



Fruits and vegetables Supply Chain in India

Contents

1. Executive summary:.....	4
2. Introduction:	5
2.1 Food Supply Chain Cluster:	6
3. Objective and scope:.....	7
4. Methodology:.....	8
5. The Global Market Scenario:.....	8
6. India Scenario of Fresh Fruit and Vegetables Market:.....	12
7. Indian Fresh Fruits and Vegetables Supply chain:	13
7.1 Traditional Fruit supply chain of India:	14
7.1.1 Traditional Marketing Channel:	16
7.2 Existing apple Value Chain in the major apple producing districts of H.P:.....	17
7.2.1 Role of various stakeholders:.....	18
7.3 India's Retail Revolution:	21
7.3.1 Vegetables Supply Chain:.....	21
7.3.1.1 Vegetable Retail Scenario	22
7.3.1.2 Food Mileage:	23
7.3.1.3 Vegetable Retail Models	24
7.3.1.3.1 Traditional Retail Model	24
7.3.1.3.2 Hub and Spoke Model.....	27
7.3.1.3.3 Value Chain Model.....	28
7.4 Private Sector Initiatives:	30
8. Factors Affecting the Fruits and Vegetables Supply Chain:	31
8.1 Availability of Cold Storage:	31
8.2 Government Policies	32
8.3 Connectivity:	33
8.4 Sorting and Grading Technology:.....	33
8.5 Handling & Packaging:	33

8.6 Skilled Labour:.....	33
8.7 Poor linkage in the marketing channel:.....	33
8.8 Standards:.....	34
8.9 Harvesting method:.....	34
8.10 Handling:.....	35
8.11 Packaging at farm level:.....	35
8.12 Transportation from farm:.....	36
9. Recommendation:.....	37
9.1 Food Packaging.....	37
9.2 Standards.....	37
9.3 Training.....	37
9.4 Sorting and grading technology improvement:.....	38
9.5 Improvement in the distribution system:.....	38
9.6 Adopt the best practices:.....	38
9.7 Forecasting methods needed for farmers:.....	39
9.8 Lack of transparency in the marketing channel:.....	39
9.9 IT System:.....	39
9.10 Infrastructure:.....	39
9.11 Information Centre:.....	39
10. Conclusion.....	40
11. Bibliography:.....	41

1. Executive summary:

In India, about 60 percent of 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 the 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 equipments); 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 retailers identify superior suppliers and distributors and help them improve productivity, which ultimately brings down the customers costs. At the same time, Market logistics helps planning the infrastructure to meet demand, then implementing and controlling the physical flows of material and final goods from point of origin to points 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 in countries like the 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 growing in size and their bargaining power is likely to increase. Probably that would bring some kind of mutual understanding between manufactures 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 no 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 loop whole 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.

2. Introduction:

India is one country where the 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% employment and 18% of country's export. India is 2nd largest producer of Fruits & Vegetable in the world. India is the 2nd largest vegetable Exporter. India's share is only 1% 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 efficient 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 stake holders. In India, the infrastructure connecting these partners is very weak. Each stake holder: farmers, wholesalers, food manufacturers, 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, goods movement synchronization through efficient transport

scheduling, are very well practiced in high technology industries with immense benefits. These best practices should find their way in to the food supply chains. Cold chain logistics supply chains should take advantage of technology improvements in data capture and processing, product tracking and tracing, synchronized freight transport transit times for time compression along the supply chain and supply –demand matching. Also, the supply chain need to be designed and built as a whole in an integrated manner with the processes 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, the 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 value is added by the new ownership such as processors, distributors, packers, etc. and the cost and profits are part of the business. The food items can go to the final consumer from any of the three stages: from farmers in the form of fresh produce, to the caterers directly from the manufacturer, 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 the all the stake holders and their information systems are all interconnected 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 we have dealt with it in the earlier sections.

2.1 Food Supply Chain Cluster:

Food chain clusters (See Figure1) are formed with the participation of all stake holders such as farmers, seed growers, merchants, transporters, wholesalers, retailers, financial institutions, and insurance companies. Information sharing is essential for generating the efficiencies. The Internet and mobile communications are used to enable information and financial transfer between the stake holders. Also, recent advances in RFID technology will have tremendous impact in the management of the food chain particularly for source identification and tracking and also in providing supply chain visibility.

