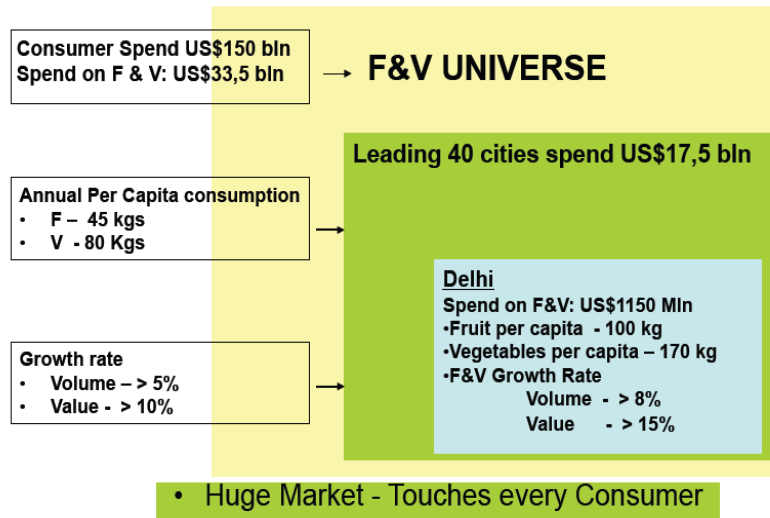


Figure 4: India Consumption

INDIAN SUPPLY CHAIN



4. INDIAN FRESH FRUITS AND VEGETABLE SUPPLY CHAIN

Supply chain management (SCM) may be defined as a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system-wide costs while satisfying service level requirements (Simchi-Levi et al., 2008).

F&V constitutes a major part of the world economy and is the raw material for many industries. Among the agricultural produce, perishable food produce like F&V have got the least attention. The SCM of perishable food produce constitutes the processes from production to delivery of the agri-fresh produce, i.e. from the farmer to the customer. SCM of perishable food produce is complex as compared to other SCMs due to the perishable nature of the produce, high fluctuations in demand and prices, increasing consumer concerns for food safety & quality (Vorst & Beulens, 2002), and dependence on climate conditions (Salin, 1998)

There are several players involved in fulfilling the needs of the consumer in the supply chain management of F&V like farmers, local traders, transporters, processors, retailers etc. From a farm gate to a consumer, a horticulture product passed through six-seven different distribution channels (Viswanadham, 2007). Perishable food produced in the farmer's field reaches the end consumer through a chain of intermediaries. These intermediaries carry out various functions, such as transfer of ownership of commodities, its movement, maintenance and preservation of quantity & quality, payment to the seller and commodity delivery to the buyer (Halder & Pati, 2011). All the links from farmers to end user of the commodity constitute supply chain of the agricultural commodities.

Generally there are three types of models in Supply Chain of F&V in India i.e. Traditional Supply Chain, Hub and Spoke Model, and Value chain Model (Halder & Pati, 2011) and are discussed in the next section.

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 (ASSOCHAM, 2013). It plays a unique role in India's economy by improving the income of the rural people. Cultivation of these crops is labor intensive and as such they generate lot of employment opportunities for the rural population. Thus, cultivation of these crops plays a vital role in the prosperity of a nation and is directly linked with the health and happiness of the people.

F&V sector is perhaps the most profitable venture of all farming activities as it provides ample employment opportunities and scope to raise the income of the farming community. It also has tremendous potential to push the overall agriculture growth. India has been bestowed with wide range of climate and physio-geographical conditions and as such is most suitable for growing various kinds of F&V. This has placed India among the foremost countries in F&V production just behind China. F&V together constitute about 92 % of the total horticultural production in India (ASSOCHAM, 2013). India has the potential to be the world's largest food producer which is bestowed with one of the best natural resources in the world and several factors like Increasing urbanization, nuclear families, working women, disposable income and changing lifestyles are gearing up the Indian food supply chains for a better future. Organized retail and Private label penetration, demand for functional food, and increased spend on health food are major drivers for the growth of this sector (Rathore et al., 2010).

F&V are also rich source of vitamins, minerals, proteins, and carbohydrates etc. which are essential in human nutrition. These are referred to as protective foods and assumed great importance as nutritional security of the people. As the population is increasing, the demand for such food is also increasing. To meet such demand and provide a food in proper quality and nutrition, Supply chain plays a very vital role in this sector and becomes even more important because of perishability nature and very short shelf life. Supply Chain Management not only helps to cut costs, but also adds to maintain and improve the quality of produce delivered, which are perishable in nature (Veena et al., 2011). Owing to the very short shelf life and perishable in nature, these items require proper transportation, handling and storage facilities in order to reach in fresh state to a customer. Supply chain manages the relationship between businesses responsible for the efficient production and supply of fresh produce products from farm level to ultimate consumers, to reliably meet the requirements of the customer in terms of quality, quantity, and price.

India's Agriculture Sector account for only a minuscule percentage of GDP and growth, however most of India's population continues to depend on it. Despite rapid growth of the services and industries sector as globalization leads to assimilation of foreign technology and practices, agriculture continues to live in medieval times. India's food supply Chain leads to massive wastage and inefficiency with 30 percent of India's vegetable and fruit produce being wasted. This is criminal in a country where most of the children go hungry. However corporatization has been repelled by vested interests leading to a sorry situation. Food inflation has seen double digits since last year and despite a better harvest year, some food price are touching the stratosphere. The inadequate supply chain leads to periodic shortages of key food items used by Indian as part of the daily diet.

Onion prices have hit around Rs 70-80/kg which is equal to the average wage of \$2 for 80% of the Indians. This has surprisingly caused consternation amongst the political classes who have clamped down to exports. Around 10% of India's 12 million ton onion production is exported and has seen exports

growing to around \$500 million in 2010 up by almost 5x in the last five years. Can't understand why a nation which sees so much hunger and starvation needs to export so much. The Indian government food policy is mostly ad hoc and driven more by vested interests rather than any strategic long term policy. Out of the 5400 cold storages in the country almost 90 percent are owned by private investors which indicate the government's lack of investment. India's nodal agency for distribution of agriculture FCI is known for its endemic corruption and massive ongoing scams. The Indian growth story keeps being celebrated in popular media even as crushing income disparity becomes wider and wider.

If we see the Indian market, mainly two different kind of supply chain exist in the fresh Fruits & Vegetables market. One is Traditional supply chain and other one is retail market or organized market supply chain. The main difference between the two supplies is this that the numbers of intermediaries in the traditional supply chain is high and thus the amount of wastages is high and transaction cost is also high in the traditional supply chain. In the following paragraphs all the different kinds of supply chain which exists in the sector in India has been explained.

4.1 TRENDS IN FRUITS AND VEGETABLES PRODUCTION & PRESENT STATUS

During 2012-13, India's contribution in the world production of F&V was 12.6 % and 14 % respectively (NHB, 2013). India is the second largest food producer in the world, after China and one of the centers of origin of F&V with the total production of 81.28 million metric tonnes of fruits and 162.87 million metric tonnes of vegetables till the year end 2013 (NHB, 2013). India is the largest producer of many F&V with share in world production till the year end 2013 as follows:

- 44.1% of Mango & Guava
- 25.6% of Banana
- 42.6% of Papaya
- 72.9% of okra

It is the second largest producer with share in world production till the year end 2013 as follows:

- 27.1% of Brinjal
- 12.2% of Cabbage
- 35.6% of Cauliflower & Broccoli
- 20.2% of Onion
- 12.4% of Potato
- 11.2% of tomato

The production of F&V in India has been shown in **Table 1** from the year 1991-2013 which has increased from 28.63 million metric tonnes to 81.28 million metric tonnes in fruits and 58.53 million metric tonnes to 162.18 million metric tonnes in vegetables from the year 1991-2013.

