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Efficient Logistics System in Agricultural Farm Fresh Market in India by Leveraging Technology

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*Rashmi Ranjan Bhuyan & **Dr. Ritesh Dwivedi

*Research Scholar, Amity Business School, Amity University, Uttar Pradesh

**Assistant Professor, Amity Business School, Amity University, Uttar Pradesh

Address for Correspondence: rdwivedi@amity.edu

Abstract

The agricultural farm fresh value chain in India have undergone significant transformation over the last few decades. Primarily the sector has been influenced by Government intervention in the form of subsidies, free extension services, regulated marketing and price stabilization mechanisms. The local and regional farm fresh value chain have been facing many challenges in absence of a robust and efficient transport system, which is predominately driven by intermediaries without contributing any significant value. Some of the major challenges faced by fresh fruit and vegetables value chain in India are, Post-harvest loss, Seasonal supply shortages, Wastage in transit, Increase in Consumer Price, Poor realization for farmers and wastage at Point of Sales. Existing Food and Vegetable logistics and distribution management system presents a unique challenge considering the industry is resource constrained and lack of information flow across the value chain. Objective of the study is to evaluate role of an efficient Logistics and Distribution management system, which would help in establishing a value based robust system, ensuring smooth flow of logistics and information by leveraging technologies.

Keywords: Logistics, Supply Chain, Agriculture Market, Transport

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Introduction

India is the second most populous country with approximately 1.34 Billion inhabitants, approximately 18% of 7.5 Billion of World's population. It is estimated to grow at the same rate and become world's most populous country surpassing China's by 2024. India will experience a tremendous increase in demand for fruits and vegetables down the line. Currently, India produces 175 million tons of vegetables and 93 million tons of fruits annually. It is projected an increase in demand for fruits and vegetables by 228 %and 95 % respectively by 2050.

Horticulture Commodity	Production in Year 2018 (in Million Tons)	Projected demand in 2030 (in Million tons)	Projected demand in 2050 (in Million tons)	Demand growth by 2050
Vegetables	175	192	342	95%
Fruits	93	103	305	228%

Source: Report of committee on Doubling farmer's income, Ministry of Agriculture and Farmer's welfare.

Although, India is one of the largest producers of many fruits and vegetables in the world with more than 100 types of fruits and vegetables are grown, higher emphasis is given to more popular fruits and vegetables considering faster sales and higher income, particularly for small and medium scale farmers. Following table shows India's share in the world in case of some of the major fruits and vegetables productions in the world.

Commodities			
Vegetables	India share %	Fruits	India share %
Brinjal	8.3	Apple	2.4
Cabbage	5.3	Banana	32.6
Cauliflower	4.9	Litichi	0.7
Onion	10.4	Citrus Fruits	12.4
Peas	2.5	Sapota	1.8
Tomato	11.2	Grapes	3.1
Potato	28.0	Mango	22.1
Sweet Potato	0.7	Papaya	6.6
Tapioca	4.5	Pineapple	1.9
okra	3.9	Guava	3.9
others	20.5	Others	11.5
Cassava	8		

Table 1: Production Share of major fruits and vegetables in World

Commodities			
Vegetables	India Ranks	Fruits	India Ranks
Brinjal	2	Apple	10
Cabbage	2	Banana	1
Cauliflower	2	Lemon	2
Onion	2	Citrus Fruits	8
Peas	1	Orange	4
Tomato	6	Grapes	16
Potato	3	Mango	1
Sweet Potato	9	Papaya	5
Lettuce	5	Pineapple	5
Pumpkins/Gourda	2		
Beans	6		
Cassava	8		

Table 2: Ranking of India in production of fruits and vegetables in World [7].