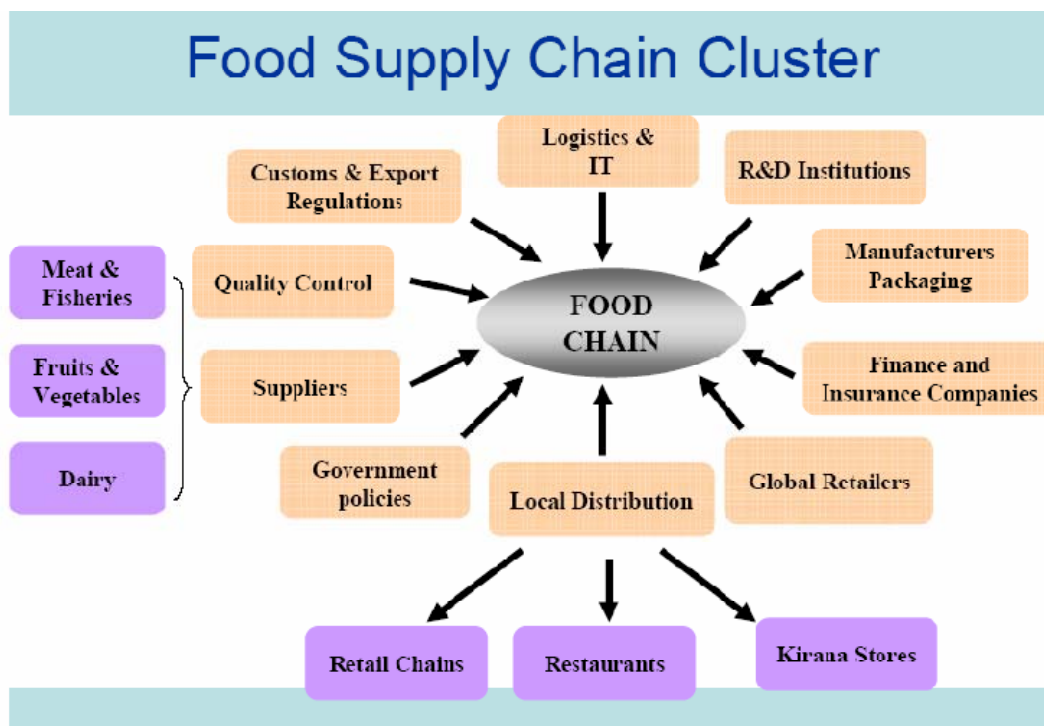


Figure 1: The Food Supply chain cluster

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

3. Objective and scope:

It's necessary for India to find out where exactly India is lagging behind when it comes to export. What are the factors which are affecting India's export and by thus a study of supply chain of fruits and vegetables and spices is been planned to be carried out for the NCR region 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 current global export market and the growth potential for fruits and vegetables export and then to study the Indian market in the same context. After initial market analysis report would tend to analyze 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 vegetable export and suggesting some recommendation to improve the situation.

The scope of the project is limited to certain fresh fruits and vegetables like Mango, Apple, Tomato and Potato only. This study will consider only the supply chain and the 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.

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 Mandis 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 questionnaires directly.

5. The Global Market Scenario:

The Fruit and vegetables market is growing over the years globally. The world fresh fruit export value is growing up every year. Only in the year 2009 due to recession there was a drop in the world export. The world fresh fruit export market is growing with a CAGR of 8%. Following are the trend over the last four years and top ten exporting countries of the world of HS Code 08 (Edible fruits, nuts,

Exporters	Exported value in 2006	Exported value in 2007	Exported value in 2008	Exported value in 2009
'World	53315688	61725376	70657528	67270880
'United States of America	6839403	7419688	8548688	8708545
'Spain	5809358	6519281	7389142	6845420
'Netherlands	2706542	3392647	4148959	3666320

'Chile	2756074	3206069	3949282	3489778
'Italy	3036754	3704139	4304847	3315652
'Belgium	2863167	3253450	3712557	3281245
'Turkey	2388333	2670618	2855221	3001830
'China	1283813	1632441	2104372	2378787
'Mexico	1600019	2061793	2027705	2207015
'Ecuador	1292309	1378797	1716941	2086605

Table:1, Unit: US Dollar Thousand, Source: Trademap.org

India is 16th in terms of export in Edible fruits segment.

If we consider the global vegetable market, the worldwide export of the edible vegetables has grown with a CAGR of 7.6% over the last 4 years. Major exporters of edible vegetables are given below in the table. Netherland export the maximum quantity. India's rank in edible vegetable export is 15th.

Exporters	Exported value in 2006	Exported value in 2007	Exported value in 2008	Exported value in 2009
'World	38685572	44939704	49108084	48141460
'Netherlands	5076109	6121600	6630047	5939267
'Spain	4409548	5036878	5527641	5539207
'China	3714727	4042922	4222043	4853057
'Mexico	3478756	3557826	3868990	3694399
'United States of America	2680588	3009946	3467752	3400734
'Canada	1910179	2379281	3038882	3023295
'Belgium	1982120	2316959	2548876	2303739
'France	1990840	2431132	2452354	2173785
'Italy	1211031	1415866	1564119	1427548
'Germany	851633	933466	1030739	1155977

Table: 2, Unit: US Dollar Thousands, Source: Trademap.org

Now if we consider specific fresh fruits like Apple, Mango market then we can see that the fresh mango world export market is growing with a CAGR of 11.7% in last four years. India

exports maximum amount of mango to the world followed by Mexico, Netherlands and Brazil. Following are the top exporters of fresh mango.

Exporters	Exported value in 2006	Exported value in 2007	Exported value in 2008	Exported value in 2009
'World	796575	995414	1061483	1111511
'India	153379	162723	214581	205436
'Mexico	99347	118869	111214	136942
'Netherlands	75594	97141	120057	100809
'Brazil	87516	90102	119122	97686
'Hong Kong,				
China	15761	38450	45266	85727
'Thailand	17861	34231	37368	71410
'Peru	59329	63674	64129	70930
'Pakistan	16657	29280	26787	33179
'Belgium	20898	45495	27362	29623
'Philippines	30326	38770	27055	24897

Table: 3, Unit: US Dollar Thousand, Source: Trademap.org

Similarly if we consider the Fresh Apple market from the following data we can realise that the world export of fresh apples has grown with a CAGR of 6.5% over the last few years. The major fresh apple exporters are USA, China, Italy and Chile. Following are the main exporters of fresh apples.

Exporters	Exported value in 2006	Exported value in 2007	Exported value in 2008	Exported value in 2009
'World	4500655	5614726	6369914	5429693
'United States of America	560781	651292	749286	761791
'China	372561	512645	698398	712126
'Italy	566599	758060	824662	666870
'France	574203	695081	778842	589150
'Chile	441480	565986	677296	497292
'Netherlands	295230	354347	456241	319217

'Poland	119561	173285	189523	281557
'New Zealand	209038	265303	237677	257524
'South Africa	157976	212662	241941	232157
'Belgium	223522	268110	263519	203683

Table: 4, Unit: US Dollar Thousand, Source: Trademap.org

If we consider the specific export market of Potato, then we can identify that the world export market of potato has grown at a very low rate with 1% CAGR over last few years. The export of total potato has decreased continuously after 2007. Following are the major exporter of potato. India ranks as 20th in the potato exporting countries in terms of values.