FRUITS			VEGETABLES		
Country	Production	Share	Country	Production	Share
China	137066750	21.2	China	573935000	49.5
India	81285334	12.6	India	162186567	14
Brazil	38368678	5.9	USA	35947720	3.1
USA	26548859	4.1	Turkey	27818918	2.4
Indonesia	17744411	2.7	Iran	23485675	2
Philippines	16370976	2.5	Egypt	19825388	1.7
Mexico	15917806	2.5	Russian Federation	16084372	1.4
Turkey	14974561	2.3	Mexico	13599497	1.2
Spain	13996447	2.2	Spain	12531000	1.1
Italy	13889219	2.1	Italy	12297645	1.1
OTHERS	270594597	41.8	OTHERS	261467661	22.6

Table1. World production and percent share in 2012-13

Source: Indian Horticulture Database, NHB, 2013

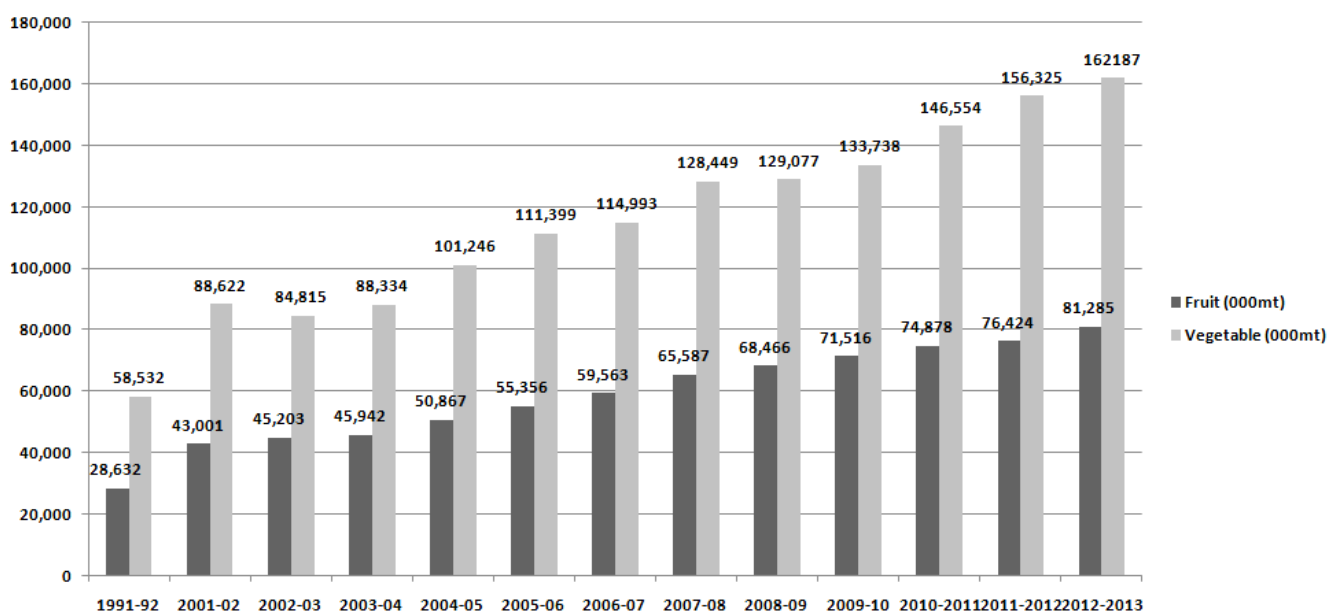


Figure5. Fruits and Vegetables Production in India

Source: Indian Horticulture Database, NHB, 2013

A large variety of F&V are grown in India like Banana, Mango, Apple, Papaya, Sapota, Citrus, Pine Apple, Grapes & Guava etc. in Fruits and Potato, Tomato, Onion, Brinjal etc. in Vegetables. Among Fruits, banana and mango accounted for more than half (55 %) of total fruit production during 2012-13 with the production of 24.86 million tonnes of banana and 17.69 million tonnes of mango. Among Vegetables, potato comprised little less than one third of the total production (28%). Potato along with tomato (11%) and onion (10 %) comprised half of total vegetable production in India (NHB, 2013) .

Various high temperate F&V like apples, oranges, pears, peaches, litchis, plums, tomato, green leafy vegetables etc. are widely grown in Himalayas and tarai region of India and also one of the centers of F&V supply for plain areas and large food processing industries. F&V is one of the most significant and thrust sector of the economy of India. The entire supply chain of F&V in India is laden with the major issue of post-harvest losses and wastages due to various factors.

The present study undertakes a thorough review of basic and contemporary literature available and discussed the issues and challenges related to supply chain of F&V sector in India and suggested the corresponding mitigation strategies.

4.2 TRADITIONAL FRUIT SUPPLY CHAIN OF INDIA

Following is a simple schematic diagram of the fresh fruit supply chain in India. It shows the minimum no. of intermediaries who are involved in the traditional supply chain of fresh fruit and vegetables in India.

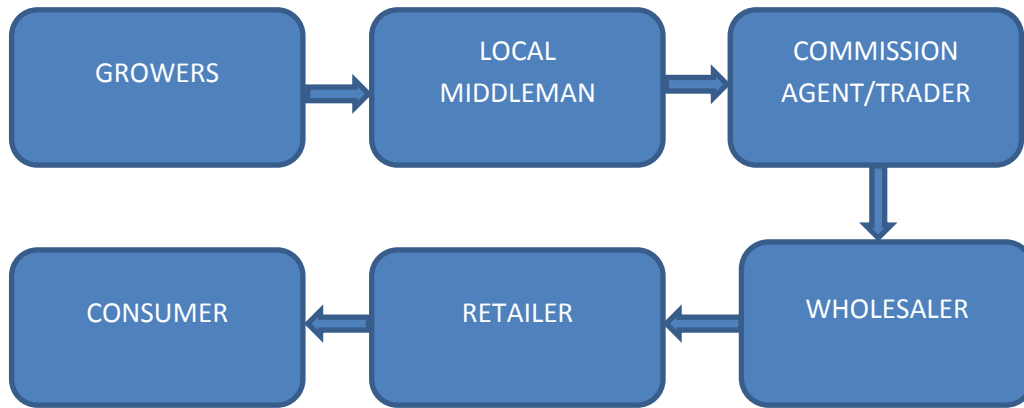


Figure 6: Schematic Diagram of Traditional Supply Chain of Fruits and Vegetables

In India the majority of the trade happens through traditional path. Generally the growers' sale fruits to the local middleman who collects mangoes from different adjacent areas and sales to the commission agent or trader. The commission agents are the middle men who find out buyers for the local middleman and take some commission against the sales made. They generally find out the bigger players or traders who buy fruits in larger quantity. Commission agent collects some money/commission from the traders too. The traders are kind of consolidators who take all small quantities and then consolidate the fruits to bigger quantities of larger varieties and sale those to the wholesaler or the big farms or companies for processing it further. Then the fresh fruits get disturbed through Retailers to the consumers.

The main problem in this supply chain is that the transaction cost is too high due to more no. of intermediaries in the value chain. Only 30-35% of the end price reaches to the mango growers and other part goes to different intermediaries. Following is the product and information flow diagram for mango which provides a fair amount of idea about the fruit supply chain.