Source:Rais and Sheoran, J Food Process Technol 2015, 6:3

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Growth in the demand for fruits and vegetables in India are influenced by several factors like, growing population, preference for fruits and vegetables based processed foods due to changing lifestyle, increase in awareness of adopting healthy lifestyle and penetration of organized retails. But, the per capita availability of fruits and vegetables in India is quite low because of postharvest losses accounting to 30% to 40% of total productions in India and substantial in-transit wastage, which leads

to price increase, market gluts and price fluctuations for consumers. An efficient logistics and distribution system for farm fresh produces plays an important role in this sector considering perishability and very short self-life of these produces. The existing fruits and vegetable logistics system is predominantly driven by a chain of intermediaries, who attributes to a substantial amount of cost without contributing much to the value chain. These intermediaries are primarily act as aggregators and facilitates farmers to sell their produces in the Mandi.

Literature review

Logistics plays an important role for farmers to make the fruits and vegetable produces available in market on time in order to reduce the post-harvest losses and fetch a higher price considering the perishability of the produces and non-availability of proper storage facility.

"At the all-India level, the proportions of the produce that farmers are unable to sell in the market are 34 per cent, 44.6 per cent, and about 40 per cent for fruits, vegetables, and fruits and vegetables combined," finds the committee on Doubling of Farmers' Income. This means, every year, farmers lose around Rs 63,000 crore for not being able to sell their produces for which they have already made investments. (Kiran Pandey, 2018)

Apart from inadequate cold storage facility, India is also lagging behind in establishing an efficient and robust logistics infrastructure in place to transport farm fresh produces from the farm to market. If plugged, the sector can create over 3 million jobs, a majority of which will be at the village level, says the State of India's Environment in Figures 2018.

This gap needs to be fixed on priority considering the perishable nature of horticulture produce and their potential in boosting the farmers' income. The recent government report too has encouraged farmers to take up horticulture to augment income and said that a farmer can earn an additional Rs 80,000 per hectare (ha) if they replace staple crops with horticulture. (Kiran Pandey, 2018)

As per the Planning Commission Total Transport system study, only 1.9 per cent of the perishable fruits and vegetables are transported through rail, while 97.4 per cent of the produce is transported through roads. Railway can play a major role in reducing in transit timeline and freight cost, which will be a win-win situation for the farmers and consumers.

Most of the fruits and vegetables are of extremely perishable in nature and needs refrigerated Trucks and temperature controlled wagons to transport the produces specifically to long distances, which will help in minimizing the transit loss.

The farm fresh supply chain in India is very complex with many partners works in isolation. Currently, integration across these partners are very weak, which impacts flow of information across the partners for a smooth logistics operation. For example, farmers try to push whatever they produce into the market in absence of proper demand forecasting in place. Due to poor forecasting, there is an imbalance between supply and demand. Fruits and Vegetable are either not plucked from the farm due

to lack of demand in some months or produce is not available in some months, which results in sudden price boost in the market. (Rais M1 and Sheoran A)

Primarily the agriculture sector has been highly influenced by Government intervention in the form of subsidies, free extension services, regulated marketing and price stabilization mechanism exercised by Government. Government facilitates farmers to sell the produce through state sponsored agencies like APMC and RMC under a regulated market. Where mandi operators and middle man influences the market conditions, resulting in lesser price realization to farmers. In a move to liberalize trade in farm produce and aid better price realization for farmers, the center has proposed a model law on agricultural marketing which would introduce features such as a single market within a state, private wholesale markets, direct sale by farmers to bulk buyers, and promotion of electronic trading. Last year, the Government has launched an electronic national agriculture market (eNAM) platform for trading of farm produce. Currently there are 585 markets that are linked to the eNAM network from 16 states and 2 UT's. Government is planning to connect all the 7500 APMCs and 22000 mandis on eNAM by 2022. The platform will hugely benefit farmers by providing transparency in Trade through better price discovery, access to more markets & buyers, real time information on prices and arrival in nearby mandis and quick payments. Government has also registered 634 Farmer Producer Organizations (FPOs), group of farmers, who are the producers of agricultural products. To facilitate this process, the Small Farmers' Agribusiness Consortium (SFAC) was mandated by Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India, to support the State Governments in the formation of Farmer Producer Organizations (FPOs). The role of FPO is to act as an aggregator for member farmers including from inputs to output which will enhance the economy of scale and bargaining power of member farmers. In case of unsold Lots, Logistics arrangement is to be made by FPOs. (Source: eNAM portal)