Exporters	Exported value in 2006	Exported value in 2007	Exported value in 2008	Exported value in 2009
'World	2217146	2706460	2411645	2289309
'France	440058	571669	469704	409498
'Germany	212559	266539	227484	230868
'Netherlands	228144	266704	213755	223122
'Egypt			38637	191116
'Canada	108564	132810	180772	138398
'United States of America	129422	128058	155414	137186
'Belgium	154332	157716	130594	121106
'China	64513	78990	81249	111845
'Spain	116077	118119	138230	107798
'Israel	79367	117746	92775	88248

Table: 5, Unit: US Dollar Thousand, Source: Trademap.org

If we consider the tomato export market then we can see world export of tomato is growing with a CAGR of 6.3% over the last four years. The major exporters of tomato are Netherlands, Mexico and Spain. Following is the trend of tomato export given in the span of last four years. India stands at 19th position when it comes to tomato export.

Exporters	Exported value in 2006	Exported value in 2007	Exported value in 2008	Exported value in 2009
'World	5697966	6729631	7374536	6837800
'Netherlands	1331066	1538381	1746662	1562741
'Mexico	1119341	1068625	1205392	1210757
'Spain	1009908	1179141	1252538	1138777
'Turkey	174284	297176	388584	406505
'United States of America	263513	311067	332942	316743
'France	164239	270930	288546	299248
'Canada	303097	270647	310637	296174
'Morocco	120770	203923	265450	254989
'Belgium	264751	296270	290222	238896
'Italy	195348	248255	241818	204485

Table: 6, Unit: US Dollar Thousand, Source: Trademap.org

India has world's largest arable area which is 11% of the world & 30% of Asia's. 32% of area is irrigated but wells being main source of irrigation, high dependence on monsoon. Commodities contribute 58% of Indian GDP out which Agriculture is 23% (Crop sizes X Value). Indian agriculture provides employment to 65% (Direct + Indirect).

6. India Scenario of Fresh Fruit and Vegetables Market:

If we see the Indian scenario of the Fresh fruit and vegetable market then it will be seen that the apple producing area has been increased with a CAGR of 5% over last five years. But at the same time apple production has increased with a CAGR of 3.5% over the same period of time. Following is the table which shows the apple production in India over last few years in some of the major apple producing states. In the table it's given that Jammu & Kashmir is the state which produces the maximum apple in India, followed by Himachal Pradesh and Uttarakhand.

Year	Arunachal Pradesh	Himachal Pradesh	Jammu & Kashmir	Uttarakhand	Nagaland	Others	India
1987-88	4.8	259	427	170	-	0.6	861.4

1991-92	9.3	301.7	624.5	212	-	0.2	1147.7
1996-97	15.2	288.6	815.7	188.7	-	0.2	1308.4
1997-98	15.2	234.3	894.5	176.4	-	0.2	1320.6
1998-99	16	393.6	791.6	178.9	-	0.3	1380.4
1999-00	8.5	49.1	929	60.5	-	0.3	1047.4
2000-01	8.5	376.7	751.3	89.7	-	0.4	1226.6
2001-02	8.5	180.6	909.6	59.3	-	0.3	1158.3
2002-03	8.8	348.3	953.9	37.2	-	0.1	1348.4
2003-04	9.3	459.5	1041.5	11.3	-	0	1521.6
2004-05	9.5	527.6	1093.3	108.5	-	0.1	1739
2005-06	9.6	540.4	1151.7	112.3	-	-	1814
2006-07	9.8	268.4	1222.2	123.3	-	-	1623.7
2007-08	9.8	592.6	1268.5	130.5	-	-	2001.5
2008-09	9.8	510.2	1332.8	132.3	0.1	-	1985.1
2009-10	9.8	510.2	1341.6	0	0.05	-	1993.9

Table: 7, Production in thousand MT, Source: Indiatat.com

Similarly if we see the other fruits and vegetables then we can find out that the fresh fruit and vegetables industry has grown at rate of 4% and around in India over last few years. And also we can see from the above analysis that the area under production has grown at higher rate than the production grown rate in case of apple. So is the case for most of the other fruit and vegetables. The main problem with India is this that the productivity of this sector is very less. At the same time the wastage rate is also very high. The wastage rate is as high as 35%-40% in some cases in this sector. So it's very important to reduce wastage in the system and to improve the productivity.

In this project the study of different existing supply chains has been carried out to understand where we Indian are lagging behind in this sector when compared with developed countries.

In the following some sections different Indian Supply chains has been described.

7. Indian Fresh Fruits and Vegetables Supply chain:

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 practises, agriculture continues to live in medieval times. India's Food Supply Chain leads to

massive wastage and inefficiency with 30% 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 prices 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 on 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 5 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% 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 (which as usual leads to no prosecution). 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 the other one is retail market or organized market supply chain. The main difference between the two supply chains is this that the number of intermediaries in the traditional supply chain is high and thus the amount of wastage is high and transaction cost is also high in the traditional supply chain. In the following paragraphs all the different kind of supply chain which exists in this sector in India has been explained.