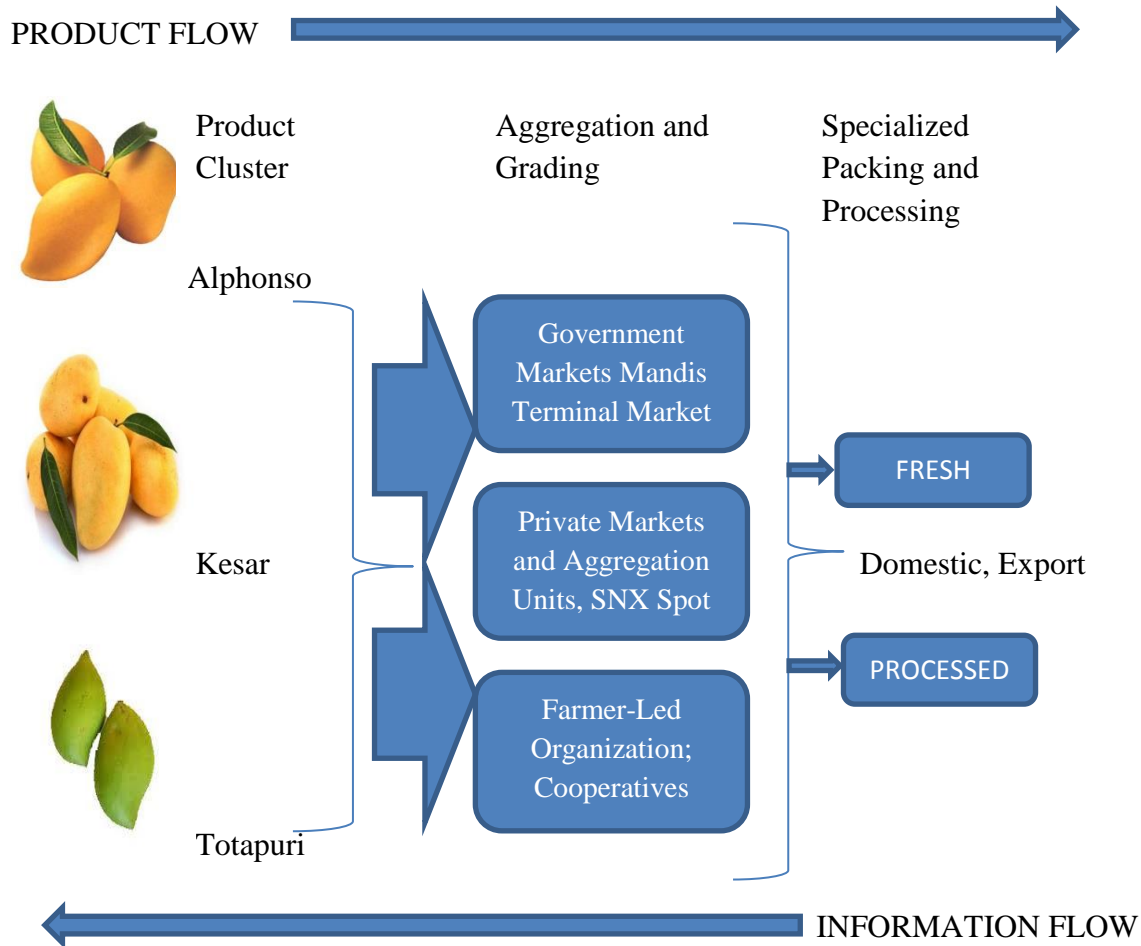


Figure 7: Product & Information Flow

4.3 TRADITIONAL MARKETING CHANNEL

In the following figure the marketing channels of the traditional supply chain of fresh fruits and vegetables of India has been shown. How the different intermediaries are connected with each other has also been shown.

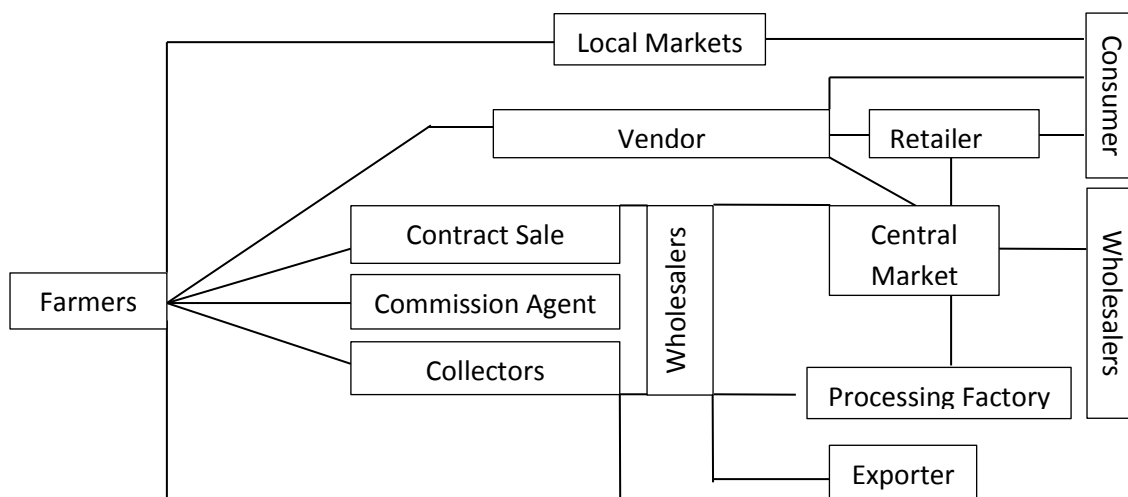


Figure 8: Marketing Channel of fruits and Vegetables

4.4 ROLE OF VARIOUS STAKEHOLDERS

Credit providers: In, HP, the need of farmers for credit is mostly fulfilled by commission agents. These agents advance credit at a commission of 6-8% to small growers for meeting out various costs associated with cultivation on the pre-condition that the produce would be sold through them only.

Agri- input suppliers: At present, the rootstocks suppliers in HP commonly import varieties like MM (Malling Merton) and M (East Malling), propagate them using budding/ grafting/ tissue culture and supply one year old grafts for planting during early springs. Around 732 registered nurseries are involved in HP in propagation of plantlets from imported rootstocks (HP State Horticulture Department). Agri-input dealers not only supply fertilizers and pesticides but also advise the growers on their mode of application, frequency and right composition. Farmers also get information of scientific agronomic practices from Krishi Vigyan Kendra (state extension agency), fairs organized by Y.S Parmar Agriculture University, NGOs and state agriculture department.

Grower: The apple grower takes care of their orchards throughout the year, add manure/ fertilizers, remove weeds and prune their trees. The new generation of growers is now practicing scientific techniques of cultivation learnt through extension agencies.

Grower's cooperative: It was observed during the survey that farmers in about 40 villages of churang and pangana division in Karsog valley of Mandi district in Himachal Pradesh have formed a 'Karsog Valley Farmers Cooperative Society', which is a body of around 350 growers and marketers who now intend to sell their produce directly in big cities under their own brand name "North harvest" and thus get rid from the web of middlemen and increase their price realization.

Pre-harvest contractor: These contractors travel across villages, inspect apple orchards post flowering and fruit formation, generate production forecasts and enter into agreements with farmers. Thereafter, they hire skilled harvesters and packers who take care of plant protection, irrigation, wrapping of poly ethylene sheets around apple bunches and theft prevention.

Harvester: These are experienced laborers who first usually inspect the apples for size and color, then conduct a fruit pressure test through penetrometer, basic starch and TSS test to check if the apple has completed its natural growth and reached optimum levels. If convinced, they pluck it using gentle clockwise rotation to minimize damage to apple and its shelf life.

Packer/ Grader: Apple being perishable needs needs quality packing and sensitivity while handling. In almost every orchard surveyed, apples where sorted, graded and packed manually because the growers having small land holdings could not afford farm based mechanical processing line. However, in bigger units like those of Adani, grading is done through sophisticated high speed computerized machines. The top quality grade apple fetches better price realization to the farmers whereas the culled apple and the surplus left after sorting and grading is packed in a ginny bag and to sent to processing units for making squash, jelly, jams and juices. In HP, the government has set the standards of apple packaging which involves use of inner and outer boxes made of reusable corrugated cardboards. These boxes have capacity of 20kgs and have ventilation holes, cushioning trays to separate different layers of apples. These boxes are further marked for variety, packing date, geographical area, trade mark of producer and weight.

Forwarding agents: Their team of workers consolidates the apple crop to create large sized lots by bringing the packed apples physically on their shoulders and/or through makeshift ropeways to the main road from where they are loaded on trucks for onward transportation.

HPMC/ Corporate buyer: It is a HP government organization involved in procurement, processing and retailing of processed apple products. It procures apples from farmers at MSP (Minimum Support price) set by the government. The price being 10 to 20% less than what is paid by the commission agents is preferred by farmers in case of low market demand especially during peak production time. As on 2008, there are over 85 fruit processing units in HP which are engaged in making value added products like juices, jams, cider, jellies, etc.

Cold Chain Operator: The perishable nature of the commodity makes the role of Cold storage very important. Besides HPMC operated cold storages few private players like “Dev Bhoomi” and “Adani” has also established state of art controlled atmosphere facilities.

Retailers, Exporters and Consumers: These business firms procure the apples from different markets through their agents, create consignments, do necessary documentation and send it to buyers and their agents in different foreign markets. Transporter provides the logistics solution to a considerable part of the apple value chain. The commission agent facilitates the transaction process between wholesaler and forwarding agents. Wholesaler breaks the bulk and facilitates distribution within a particular area. Retailers display and make the apple available to the consumers conveniently at a particular location. The consumers pay the money in return for the value accumulated in the entire value chain and create demand for apples, thus sustaining the entire apple value chain.