Information system plays an important role in building a meaningful integration among various stakeholders from farmers to consumers in the Fruits and Vegetables value chain. The growing need for transparent, flexible and easily adjustable logistics services fosters the usage of digital technologies, that match a variety of logistics demands with supply.

Objective of Study

Logistics of Fruits and Vegetable presents a unique challenge considering the industry is resource constrained and lack of information flow across the value chain. An efficient logistics and distribution management system would help in establishing relationships among all the key stakeholders, that ensures smooth flow of logistics. Apart from Government initiatives, there are also other significant variables, that would push agricultural farm fresh value chains more organized and efficient to meet the market demand.

- Availability of IT enabled applications has become easy
- Usage of IT enabled applications are widely penetrated

- Demand for processed foods due to factors like urbanization, demand for ready to eat food, different flavors and taste and organized food retail stores….
- Increase in organized Food Processing industry
- Government initiative to encourage more online transactions through eNAM
- Increase in organized retail stores like exclusive Food retail outlets, Grocery stores, departmental stores, which sells either fresh farm produces or processed foods

Researcher has briefly outlined objective of the research as follows,

- To evaluate the relationship between an efficient logistics system and performance of Fruits and Vegetables value chain in India.
- To identify key stake holders and factors, who influence the performance of Fruits and Vegetables logistics.
- Role of Information technology for an effective logistics system integration and performance in Fruit and Vegetable sector?
- How to reduce number of intermediaries in the Fruits and Vegetables value chain? And, how to optimize economic for farmers and consumers?

Research Methodology

The study is descriptive and empirical in nature. The study is based on the literature reviews and secondary source of data published by Government agencies and other sources. Most of the prior literature are focused on the general supply chain of Fruits and Vegetables and ignore the perspective role of technologies to drive an efficient logistics system in the Food and Vegetable value chain.

Analysis

Existing Fruits and Vegetables value chain is very complex and consists of multiple intermediaries. Absence of an adequate logistics system in the value chain makes it inefficient. (Picture1)