7.1 Traditional Fruit supply chain of India:

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

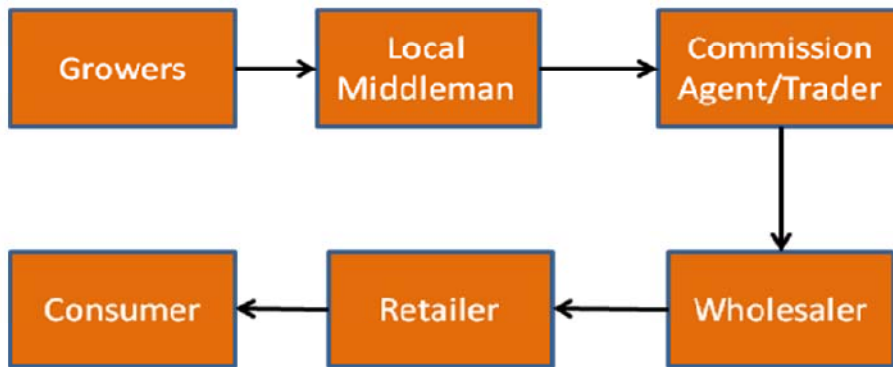
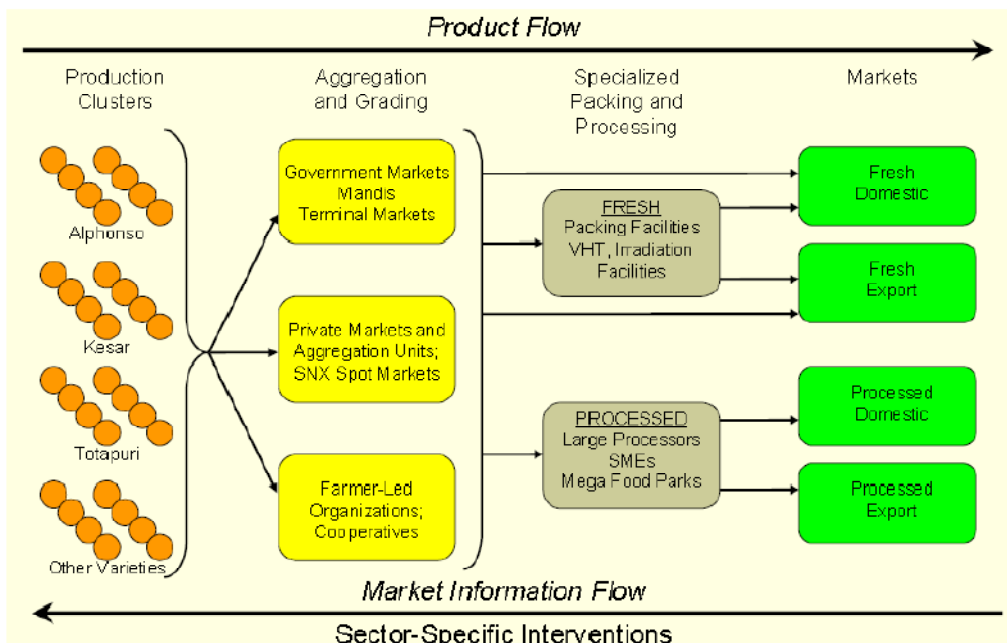


Figure: 2, Schematic Diagram of Traditional Supply Chain of Fruits and Vegetables

In India the majority of the trade happens through traditional path. Generally the growers sale fruits to the local middleman who collect 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 large 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 verities and sale those to the wholesaler or the big farms or companies for processing it further. Then the fresh fruits get distributed through Retailers to the consumers.

The main problem in this supply chain is this 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 flow and information flow diagram for mango which provides a fare amount of idea about the fruit supply chain.

Figure: 3, Product and information flow of a Mango Supply chain



7.1.1 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.

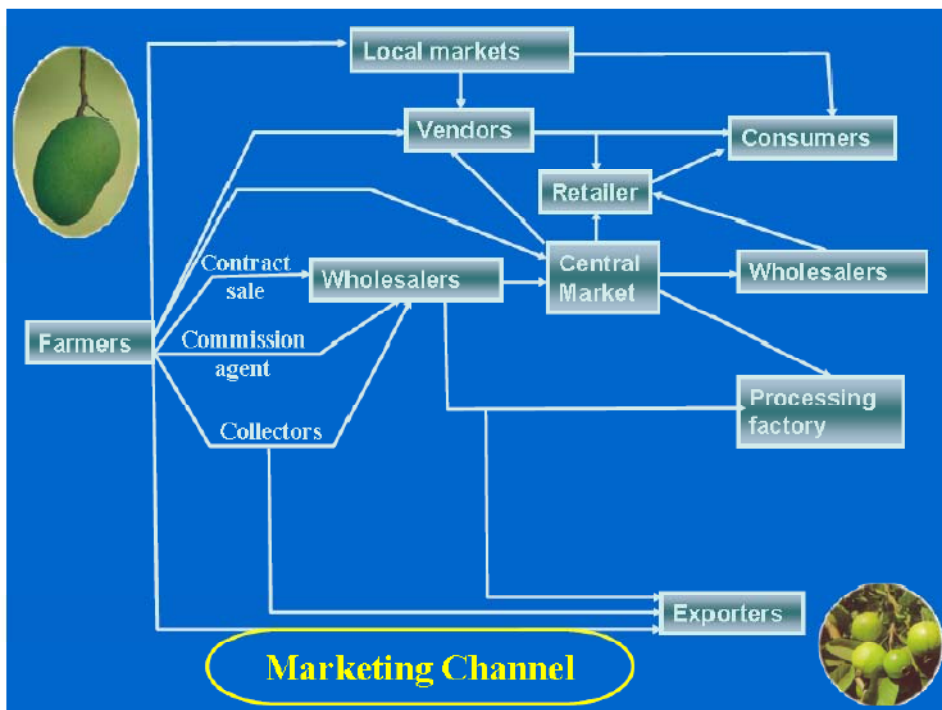


Figure: 4, Marketing Channels of fruits and Vegetables



Figure: 5, Traditional way of marketing mango

Similarly a complete value chain of Apple in Himachal Pradesh has been explained in the following paragraphs.

7.2 Existing apple Value Chain in the major apple producing districts of H.P:

The apple produce from the orchards of HP reaches the consumers through a multitude of channels, each of which differs in the number of intermediaries and as such has varying degree of complexities (Exhibit 3). Although these channel intermediaries perform a specific role in the apple value chain, they also exploit the farmers to a great extent. More often than not, each intermediary adds his margins arbitrarily with little adherence to the Market Acts. This ultimately jacks up the retail price with adverse consequences to both the growers and the consumers.