4.5 INDIA’S RETAIL REVOLUTION

In the above paragraph the Traditional supply chain of Indian Fresh Fruits and vegetables has been explained. But from last one decade the retail revolution in Indian is taking shape in Indian is taking shape and India is showing tremendous improvement in its retail market development. Conglomerates like Reliance, Future Group, Spencer’s, ITC etc. have developed a very good supply chain in the Indian market. Also MNC’s like Metro (Cash and Carry), ShopRite etc., have also entered Indian market. In the following paragraphs the retail revolution in Indian and the different supply chain involved in the retail market of vegetable has been explained.

4.6 VEGETABLES SUPPLY CHAIN

Retail sector in India is at crossroads today. A shift between organized and unorganized retail sector is apparent, especially in the vegetable retailing zone. This shift is a call for transfer of consumerism towards organized retailing. The penetration of organized retail in the field of vegetable retailing will face fierce resistance from traditional retailers with their existing strong foothold. The resistance from traditional vegetable retail cannot be ignored. The most important thing to note is that the traditional retail format supports a larger population and provides direct employments. So there is no way that government or anyone can discount these foundation stones of Indian economy. The role of government and its policy are vital in supporting, improving and developing traditional vegetable retailers.

Vegetables, fruits and grocery play a vital role for the existence of people and also a very influencing role in the economy. Though fresh fruit, vegetables and grocery retail has been considered as a very low margins business, the market potential has attracted Indian business houses and corporates, driving the forays through different models like single format, multi format and integrated urban -rural models. To attract the global leaders in vegetable retailing, the government allows FDI in cash and carry type business model to the tune of 100 percent. The joint ventures of domestic Indian companies with the global players are allowed to operate India. However, the domestic companies have controlling stake in the vegetable grocery retail. Currently, organized retailers are anchoring the metropolitan cities and urban markets. In the near future, corporate retailers will concentrate on the rural markets, which have been uncovered and have untapped potential. The traditional retailers are unorganized small shopkeepers, Kirana (mom and pop) stores managed by families or individuals. There are two classification of their formats- stores and non- stores. Store formats include stores with permanent and semi- permanent building, ranging around 50 square feet or more size, corner stores and paper and cigarette shops. Non-stores format covers street vendors, cart vendors, mobile vendors (head carrying) and vendors are daily or weekly farmers markets.

An exploratory study has been carried out to understand traditional and organized vegetable retailing and its logistical process.

4.7 VEGETABLE RETAIL SCENARIO

Traditional Indian retailers account for 12 million retail outlets all over India and more than 40 percent of them sell vegetable and grocery (IBEF, 2008). Indian food retail consists of staple commodities comprising grains, pulses, and vegetables. The Indian food retail business, especially vegetable retailing is witnessing a rapid growth in India's organized retail sector. The traditional retailing of vegetables is not very much organized, amounts to 97% of the total market (Ernst & Young, 2006), is extremely localized and fragmented with large number of intermediaries. The intermediaries between the customers and the farmers are the traditional retailers with different outlet formats-mom and pop shops, non-permanent shops in the market, pavement vendors, roadside vendors and push cart vegetable sellers, wholesale traders, commission agents and auctioneers.

The farmers themselves sell their produce directly to the end customer in the local markets, regulated and unregulated 'farmer markets'. Or they sell to intermediaries-agents or organized retailers. The market place is usually in close proximity to the farmland and customers accessing the market live in around locale. Farmers selling vegetables directly to the customer amount to very small fraction of volume. Farmers sell bulk of their produces to the agents and auctioneers. The agents buy small quantities of produces from farmers and transfer it to the wholesalers directly or through another agent. The auctioneers are people who enter into buying a contract with farmers for whole or partial quantity of the produce and sell the produce to an agent or a wholesaler. Auctioneers also transfer the vegetables to wholesalers directly or through other agent. Wholesalers of vegetables sell to retailers- both traditional and organized retailers, sell to customers in mobile-carts and deliver to customers at customer's doorstep.

Wholesale market is a vital link in vegetable supply chain. Both traditional and organized retailers are dependent on wholesale market with different propositions.

It is necessary to study the vegetables retail marketing of the conventional retailers as well as the modern retailers who made their entry in the recent past in to Indian market.

4.8 FOOD MILEAGE

When selling vegetables, the vegetables have to reach the user in the minimum possible time, otherwise it becomes waste. The food mileage of vegetables causes considerable impact on the vegetable due to perishable nature. The term 'Food Kilometers' refers to the distance the food travels from the location where it is grown or processed to the location where it is consumed, or in other words, the distance the food travels from farm to plate. Food miles do not refer to the input material, effort, efficiency, or energy of the crop yield. Food miles are a way of attempting to measure how far has food travelled to reach consumer. That includes the journey from farm to processor, then from processor to retailer and finally from retailer to the consumer. Studies estimate that processed food in the United States travels over 2080 kilometers (1300 miles), and fresh produce travels over 2400 kilometers (1500 miles), before being consumed (Holly Hill, 2008). The food mileage impact is realized by players in the vegetable supply chain from farmers to customers. 'Food Mileage' is an indicator that evaluates impact on economic, social and ecological system and it associates the quality food availability, foods wastage and disposal. 'Food Miles' is a factor to understand inefficiency of food supply chain. In economical or business perspective, every food mile is costly. The transportation cost is directly proportional to the food miles. Every mile addition in transport is addition in the cost of the goods and the customer pays for it. The more the vegetable travel in miles, the less fresh they become. This means customers pay for vegetables, which have less nutritional value. Alternatively, to retain freshness, conditioning is required while transporting. Conditioned transport again adds cost to goods. When the food travels less; the money is reinvested closer to the farm land community and more financial contribution is provided to the local economy. Local farmers who sell directly to consumers receive a larger share of the profit for their food. The local family farmer spends their money with local merchants and builds a stronger local economy. Local farmers who sell directly to consumers receive a larger share of profit for their food. The local family farmers spend their money with local merchants and build a stronger local economy. The social impact of higher food is the food that consumes in from abroad. The different food safety standard is more vulnerable to unsafe food. Vegetables with less mileage are fresh, preserve original taste, retain initial ingredients and more palatable. Less food miles create more sense of closeness and trust. Ecologically, 'Food Mileage' is a convenient indicator of sustainability and sustainable development; wherein less food miles indicate more sustainability. Reducing food miles is reduction of emissions. Shorter distance travel leads to reduced usage of fossil fuels and thus, conservation. Minimum food travels signifies minimum pollution, environmental degradation and global warming.

Vegetables travelled in different routes log different mileages. Effects of the 'Food Mileage' on the players of the vegetable food chain can be traced. The food mileage has been expressed in kilometers;

“minimum” mileage is the shortest distance travelled by a vegetable and “market” mileage is the average mileage of the same vegetable. The minimum mileage distance is contributed by very small quantity, which is less than 0.5% of the daily transactional volume.

Business leaders have adopted food miles as a model for understanding efficiency in a food supply chain. Ecologists consider food miles as indicators of sustainability and different segments of people and different agencies perceive food miles differently. There is a need felt to study the food mileage for vegetables in India with current infrastructure and market condition. As time taken between any two points was not observed, speed at which vegetables reaches its destination has not been studied. The comparison of different business models by efficiency, mode of transport system and infrastructure facilities are beyond the scope of this study. This is the limitation of this study and it provides the scope for further future research.

4.9 VEGETABLE RETAIL MODELS

Distinct and primary routes adopted in the retail vegetable marketing have been revealed by this exploratory study. The study found three business models of vegetable retailing. Traditional retailers follow “Traditional Retail Model” (TRM) and organized retailers implement two different business models- “Hub and Spoke Model” (HSM) and “Value Chain Model” (VCM). “Reliance Fresh” (Reliance Retail Ltd.) strategically deployed value chain model and rest of the organized players in the industry go with Hub and spoke model with minor modifications to fit to their marketing and logistical Strategies.