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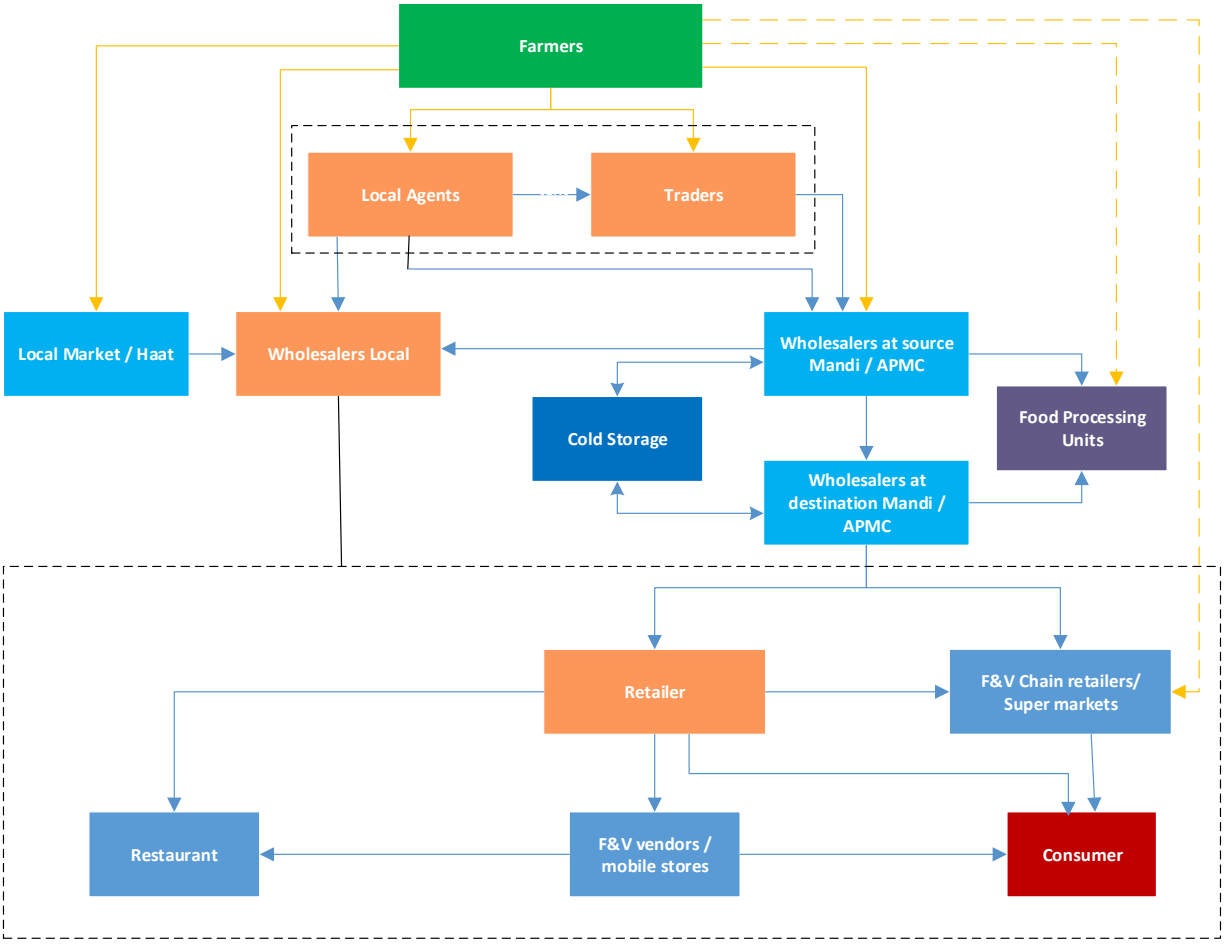


Picture 1: Existing Fruits and Vegetables value chain.(Source: Author)

- **Inadequate logistics system for movement of produce surplus from farmers to mandi**

  Farmers do not have adequate and cost effective logistics facility for transporting farm fresh produces surplus to the mandi. As a result, farmers does not have any options other than selling to local agents and / or traders at a lesser price. Primarily, the small scale farmers sell their produce surplus to the local agents and/or traders in scenarios like, when the volume is very low, economically unviable and resource constraints. Local agents and the traders act as an aggregator and make a substantial profit by selling the produces to wholesalers in the mandi.

  Government has created an electronic market place called eNAM (National Agriculture Market) to facilitate the farmers directly selling the produces on-line. Recently Government has initiated FPOs (Farmer Producers Organization), who will act as an aggregator for member farmers including from inputs to output which will enhance the economy of scale and bargaining power of member farmers. FPOs will also arrange logistics for unsold lots, which is going to be major game changer in the sector. This will not only enable farmers to sell the produces faster but also provide a better realization by removing the intermediaries.

- **Wastage in transit**

  Currently almost 97.4 % of the fruits and vegetables are moved by road transport. Most of the fruits and vegetables are of extremely perishable nature and cannot be transported under ordinary conditions, which demands refrigerated trucks to cut down the wastage.

  Transit time is very high for long distance transportations, which impacts the quality of the produces and availability of produces to consumers on time,

- **Poor realization for farmers**

  There are no proper demand and supply matching in the sector. More supplies in the mandi for specific produces helps intermediaries a better bargain, which results in farmers selling the produces at the lesser rate in order to avoid further losses.