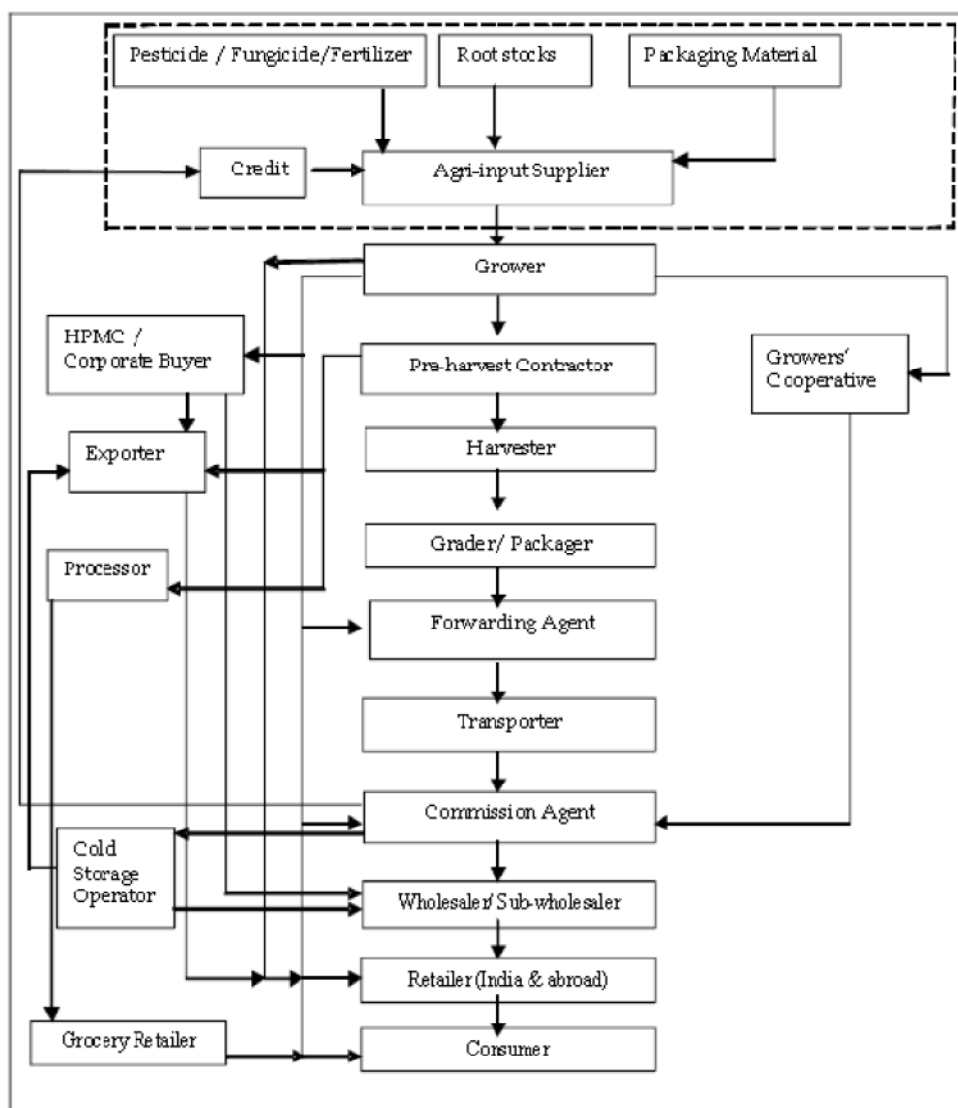


Figure: 6. Existing Apple Value Chain in Himachal Pradesh

7.2.1 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 spring. 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 compositions. Farmers also get information of scientific agronomic practices from Krishi Vigyan Kendras (state extension agency), fairs organized by Y S Parmar Agriculture University, NGOs and state agriculture departments.

Grower: The apple growers take 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.

Growers' cooperatives: It was observed during the survey that farmers in about 40 villages of Churag and Pangana divisions 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 labourers who first visually inspect the apples for size and colour; 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 maturity 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 quality packing and sensitivity while handling. In almost every orchard surveyed, apples were 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 of apples fetch better price realizations to the farmers whereas the culled apple and the surplus left after sorting and grading is packed in gunny bags and sent to processing units for making squash, jelly, jams and juices. In HP, the government has set the standards for apple packaging which involves use of inner and outer boxes made of reusable corrugated cardboards. These boxes have a capacity of 20 kg and have ventilation holes, cushioning trays to separate different layers of apples. These boxes are further marked for variety, packing date, geographical area, trademark of producer and weight.

Forwarding agent: 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. This price being 10 to 20% less than what is paid by 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. (www.himachal.nic.in).

Cold Chain Operator: The perishable nature of the commodity makes the role of Cold storages 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 apple from different markets through their agents, create consignments, do necessary documentation and send it to buyers or their agents in the 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 agent. Wholesalers break the bulk and facilitate 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.

7.3 India's Retail Revolution:

In the above paragraphs 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 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 MNCs like Metro (Cash and Carry), ShopRite etc. have also entered Indian market. In the following paragraphs the retail revolution in India and the different supply chain involved in the retail market of vegetables has been explained.

7.3.1 Vegetables Supply Chain:

Retail sector in India is at the crossroads today. A shift between organised and unorganised retail sector is apparent, especially in the vegetable retailing zone. This shift is a call for transfer of consumerism towards organised retailing. The penetration of organised retail in the field of vegetable retailing will face fierce resistance from traditional retailers with their existing strong foothold. This resistance from the 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, vegetable, and grocery retail has been considered as a very low-margin business, the market potential has attracted Indian business houses and corporate, driving the forays through different models like single-format, multi-format or integrated urban-rural models. To attract the global leaders in vegetable retailing, the government allows foreign direct investment in cash-and-carry type business model to the tune of 100 per cent. The joint ventures of domestic Indian companies with the global players are allowed to operate in India. However, the domestic companies have controlling stake in the vegetable and grocery retail. Currently, organised 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 unorganised small shopkeepers, Kirana (mom and pop) stores managed by families or individuals. There are two classifications of their formats—stores and non-stores. Store formats include stores with permanent and semi-permanent building, ranging around 50 square feet or more in size, corner stores, and paper and cigarette shops. Non-stores format

covers street vendors, pavement vendors, cart vendors, mobile vendors (head carrying), and vendors at daily or weekly farmers markets.