4.10 TRADITIONAL RETAIL MODEL

“Traditional Retail Model” is a complex route for the logistical flow of vegetables, which is predominantly followed currently in traditional retail marketing. Figure 1 outlines the logistical route of TRM of vegetable retail marketing. Players involved in this model are agents (commission agents), auctioneers, wholesalers, traditional retailer of all type of formats family run ‘mom and pop’ stores, roadside shops, pavement shops and cart vendors apart from farmers and customers, Agents, auctioneers, and wholesalers are traders in vegetable marketing . Farmers are the cultivators of produce and source of vegetable supply. They are small by land holding and yield volume of crop and are highly fragmented across geographical areas. In this traditional retail mode, farmers sell their products to customer and to agents intermediately, Agent and auctioneers are first level of middlemen in vegetable supply chain and transfers vegetable from customers to wholesalers, Numbers of transfers of ownership as well as transshipments of vegetable depend upon the number of agents present in between farmer and wholesalers. An agent operates from shops of small space, works for one or more wholesalers and normally deals with a particular range of vegetables; Most of the wholesalers deal with specific vegetables(s) only and there is very few exceptions in the range of products. Normally wholesalers do not get involved in transportation of vegetables, both inward and outward transportations. The traditional retailers buy vegetables, from wholesalers and sell directly to customers constitute small domestic customers who buy vegetables for household consumption from traditional retailers, and Hoteliers who buy for commercial consumption procure their vegetables from the wholesale market.

Vegetable logistics in TRM have four phases producers (farmers) to (commission) agents, agents to wholesalers, wholesalers to traditional retailers and traditional retailers to customers. In the first phase, vegetables are transported from farmland to agents. Farmers are responsible to bring the vegetables to agent’s premises. In case of contract, the auctioneers take care for the transportation of vegetable from farmland to his premises and transportation is seller’s responsibility for the transaction of vegetable between the agents and auctioneer. Agents arrange to pick up vegetables directly from farming locations

to deliver at wholesaler's premises of for huge volume of produce and cost of transport is on farmers account. The second phase of vegetable movement starts with outward transportation form agents to wholesalers. Traditional retailers, cart vendors and commercial customers buy vegetables and make their own arrangement for transport from wholesale market to their destinations. The retailers jointly hire a truck to share the transportation cost. Customers and retailers are the player in the fourth phase. Domestic customers shop for their vegetables at traditional retailers stores that are conveniently located closer to their residence and walk down. Vegetables are delivered at door steps of the customer by cart vendors who sell vegetables in push cats, tricycles, and bullock carts.

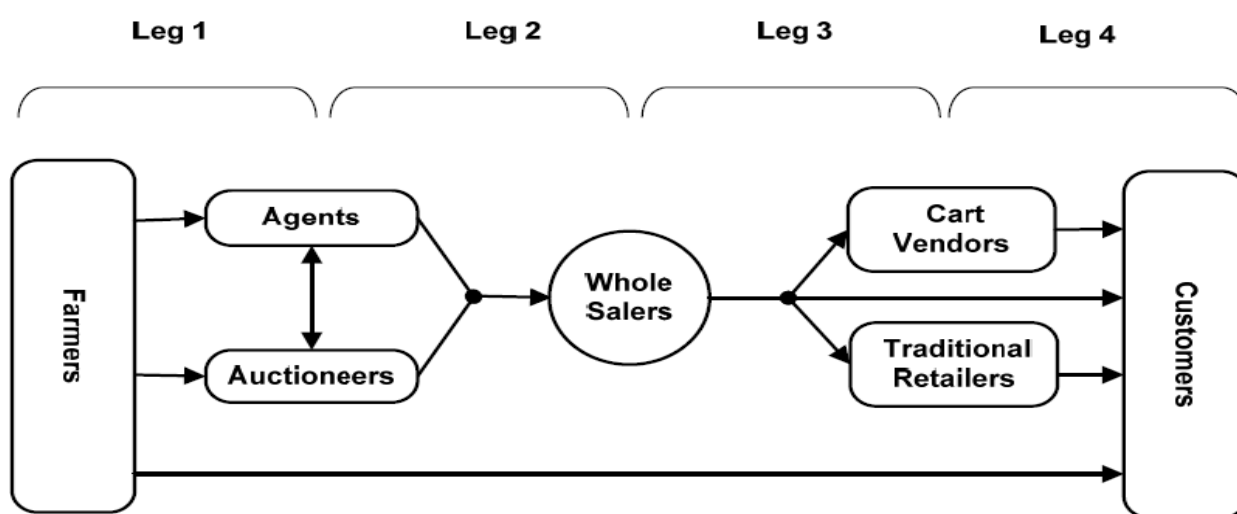


Figure9. Supply Chain of Traditional Model

Source: Halder & Pati (2011)

Cane baskets and jute or gunny bags are used in handling vegetables. Loading and unloading are carried out manually. Vegetables are not cleaned and washed of dirt and soil. Sorting, Grading and packaging of any kind is being done. No temperature controlled storage or warehousing is used across the TRM route. Information technology and advanced management techniques are not deployed. Movement of vegetables in this Traditional Retail Business model has four legs.

Leg 1: The first move in vegetable journey starts with the transportation of vegetables from farmland to agent. Farmers are responsible for bringing the vegetables to agent's premises. In case of contract, the auctioneers take care of the transaction of vegetable from farmland to his premises and transportation is seller's responsibility for the transaction of vegetable between the agents and auctioneers. Mode of transports are mini truck, farm tractor, bullock cart, bicycle, tricycle, motorcycle and head carrying.

Leg 2: Mode of transports is unconditioned trucks and for shorter distance farm tractors are used agents make arrangements to pick up vegetables directly from farming locations to deliver at wholesaler's premises for huge volume of produce.

Leg 3: Buyers of wholesalers make their own arrangement for transport from wholesale market to their destinations. The regular modes of transport for them are mini truck, motorcycle, bicycle, tricycle, and pouch cart.

Leg 4: Domestic customers who reach the vegetable retail shop by walk. The average distance is less than half a kilometer (average distance has been rounded off as 1 kilometer in table 1).

4.11 HUB AND SPOKE MODEL

At present, organized retailer including prominent players like Spencer's Retail, Food Bazaar (Pantaloon Retail (India) Ltd) are adopting "Hub and Spoke" business model of retail vegetable marketing. Figure 2 illustrates the Hub and Spoke business model of retail vegetable marketing fewer player are involved in this model compare to the traditional retailing model. Farmers, organized retailers, wholesalers and customers, form this chain. Buying centers, hub and stores (retail outlets) are operational units of the organized retailers. Small farmers and contract famers who executed a trade contract with the organized retailers are the primary source of supply of vegetables to the organized retailers, the buying centers make the vegetables purchases directly from the farmers and transport to the hubs. A hub is served by one or more buying centre and serves one or more hubs. Hub infrequently buys small volume of vegetables form the local wholesale market to balance demand supply gap. Hub in turn distributes vegetables to stores attached to it. A store is served by only one hub. Store sells vegetables in retail quantity to the customers'.

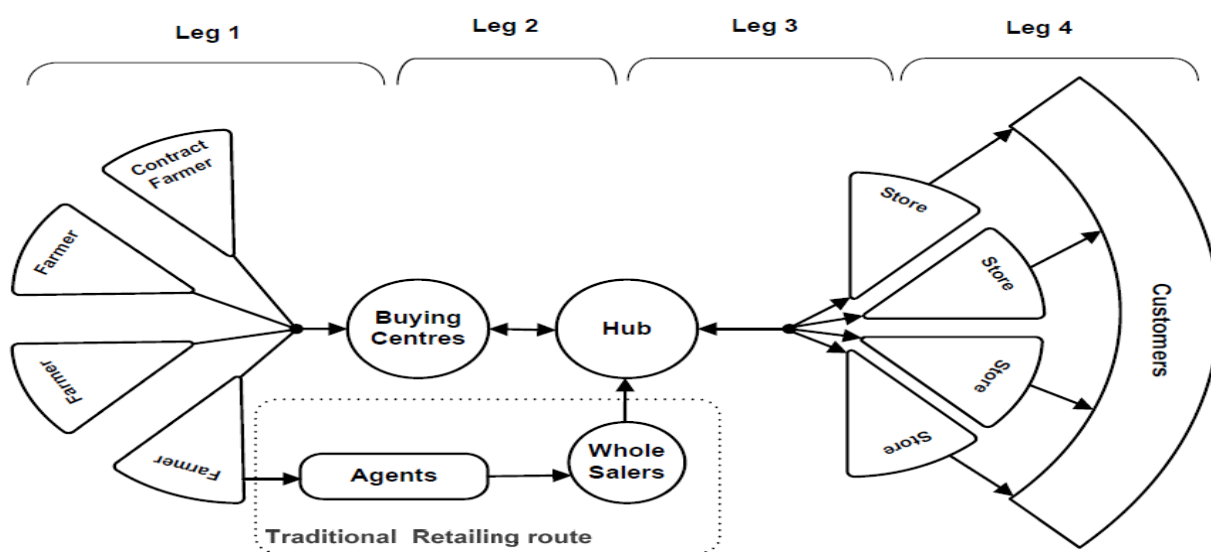


Figure10. Supply Chain of Hub and Spoke Model

Source: Halder & Pati (2011)