  Existing mandisystem has number of inefficiencies like non-transparent price setting where seller and buyer are often manipulated.

  Farmers get a very less in compare to the consumer price due to the contingency price added to the cost of the produces to factor the wastage at the various level of the value chain and cuts paid to the multiple intermediaries.

- **Wastage at Point of Sales**

  Currently, there are no reverse logistics process in place to transport the wastage at point of sales to the facilities and/or food processing units for further processing, which can fetch better value realization.

- **Postharvest Loss**

  Fruit and vegetable sector has grown substantially both in volume, quality and varieties. However, the increase in production has not been matched by developments in the logistics management in the sector.

  Additionally, there are no proper demand and supply matching in the sector. In absence of adequate logistics facilities to farmers, sometime the produces are wasted either in the field or local storage facility of the farmer.

- S**easonal supply shortages**

  Production and quality of fruits and vegetables is highly dependent on soil and climate conditions. There is a continuous demand for fresh fruits and vegetables throughout the year, whereas supplies are seasonal, which demands adequate and cost effective cold storage facility and distribution system both at farmers' end and consumers end.

- **Increase in Consumer Price**

  Fruits and Vegetables are sold to the consumers at a very higher price in compare to the price it procured from the farmers due to the wastage of the produces at various points of the value chain and cuts paid to multiple intermediaries.

- **Accessibility and usage of information technology in F&V logistics is almost negligible**
  There are various technologies and tools available in the market, which can be used for information flow across value chains including best available price, data capture and processing, shipment tracking, synchronized freight across different modes of transports and supply-demand matching. The internet and mobile communications are widely available and can be leveraged for online transactions in the sector.

Findings and Conclusion

There is a significant relationship between efficient logistics system and performance of F&V value chain in India. An efficient logistics system in F&V sector will immensely contribute to plug the wastage in transit, wastage at point of loss, post-harvest losses, reduction in transit time, making the supplies available in market. An efficient logistics system will not only give a better realization to farmers, provide an optimized competitive price to consumers, but also help in meeting future demand effectively.

Picture 2: Relationship between an efficient logistics system and F&V value chain (Source: Author)

The prevailing agri-food market has gone through a paradigm shift to “Fork to Farm”. Therefore, it is essential to have information technologies like Artificial intelligence in use to understand the consumption trend and future demand proactively for specific fruits and vegetables, which can be inputs for the upstream partners, both farmers and wholesalers can be benefitted with a better realization.

Milk run logistics system integrated with mobile technology can provide a great relief to the farmers to transport the produces surplus to the mandi on time and cost effectively. It will further eliminate the intermediaries like local agents and traders exists currently between farmers and mandi, which will help farmers obtaining a better price for the produces.

Focus needs to be shifted to use Railways as a preferred transport mode, which will reduce the transit time substantially for longer distances resulting in on time availability and meeting demand supply gap in the specific regional markets. Further enhancement of Railways with temperature controlled wagons will further boost the sector, which will not only reduce the freight cost but also plugs the in transit wastages keeping the quality of the produces intact at point of sales for consumers. It also

boosts income for Farmers by helping them to expand their market reach. While existing trade into local markets will continue, the amount that is surplus to the localized demand can be safely connected to consumers far away, thereby mitigating loss and increasing recovery from surplus. Block chain technology can be used to ease the consolidation process for Railway transportation and further smooth less multi modal logistics integrations.

Information technologies like Artificial intelligence and analytics can be leveraged by the wholesalers to establish a system for estimating and consolidating demand at point of sales effectively. Further a Milk run logistics system integrated with mobile technology can be developed for distribution of supplies at the point of sales on time and cost effectively, the same vehicles can be used on return to transport the wastage at point of sales to the facilities and/or food processing units for further processing, which can fetch better value realization.