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

7.3.1.1 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 organised retail sectors. The traditional retailing of vegetables is not very much organized, amounts to 97% of the total market (Ernst & Young, 2006), is extremely localised and highly fragmented with large number of intermediaries. The intermediaries between the customers and farmers are 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 produces directly to the end consumers in local markets, regulated and unregulated 'farmer markets', or they sell to intermediaries—agents and organised retailers. The market place is usually in close proximity to the farmland and customers accessing the market live in and around locale. Farmers selling vegetables directly to the customer amount to very small fraction by volume. Farmers sell bulk of their produces to agents and auctioneers. The agents buy small quantities of produces from farmers and transfer it to wholesalers directly or through another agent. The auctioneers are people who enter into buying 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 another agent. Wholesalers of vegetables sell to retailers—both traditional and organised retailers, and to customers, who buy in large quantity. Cart vendors, a type of traditional retailers, buy vegetables from wholesalers or organised retailers, sell to customers in mobile carts and deliver to customers at customer's doorsteps.

Wholesale market is a vital link in vegetable supply chain. Both the traditional and organised 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.

7.3.1.2 Food Mileage:

When selling vegetables, the vegetables have to reach the users at the minimum possible time, otherwise it becomes waste. The food mileage of vegetables causes considerable impact on the vegetable due to its perishable nature. The term 'Food Miles' or 'Food' Kilometres' 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 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 food has travelled to reach consumer. That includes the journey from farm to processor, then from processor to retailer and finally from retailer to consumer. Studies estimate that processed food in the United States travels over 2080 kilometres (1300 miles), and fresh produce travels over 2400 kilometres (1500 miles), before being consumed (Holly Hill, 2008). The food mileage impact is realised 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 propositional 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 vegetables travel in miles, the less fresh they become. This means customers pay for vegetables, which have less initial 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 local economy. Local farmers who sell directly to consumers receive a larger share of the 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 mileage food is the food that comes 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 travel 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 vegetable reaches its destination has not been studied. The comparison of different businesses 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 scope for further future research.

7.3.1.3 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 organised 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 organised players in the industry go with Hub and Spoke model with minor modifications to fit in to their marketing and logistical strategies.

7.3.1.3.1 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 model, farmers sell their produces to customers and to agents intermediately. Agent and auctioneers are first level of middlemen in vegetable

supply chain and transfer 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 farmers 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 vegetable(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 transportation. The traditional retailers buy vegetables from wholesalers and sell directly to customers. The families-run 'mom and pop' type stores sell staple products including vegetables. Customers constitute small domestic customers who buy vegetables for household consumption from traditional retailers. 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 of the transportation of vegetables from farmland to his premises and transportation is seller's responsibility for the transaction of vegetable between the agents and auctioneers. Agents arrange to pickup vegetables directly from farming locations to deliver at wholesaler's premises for huge volume of produce and cost of transport is on farmers account. The second phase of vegetable movement starts with outward transportation from agents to wholesalers. Agents handle the transportation from agents to wholesalers. During the third phase, 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 customers by cart vendors who sell vegetables in push carts, tricycles, and bullock carts.

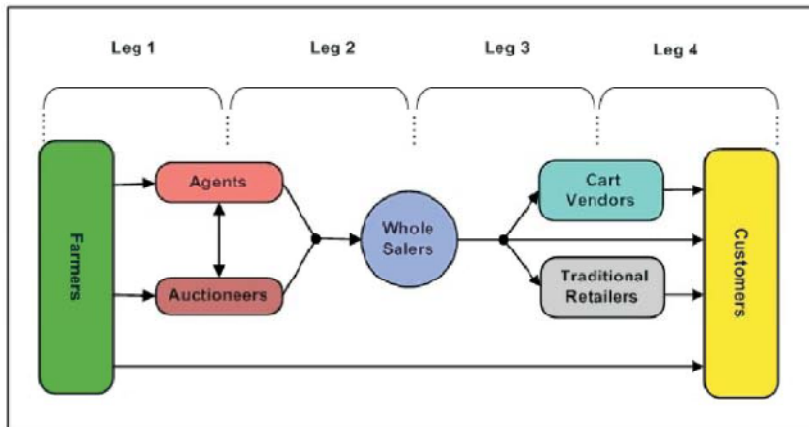


Figure: 7. Traditional Retail Model.

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 transportation of vegetables 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 transport is unconditioned trucks and for shorter distance farm tractors are used. Agents make arrangement to pickup 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 push cart.

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

7.3.1.3.2 Hub and Spoke Model

At present, organised retailers 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 players are involved in this model compare to the traditional retailing model. Farmers, organised retailers, wholesalers and customers form this chain. Buying centres, hub and stores (retail outlets) are operational units of the organised retailers. Small farmers and contract farmers who executed a trade contract with the organised retailers are the primary source of supply of vegetables to the organised retailers. The buying centres make the vegetable purchases directly from the farmers and transport to the hubs. A hub is served by one or more buying centre and a buying centre serves one or more hubs. Hub infrequently buys small volume of vegetables from 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 vegetable in retail quantity to the customers.