Vegetables travel in four phases, namely farmers to organized retailer's buying centers, buying centre to hubs, from hub to retail stores and retail outlet to customer. Farmers transport vegetables, from farming location to the buying centers. The transport of vegetables in the second phase from buying centers to hub is arranged by buying centre. Mode of transport is unconditioned trucks. Fresh vegetables are transported in the third phase from hub to stores and shelf life –expiring vegetables are returned from stores to hub. The shelf life- expired vegetables are sold to cart vendor. Customers buy and pick up vegetables from the organized retail stores

The stores offer home delivery for a shorter coverage area and high value of purchases. Vegetables are handled in stackable plastic crates and corrugated fiberboard boxes. The loading and unloading are carried out manually. Vegetables are cleaned and washed at the hub on arrival. The sorting and grading is done at the hub without packaging. The space available for temperature-controlled storage is very less, but warehousing is used or it. Information technology and advanced management techniques are deployed partially. Connectivity between hub and corporate office is established. Transportation of procured vegetables has four legs.

Leg 1: Farmers transport vegetables from farming location to the buying centers. Modes of transport are mini truck, farm tractor, bullock cart, bicycle, tricycle, motor cycle and baskets. Buying centers arrange to pick up vegetables in a truck from the farm gates of the contract farmers.

Leg 2: The transport of vegetables from buying centers to hub is arranged by buying centre and mode of transport is unconditioned trucks.

Leg 3: Fresh vegetables are transported from hub to stores and shelf life-expiring vegetables are picked up from stores to hub. Mode of transport is unconditioned small trucks.

Leg 4: Customer buys and pick up vegetables from the organized retail stores. The modes of transport are motorcycle, car and public transports vehicles.

4.12 VALUE CHAIN MODEL

Currently, organized retailer Reliance Fresh (Reliance Retail Ltd) follows a Value Chain business model (VCM). Organized retailers who adopt VCM procure the produces directly from famers and sell to customers by avoiding intermediaries. This model is based on its core growth strategy of backward integration and progressing towards building an entire value chain starting from the farmers to the end consumers. Very fewer players are involved in this model compared to the traditional retailing model or organized retailer’s hub and spoke model. Famers, organized retailers, and customers are the players who form this value chain. In this practice, farmers, organized retailer’s operational units, consolidation centers, hub (distribution center’s) and retail outlets stores, and customers are players. Small farmers, contract famers and lease farmers and the primary source of supply of vegetables to the organized retailers, Contract farmers and lease farmers are farmers who execute a trade agreement with the organized retailers for sale of vegetables. Figure 3 illustrates the VCM business model of vegetable retailing. Vegetables move form farm locations to customers in four phases farmers to consolidation centers, consolidations Centre’s to hub, hub to retail outlets (stores) and stores to customers, Independent farmers supply their produces to the consolidation Centre’s; contract farmers and lease farmer’s produces are picked up by consolidation centers’. One consolidation centre supplies vegetables to multiple hubs. Depending upon the product. Hubs get direct delivery form the contract farming locations.

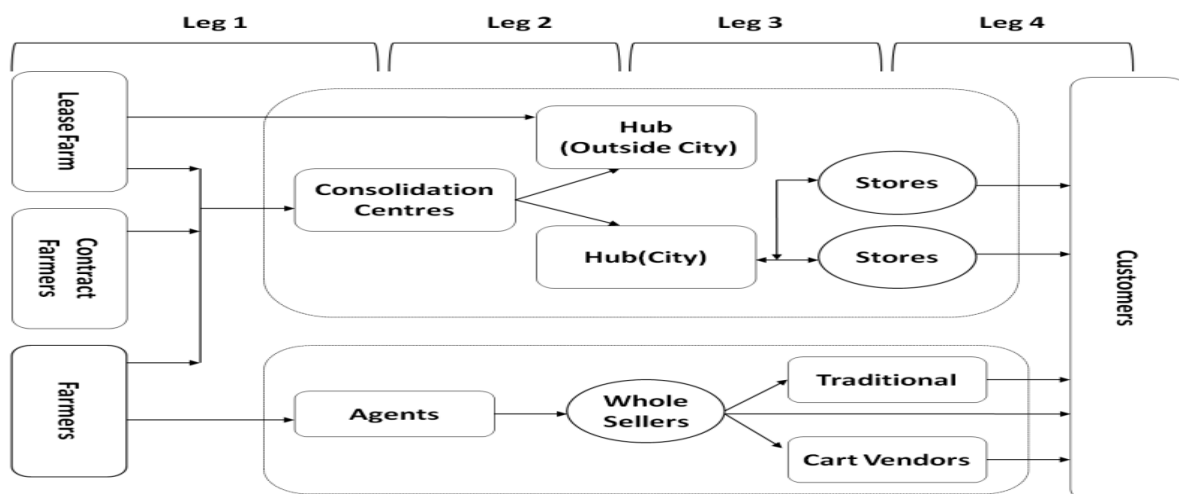


Figure11. Supply Chain of Value Chain Model

Source: Halder & Pati (2011)

The hub takes care of supply of vegetables to retail outlets. It has supply coverage to all stores of a specific geographical area. A hub is served by one or more consolidation Centres and a consolidation centre serve one or more hubs. A store is served by only one hub. Store sells vegetable in retail quantity to the customers and is the last phase of distribution in VCM business model. The hub disposes off the shelf life-expiring vegetables and do not sell to cart vendors. Value business model differs from hub and spoke business model in dependency on wholesales market and supply link between hubs. The hub in the VCM disposed off the shelf life-expired vegetables, but hubs in HSM sell off to the art vendor. Stackable plastic crates, pallets and corrugated fiberboard boxes are used in handling vegetables, The loading and unloading are done with semi-automatic platform trolleys and hydraulic stackers, Vegetables are cleaned and washed at the hub on arrival. Preliminary sorting and size sorting is done at the hub itself. Wrapping machine and film packing machines are used at the hubs. Every hub has warehouse and space is available for temperature-controlled storage. Implementation of information technology and advanced management techintgues are in progress. Connectivity between stores (retail outlets), hub and back offices is established. Vegetable transportation has four legs.

Leg 1: Farmers transport vegetables form farming location to the consolidation centers. The modes of transports are mini truck, farm tractor, bullock cart, bicycle, tricycle, and motorcycle. Consolidation centers arrange to pick up vegetables in a truck form the farm gates of the contract farmers and lease farmers. Consolidation centers also arrange to pick up vegetables form farmers if the volume is considerably high.

Leg 2: The transport of vegetables from consolidation centers to hub is arranged by consolidation centers and both temperature-conditioned and unconditioned tucks are used. The hubs get direct delivery form the contract farming locations.

Leg 3: Fresh vegetables are transported from hub to stores twice a day and collection stores return shelf life-expiring vegetables to hub for disposal once a day in unconditioned small trucks.

Leg 4: customers buy and pick up vegetables form the organized retail stories. The stores for a shorter coverage area and high value of purchase provide home delivery.

4.13 PRIVATE SECTOR INITIATIVES

There are several private sector initiatives in the food processing and service sector. A number of companies are actively working on integrating the agriculture supply chain. Here we mention a few of them. These show the feasibility of operating efficient cold chains in the India scenario. They could be treated as pilots and other projects can be built emulating them. Here we consider the following cases

- McDonalds-India, a fast food service operator growing its own ingredients such as lettuce, potatoes, etc.
- Amul which is a highly successful cooperative dairy in Gujarat.
- E- Choupal which is an ITC success story of procurement of produce from small farmers is an example of supply chain management Indian style.
- There are other examples such as Bombay dabba walah which is an excellent example of six- sigma forward and reverse logistic delivery. Also, ITC, Mahindra and Rallis together are creating a network of service providers who offer information on weather and prices, credit, transport and assured demand.
- Food bazaar has teamed up with ITC Choupal Fresh to provide better service to customer at cheaper rate and have removed lots of inefficiencies of the supply chain.