India needs more Food Processing units to meet upcoming processed food demand in the urban and semi urban areas considering the lifestyle changes. These Food processing units can be strategically located closer to the regions having surplus produces. Information technology can be leveraged to analyze the available surplus in the region and enabling the farmers to sell the surplus produces directly to the Food processing units.This will not only help in reducing postharvest losses but also help farmers to maintain a steady income throughout the year.

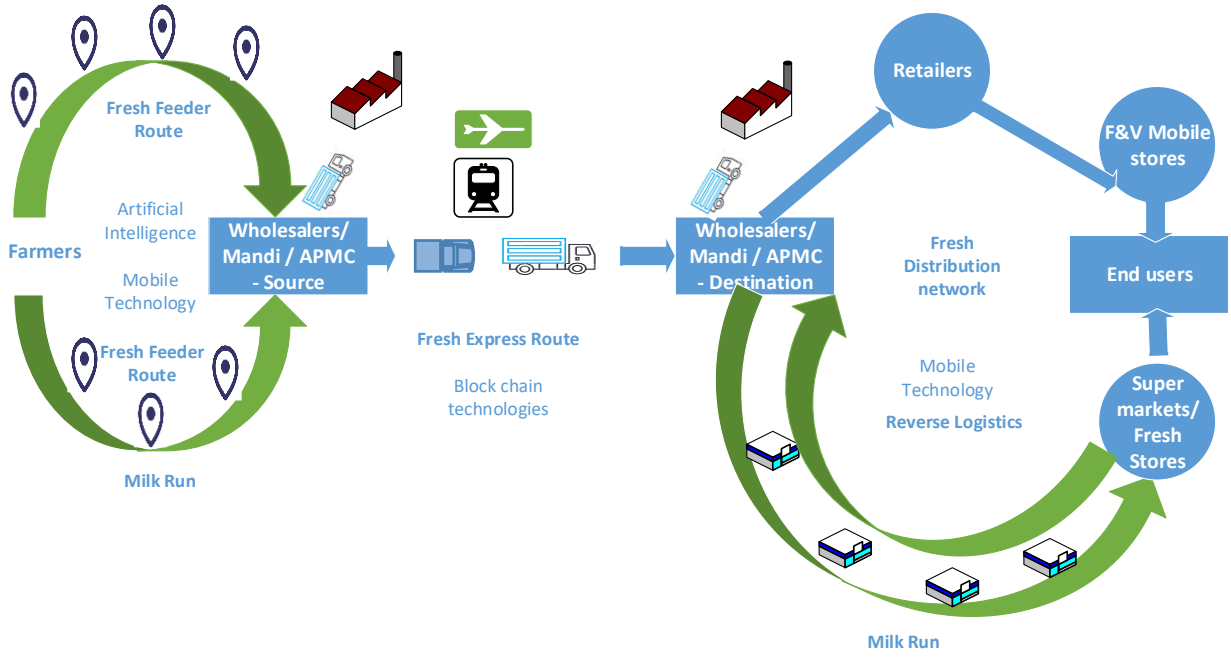
Information technology enablers like Visual Positioning system and Artificial Intelligence can be used for making the logistics system more efficient in the F&V sector.

- Visual Positioning system can be leveraged for the Milk run logistics system at both farmers and point of sales end. Routes can be mapped to Visual Positioning System in Google Maps Navigation, which will visually communicate the direction right in front of your eyes.

- Long haul transport operators carrying perishable products like, fruits and vegetables can use AI based application to predict disruptions by feeding data from the National Weather Service, National transportation board, National Highway Authority of India, law enforcement, union activities……. etc.

On the basis of findings, author has recommended a prospective logistics system as below.

(Picture 3)



Picture 3: Prospective Fruits and Vegetables logistics system (Source: Author)

Acronyms:

IT: Information Technology

eNAM: National Logistics Platform

Mandi: Market place where farmers and / or farm produce aggregators sales the farm fresh produces

F&V: Food and Vegetables

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