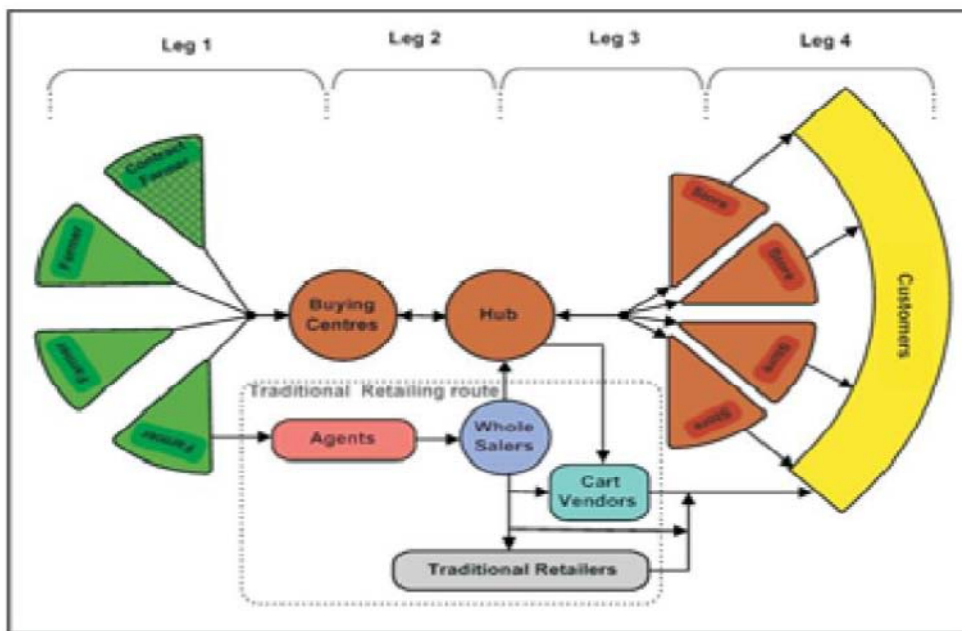


Figure: 8, Hub and Spoke Model.

Vegetables travel in four phases, namely farmers to organised retailer's buying centres, buying centre to hubs, from hub to retail stores and retail outlet to customer. Farmers transport vegetables from farming location to the buying centres. The transport of vegetables in the second phase from buying centres 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 organised 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 for 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 centres. Modes of transport are mini truck, farm tractor, bullock cart, bicycle, tricycle, motor cycle and baskets. Buying centres arrange to pick up vegetables in a truck from the farm gates of the contract farmers.

Leg 2: The transport of vegetables from buying centres 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: Customers buy and pick up vegetables from the organised retail stores. The modes of transport are motorcycle, car and public transport vehicles.

7.3.1.3.3 Value Chain Model

Currently, organised retailer Reliance Fresh (Reliance Retail Ltd) follows a Value Chain business model (VCM). Organised retailers who adopt VCM procure the produces directly from farmers 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 organised retailer's hub and spoke model. Farmers, organised retailers, and customers are the players who form this value chain. In this practice, farmers, organised retailer's operational units, consolidation centres, hub (distribution centres) and retail outlets stores, and customers are players. Small farmers, contract farmers and lease farmers are the primary source of supply of vegetables to the organised retailers. Contract farmers and lease farmers are farmers who execute a trade

agreement with the organised retailers for sale of vegetables. Figure 3 illustrates the VCM business model of vegetable retailing. Vegetables move from farm locations to customers in four phases farmers to consolidation centres, consolidation centres to hub, hub to retail outlets (stores) and stores to customers. Independent farmers supply their produces to the consolidation centres; contract farmers and lease farmer's produces are picked up by consolidation centres. One consolidation centre supplies vegetables to multiple hubs, depending upon the product. Hubs get direct delivery from the contract farming locations.

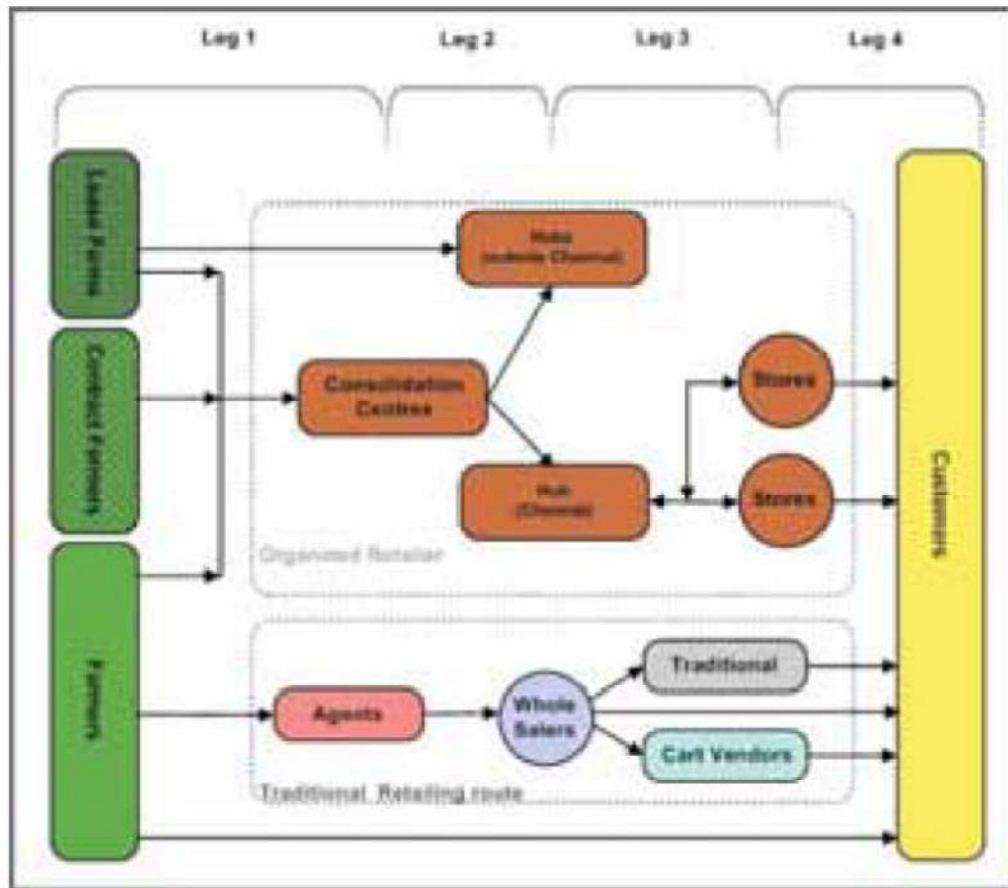


Figure: 9, Value Chain Model.