FACTORS AFFECTING SUPPLY CHAIN

5. FACTORS AFFECTING THE FRUITS AND VEGETABLES SUPPLY CHAIN

Availability of cold storage

Cold chain is a logistic system that provides a series of facilities for maintaining ideal storage conditions for perishables from the point of origin to the point of consumption in the food supply chain. The chain needs to start at the farm level (eg. harvest methods, pre-cooling) and cover up to the consumer level or at least to the retail level. A well-organized cold chain reduces spoilage, retains the quality of the harvested products and guarantees a cost efficient delivery to the consumer given adequate attention for customer service. The main feature of the chain is that if any of the links is missing or is weak, the whole system fails.

The cold chain logistics infrastructure generally consists of

- Pre-cooling facilities
- Cold Storages
- Refrigerated Carriers
- Packaging
- Warehouse and Information systems
- Traceability
- Financial and Insurance Institutions

The temperature controlled supply chains are a significant proportion of the retail food market. Fast foods, ready meals and frozen products have increased market share in recent years. There are several food temperature levels to suit different types of products. Frozen, cold chill, medium chill, and exotic chill are some of the frequently nomenclatures with identified temperature ranges. The range of temperature is dependent on the product whether it is meat or ice cream or potatoes or bananas. Failure to maintain appropriate temperature regimes throughout the product life cycle may shorten the product life or adversely affect its fitness for consumption. Cold chain management involves maintaining appropriate temperature regime when the product travels from the farm in Himachal Pradesh to the consumer in London or New York City. That is why the logistic challenge is formidable in food chains, which is cost conscious industry. There are several governmental regulations in all countries and the responsibility to maintain hygiene and standards falls on the food retailer or manufacturer. The recent developments in

electronic tagging could be useful for monitoring the temperature and also the shelf life of the product. This is generally absent, but critical segment in Indian logistics infrastructure.

We have realized that there is great amount of wastage happening post-Harvest. This wastage is being estimated at 25% of total produce or approx. Rs. 50000 Cr US \$ 10 Billion. Shortages of cold storage facilities and Refrigerated transport lead to inefficiency in handling perishables which manifest in into wastages. Some estimates say that the post-harvest losses of fruits and vegetables in Great Britain.

So end to end cold chain solution is required which will provide suitable transportation conditions from farm gate to wholesaler / distributor to retailers/chain/fruit marts. And these facilities have to be available across infrastructure of cold chain in India.

Government Policies: Food and Agriculture are important national activities and affect the well-being of its population of every country. In formulating the policies of farming production, processing, distribution and retailing and also in financing these activities the Government play leading role. This becomes all the more important in view of the globalization of the food industry. Allowing foreign operations for food productions, distribution and retailing is a decision of national importance. The decisions need to be consistent all along the supply chain and mutually reinforcing and not contradictory. There are several regulatory measures handled by multitude of departments divided between State and Central governments. While some of this is inevitable but streamlining by looking at the supply chain would be extremely productive. Further, research should be initiated to develop indigenous packaging materials, machines, laboratories for developing new food products and more importantly protocols for storage and processing food raw materials.

Connectivity: Connectivity is a major issue here in India and its playing a vital role in supply chain inefficiency. The road infrastructure is not good in India. Many villages are not connected with proper roads. So, transferring goods from these locations is a real challenge. Also the trail connectivity is not that good. Lots of development in these aspects needs to be done to improve the supply chain efficiency.

Sorting Grading Technology: In generally in India most of the cases the sorting is done by the farmers itself and they have very less knowledge about the grading techniques and processes. The sorting and grading is been done by hand thus some improvement in the sorting and grading technology is needed to improve the supply chain efficiency.

Handling & Packaging: The proper handling and packaging facilities are not available in all the locations and because of this reason lots of fruits and vegetables are getting wasted and the quality also

getting deteriorated. To reduce wastage proper training and knowledge about packaging and handling needs to be provided to different intermediaries and to the growers.

Skilled Labour: Good number of skilled labour is not available for sorting, grading and packaging. Proper training is required and government should build some institutions where training on sorting, grading and packaging can be provided. So that the countries fruit and vegetable supply chain becomes more efficient.

Poor linkage in the marketing channel: Information flow in the marketing channel partners don't happen properly and thus demand supply gap are huge and other factors like price discovery etc. gets affected. The blockage of information also leads to the supply chain efficiency.

Standards: No scientific standard followed for a determination of maturity. Mostly based on expertise, sometimes colour (litchi, mango), softness (mango), attainment of size (banana, jackfruit). Harvesting before maturity because of sudden market demand (Festival), or getting higher price early in the season, avoiding pest incidence after rain etc. increases supply chain inefficiency and results into inferior quality and low price in the market. So it's necessary to follow certain standards and the farmers also need to be trained on the same.

Harvesting Method: Hand picking, by climbing on the tree (mango, jackfruit etc.), with a notched stick having a pouch etc.

Result: Accidental falling of fruits, resulting brushing brushing and crushing of fruits. Estimated loss between 5% (jackfruit) to 15% (mango). Mechanical injury allows entry of pathogen and thereby leading rotting during operations.

Handling: Assemble the fruit on the ground – in shade or even without shade. Informal sorting and grading-removal of highly damaged fruit and very small size fruits. These results into low market price, black strain on the peel of mango and low market price and low storage life.

Packaging at farm level

In gunny bags- guava, mango, bael, ber

In cloth bags- guava, mango

In bamboo basket covered with leaves- guava, mango, litchi, papaya

Without any packaging- banana, pineapple, jackfruit

Wooden box- litchi, mango

Plastic crate- litchi

Cushioning materials- newspaper or leaves of the same fruit, covering with newspaper or banana leaves. These techniques lead to damage of fruits and thus low quality and lesser price.

Transportation from farm:

Rickshaw van- mango, banana, guava, jackfruit

Trucks- banana, mango

No control on temperature and humidity

Packaging bags/boxes of different weight, sizes, commodity in the same carrier

Due to these unsafe ways of transportation wastage is very high. Fruits need to be transported safely so that no damage happens while transportation. And the slower mode of transportation like Rickshaw van takes more time and thus reduces the product's useable life after it reaches to the customer.

RECOMMENDATIONS

6. RECOMMENDATION

Food Packaging

Packaging is very important. Packaging is something which protects the products from damages and also it give a kind of identity to the product. And as fruits and vegetables are perishable more care and newer technology have to be applied while packaging, cost has to be reduced through use of manufacturing automation (wherever possible) and economies of scale.

Standards

Standardization is a powerful tool for improving the supply chain efficiency. There are two kinds of standards in the food supply chain. The first one is the food standard that concerns itself about the content, grade, and the quality of the fruits and vegetable. The second concern regarding the logistics and IT systems like standardization of cartons, pallets and IT software so that seamless transfer of goods and information is possible. Standards enable partners across the supply chain to enjoy increased productivity and economies of scale due to better compatibility and interoperability of their systems and processes.

Training

The food supply chain is going through a period of great change and needs to be supported through new organizational forms manned by specialists. Training, coaching, counseling and mentoring have to be extended to all the parties in the supply chain. For example, it is important to conduct courses and training sessions on cold chain management to raise the knowledge and awareness on the importance of implementing the cold chain management to ensure that there is no breakdown in maintaining the temperature throughout the supply chain. In this way a pool of skilled workforce with good knowledge of cold chain management need to meet the needs of the industry to be a cold chain will be generated. The same applies to other areas in the food supply chain such as procurement, retailing etc. The farmers and the labourers also have to be trained on packaging, grading, sorting, and other necessary sectors.

Sorting and Grading Technology Improvement

Improvement of the sorting and grading technology is required, is very important if supply chain efficiency have to be improved. Improvement in the technology will reduce the time required for these work and will help in making the supply chain lean.

Improvement in the distribution system

The distribution system has to be improved. The number of intermediaries has to be reduced to make the supply chain more efficient. Direct sourcing from farmers has to be encouraged to provide greater benefits to the customer.