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 serves 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 chain business model differs from hub and spoke business model in

dependency on wholesale 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 cart vendors.

Stackable plastic crates, pallets and corrugated fibreboard 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 grading are done at the consolidation centre without packaging. The weight 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 techniques are in progress. Connectivity between stores (retail outlets), hub and back offices is established. Vegetable transportation has four legs.

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

Leg 2: The transport of vegetables from consolidation centres to hub is arranged by consolidation centres and both temperature-conditioned and unconditioned trucks are used. The hubs get direct delivery from 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 from the organised retail stores. The stores for a shorter coverage area and high value of purchase provide home delivery.

7.4 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-choupals 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 logistics 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 tied up with ITC Choupal Fresh to provide better service to customer at a cheaper rate and have removed lots of inefficiencies of the Supply Chain.

8. Factors Affecting the Fruits and Vegetables Supply Chain:

8.1 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 (e.g. 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 Management systems
- Traceability
- Financial and Insurance Institutions

The temperature controlled supply chains or cold 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 temperatures is dependent on the products 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 logistics 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 temperatures 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 it into wastages. Some estimates say that the post harvest losses of fruits and vegetables alone in India is more than the total production of fresh 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 the country. Government as well as Corporate should take steps towards this and improve the overall infrastructure of cold chain in India.

8.2 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 Governments play leading role. This becomes all the more important in view of the globalization of the food industry. Allowing foreign operators for food production, 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.

8.3 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 rail connectivity is not that good. Lots of development in these aspects needs to be done to improve the supply chain efficiency.

8.4 Sorting and Grading Technology:

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

8.5 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.

8.6 Skilled Labour:

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

8.7 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 inefficiency.

8.8 Standards:

No scientific standard followed for determination of maturity, mostly based on experience, 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.

8.9 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 and crushing of fruits. Estimated loss is between 5% (jackfruit) to 15% (mango). Mechanical injury allows entry of pathogen and thereby leading rotting during operations.



Figure: 10, Harvesting Technique: By climbing on the tree.

8.10 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. Following picture shows some of the handling techniques used in India.



Figure: 11, Sorting and Handling of Fresh Fruits

8.11 Packaging at farm level:

In gunny bag- guava, mango, bael, ber

In cloth bag – 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.



Figure: 11 & 12, Packaging and storage of Mango

8.12 Transportation from farm:

- Rickshaw van – mango, banana, guava, jackfruit
- Trucks – banana, mango
- No control on temperature/ humidity

- Packaging bags/ boxes of different weight, size, 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 transporting. And the slower mode of transportation like Rickshaw van takes more time and thus reduces the product's useable life after it reaches to customer.

9. Recommendation:

9.1 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.

9.2 Standards

Standardization is a powerful tool for improving 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 and the grade and the quality of the fruits and vegetable. The second standard concerns 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.

9.3 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, counselling 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 required temperature throughout the supply chain. In this way a pool of skilled workforce with good knowledge of cold chain management 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.

9.4 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.

9.5 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 efficient. Direct sourcing from farmers has to be encouraged to provide greater benefit to the customers.

9.6 Adopt the 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 the commodities
- Protection from contamination is required, so that the quality of the commodities don't get deteriorated
- Not imparting any toxic substance

Handling

- Speciality handling tools and equipments 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 services should be used to take full advantages of all the infrastructure available and to reduce the time to make the commodity available to the customer.

3PL service provider

- Storage, warehousing and material handling service providers can handle the job in a better way as they have proficiency in this field. It will reduce the cost also as they will be having an advantage of economy of scale.

9.7 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.

9.8 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 know to all the channel members. This is one of the main sources of inefficiency in the supply chain.

9.9 IT 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 technologies 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 kind of industry to become competitive in the market.

9.10 Infrastructure:

Development of infrastructure is a must. Development of more no 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.

9.11 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.

10. Conclusion

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 fruits and vegetables, 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 organised 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 organised 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 to organised retailers. Organised retailer's 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 auctions. They do not have to pay for transport and offloading, which is borne by the retailer. The electronic scales of organised retailers are more reliable than the local mandi's mechanical scales. The middlemen tend to round-off the weights, which organised retailers never do.

In the 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 policy. The expanding retail markets require a 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.

The inefficiencies discussed in the above study have to be handled more carefully. The factors which affect the supply chain also have to be monitored and development to improve the supply chain efficiency has to be carried out if India wants to become the leading food supplier of the world.

11. Bibliography:

1. Increasing Food – Safety Protection: Fresh Apple Market in China by Lili Gao and Suzanne Thomsbury.
2. Industry & Trade Summary, Apples, Office of Industries, US International Trade Commission
3. Commodity Specific Food Safety Guidelines for Fresh Tomato Supply Chain, North American trade Worker Group
4. US Fresh Produce Supply Chain, Dr. Roberta Cook
5. Fresh and Healthy Enterprise Limited.
6. Reliance Fresh Stores in Food Retailing, Dr. Debasis Pradhan & Dr. B. K. Mangaraj
7. www.indiastat.com
8. <http://www.apeda.gov.in/apedawebsite/index.asp>
9. www.trademap.org
10. <http://agmarknet.nic.in/>