Forecasting methods needed for farmers

Till now generally the farmers produce to the maximum extent which they can produce as a matter of routine. No forecasting technique is used to predict the demand of the market and so no input or guidelines provided to the farmers on the amount to be produced. So, I think forecasting methods needs to be provided to the farmers to find out how much to produce.

Lack of transparency in the marketing channel

The partners don't share information with each other properly. Due to this many factors like Price, Demand, availability, customer preference etc. are not known to all the channel members. This is one of the major reasons for inefficiencies in the supply chain.

Information Technology System

Implementation of IT system in the supply chain will definitely improve the information sharing between the channel partners and also will improve efficiency of the supply chain. With the advance technology like RFID and with the help of IT system the supply chain can be taken to a greater height. IT is almost necessary in all kinds of industry to become competitive in the market.

Infrastructure

Development of infrastructure is a must. Development of more number of cold storage, developing more roads and connecting more number of villages is necessary. At the same time other infrastructural development like development of cold chain is also required.

Information Centre

Some kind of information centre, which will provide information like weather forecast, government policies, technologies available, loan information etc. to the farmers, is required. This will help the farmers to plan its activities more efficiently.

Adopt Best Practices

Storage: Postharvest storage facilities should be good, so that the fresh fruits and vegetables can be protected for a longer time. Collection Centres should also have adequate storage facilities. Cold chain should be provided for end to end operations.

Packaging: Special purpose containers to prevent damages during handling and transport of commodities. Protection from contamination is required, so that the quality of the commodities don't get deteriorated. Not imparting any toxic substance.

Handling: Specialty handling tools and equipment is needed to reduce wastage during handling and to reduce the time consumed too.

Transportation: Freighters can be contacted and can be given the full responsibility of the transportation task. Multimodal transport service should be used to take full advantages of the entire infrastructure available and to reduce the time to make the commodity available to the customer.

Productivity	Precision farming through cluster approach by adopting greenhouse and hydroponics cultivation
Quality Management	Quality inputs, organic farming, good agricultural practices, and management.
Post-Harvest Management	Establishing collection and processing centers in each growing clusters because premium crops are climacteric in nature and are highly sensitive to change in temperature they need proper cold storage chain till point of sales to the end consumer.
Packaging	Innovative and attractive customized packing so that material is safe during transportation.
Transportation	Refrigerated vans.
Storage	Cold storage near production areas.
Marketing	Direct marketing to customers, aggregators, hotels and establishments.

ENABLES

Fast growth in organic products.

Cash and carry of organic fruits and vegetables.

Good profits due to higher selling rates.

Changing food habits of rising middle urban class due to rise in their income.

Modern retail outlets in urban clusters.

Government support with Foreign Direct Investment.

Income and employment generation.

CONCLUSION AND DISCUSSION

7. CONCLUSION

The whole supply chain in this sector suffering from maximum inefficiency and facing the biggest problem of Inadequate cold chain storage and transportation facilities, Fragmented and long supply chain, high cost of packaging, poor distribution etc. (Dharni & Sharma, 2008).

India is all set to become the food supplier of the world. It has the cultivable land, all the seasons for production of all varieties of fruit and vegetable, well developed agribusiness system that works in its own way. Factors such as rapid growth in the economy, the technological innovations in home appliances such as refrigerators, microwave ovens, rise of families with dual incomes and the changing food habits of the population all point to the increasing need for healthy processed food. The supply chain sector is very weak with no process owner and this can spell disaster. The food supply chain needs the attention of the academics, the industry and the government.

Presently, different business models of fresh fruits and vegetable marketing are tested by the organized retailers and they are rapidly evolving. Compared to traditional retailers, modern retailers are evidently cutting themselves off from the clutches of middlemen in different ways. This study finds that organized retailers offer significantly higher prices for the vegetables than their traditional counterparts to the farmers and payments is faster or payment is on delivery. This is one of the benefits of selling it to the organized retailer. Organized buying Centres are closer to the farm locations. Farmers save on travel time to the Mandi (traditional wholesale market) and on the hours spent waiting for auction. They do not have to pay for transportation and offloading, which is borne by the retailer. The electronic scales of organized retailer are more reliable than the local Mandi mechanical scales. The middlemen tend to round off the weights, which organized retailers never do.

In traditional business model, wholesalers are intermediaries and a predominant link in the retail vegetable logistical chain. In general, all the retailers are inevitably dependent on the local wholesales market. Currently, traditional retailers are protected from the competition from the global retail leaders either directly or indirectly by the government. The expanding retail market requires parallel expansion of infrastructure and market related technologies at least to match their speed and economies of scale. The major constraints are poor transport facilities, non-availability of large scale cold storage, no clear policy guidelines from the government, and fragmented and small farmers.

In India, organized retailing in fresh fruits and vegetables is gaining a lot of impetus with huge investments by leading Indian corporations. India opened up post 1990, a number of new liberalized public markets for fruits and vegetables in the WTO regime. Forward and future markets have been

identified as important tools of price stabilization and risk management. The study concludes that there is an immediate need to replicate such models in a much larger scale. The study suggests that it is mandatory for both the public and private retail markets who adopt the new models of supply chain to enhance the distributional efficiency of the marketing system.

Fruits and Vegetables (F&V) sector in the case of agriculture and allied sector in India account for a significant share in the world production. This paper presents a status of F&V sector supply chain in India, supply chain efficiency, and highlights the need & importance of efficient supply chain to remove various bottlenecks and reducing the losses and wastage in this sector. The study and research conducted on the supply chain of F&V sector in India suggest that the supply chain is highly inefficient which is leading to huge losses and wastages and less income to the stakeholders. F&V sector in India is a very growing sector and presents a huge opportunity to the stakeholders and entrepreneurs through setting up the cold chain infrastructure and food processing units.

As Indian economy is based on agriculture and there are huge potential to serve domestic or global markets through various value addition, development of intelligent and efficient supply chain will play a crucial role in reducing the losses and wastages, increase in farmer income, increase revenue from export, generate employments opportunities for the local peoples, and improve the livelihood of the farmers which leads to developing the economy and help India to emerge as a global leader in Food Sector. The paper examines the existing position of F&V sector in India. After giving a conceptual coverage of supply chain management, the supply chain relating to F&V sector is studied. Then, the efficiency of F&V supply chain is analyzed and the need & importance of the research for efficient supply chain in F&V sector has been discussed. It has been evident from the literature that the F&V's supply chain is highly inefficient. The present study undertakes a thorough review of basic and contemporary literature available and attempts to identify the business problem in the supply chain of F&V sector in India.

The study and research conducted on the Supply chain of F&V in India suggest that there is a lack of cold chain infrastructure and Food Processing units which are leading to maximum inefficiencies and resulting to losses and wastage of F&V in India.

India's F&V sector is a very growing sector and presents a huge opportunity for the development of the rural areas through setting up the cold chain infrastructure, food processing units and other infrastructural facilities. The study indicated that Cold Chain Facilities; Fragmented Supply Chain; Linkages and Integration between the partners; Taxation Issue; Infrastructure Facilities; Cost of Packaging Material; Technology and Techniques; Farmer's Knowledge and Awareness; Quality and Safety standards; Processing and Value Addition; Supply Chain inefficiency; Farmers income; Supply chain losses and

wastage of fresh produce; Transportation facilities; Demand and market information etc. are the factor which constitutes serious challenges for F&V sector in India and are affecting the growth of the development of economy as a whole. As Indian economy is based on agriculture, there is a need to encourage developing up of supply chain infrastructural facilities which may play an important role in increasing the shelf life of the F&V and in turn reduce the losses and wastages in F&V, increase in farmer income, generate employments opportunities for the local peoples, and improve the livelihood of the farmers which leads to the development of hilly & rural areas and Indian economy as a whole.

7.1 FUTURE RESEARCH DIRECTIONS

To the best of our knowledge, the concept of efficient supply chain of F&V sector in India is still in a nascent stage and several possible future research directions can be defined. Addressing the problem of supply chain losses and wastage, transportation and storage can be the area of focus. Most significant logistics activity leading to supply chain inefficiency can be identified. Next, developing a framework to improve the supply chain efficiency of F&V sector can be a very interesting area of study.

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