

# Understanding Risks in Perishable Supply Chains and Risk Mitigation Strategies in the Context of a Large Fruit/Vegetable Retail Store

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**Abstract** — This paper is case study research on the causes and mitigation methods of fresh produce supply chain disruptions resulting from unpredicted risks. The research was motivated by the unprecedented incidents such as political turmoil as well as demonetization in India. The information gathered is based on literature which is published in this area of research and expert interviews. The research is aimed at addressing the following research questions: How sudden risks affect the perishable supply chain? What managerial actions are done in order to lessen the consequences of these risks? What key factors contribute to the vulnerability to disruption from the risks?

**Keywords:** *supply chain management, supply chain risk management, disruption, vulnerability, perishable*

## I. INTRODUCTION

Supply chains are becoming more and more complex. The underlying factor for this increase in complexity includes globalization and technology. Now we are dependent on more and more resources. This multiple dependency pave way to a complex supply chain. With this complexity, there arises an uncertainty and risk involved is bound to increase. If these risks are not solved timely, it can lead to heavy losses. The safety of the supply chain becomes difficult to predict with this increased complexity and inter relation of modern supply chains. These disruptions in supply chain have long term effects. Some of the disruptions are predictable like the Cauvery issue in Tamil Nadu and Karnataka but some are unpredictable like the demonetization in India, Chennai floods, Tsunami etc. Some of the other factors include the demand volatility, variation in the supply capacity, pricing. Some of the risks can be prevented while some of the risks can be mitigated by adopting appropriate risk mitigation strategies. Big companies have realized the importance of risk prevention and mitigation and have taken steps for risk management.

Indian agriculture market is on the verge of changing from its traditional ways to horticulture, meat, poultry and dairy products. All these fall into the category of perishables. With the change in consumption habits the demand of perishables is increasing. Government realized the need for risk management in this sector and therefore there has been advancement in country's rural infrastructure. In order to reduce the production wastage there are cool chains. It will reduce the wastage from the production centers to consumption centers. These cool chains are used for fruits and vegetables, dairy products, meat and marine products etc. There have been plans for an integrated cool chain that will integrate the supply chain for all commodities. Though there are approaches to prevent the known disruptions there is a need to look into the sudden disruptions that occur in the perishable supply chain.

## II. LITERATURE REVIEW

This research focuses on the supply chain risks and risks that are associated in domestic supply chain of consumable perishable.

### A. SUPPLY CHAIN

“It seems that many companies are not adequately prepared for assessing and addressing supply chain disruptions.”<sup>[1]</sup> This is either because they do not have clarity regarding the risks involved or they are not willing to spend for intermittent risks. This section covers the literature related to the supply chain risks, key factors which contribute to the vulnerability to disruption from these risks and managerial actions are taken to minimize the fresh produce supply chain's vulnerability to disruption.

The supply chain is the connected series of activities which is concerned with planning, coordinating and controlling material, parts and finished goods from supplier to customer <sup>[2]</sup> and is the integration of business process from end user through original suppliers that provides products, services and information that adds value for customers <sup>[3]</sup>.

Supply Chain Risk is the variation in the distribution of possible supply chain outcomes, their likelihood, and their subjective values <sup>[4]</sup>. There are different categories of risks. It includes the risks associated with the suppliers, transport, warehousing, production, marketing, demand, supply, regulatory, legal and bureaucratic, infrastructural and catastrophic risks <sup>[5]</sup>. Supply chain disruptions affect the flow of goods, it creates a delay for customers, creates unavailability, product deterioration and loss of revenue. The risks can be categorized into two- Major risks and Minor risks. Major risks include sudden/short lived absenteeism, machine breakdown leading to late deliveries etc. and major risks involves catastrophic disasters like tsunamis, hurricane etc.

## B. PERISHABLE SUPPLY CHAIN, RISKS AND RISK MITIGATION

The total value of India's perishables/cool chain industry is currently estimated at \$3 billion and is reportedly growing at an annual rate of 20 to 25 percent. The total value of the industry is expected has reached at \$8 billion by 2015 through increased investments and modernization.

This trend is continually increasing along with the increase in the competitive environment. Supply chain activities are adapted according to the change in the demand and activities are rebuilt in order to match the supply and demand. Multiple items are shipped from one location to another in the same truck. The major fails that occur are in regard with inventory, co-ordination challenge, bull whip effect, coordinating disruptions and decreased inventory. Perishables have finite shelf life and it undergoes physical damages and there is high volatility in the demand. These demand variations happen in the upstream of the supply chain contributes to bullwhip effect.

Risk mitigation involves strategies to decrease the likelihood and impact of risks. These strategies should help a supply chain to manage risks under normal conditions, as well as under abnormal circumstances or major disruptions. Thus, a supply chain with risk-mitigation strategies is made more resilient. <sup>[6]</sup> Most researches offer mitigation strategies that seek to minimize supply chain risks in general; only a few offer guidance for specific risks. This risk mitigation strategy involves: Strategic sourcing, E-business technology and Supply Chain Integration <sup>[7]</sup>. Another important factor to be

considered after risk mitigation is reducing the vulnerability to disruption. For this, focus is needed on reducing the likelihood of disruption and resilience. Relevant network should focus on anything malicious and should focus on rebounding the network. There are different dimensions of vulnerability:

- What can go wrong?
- What is the likelihood of that happening?
- What are the consequences if it does happen?

Different kinds of vulnerabilities include financial vulnerability, Hazard vulnerability, Operations Vulnerability and Strategic Vulnerability. Each of this vulnerability is a risk to the supply chain.

## III. METHODOLOGY

The methodology is based on production management and consists of literature review and case study to understand the subject <sup>[8]</sup>. The case focuses on the cantaloupe market in Tamil Nadu and has taken a successful fresh perishable retail chain for the studies. The case focuses on the supply chain, risks and the risk mitigation strategies adopted by them.

The case study is on a local perishable food supplier 'Pazhamudir Nilayam' established in the year 1965 at Coimbatore by two brothers N. Chinnasamy and N. Natarajan. They started off as push cart sellers and later became the largest regional retailer by revenue. By 1983 they had four shops and the same year business was split between the four brothers and the number of outlets grew to nine. Under Natarajan the expansion of 'Pazhamudir Nilayam' became under the banner 'Kovai Pazhamudir Nilayam' expanding from Tiruppur in 1998. The losses made during this expansion didn't stop Natarajan from expanding his business. His confidence and beliefs led to further expansion in Chennai. By 2006, there were eight outlets under 'Kovai Pazhamudir Nilayam'. The annual turnover was around Rs. 40 crores. The business saw many leaps and ups. In 2006, the total outlet numbered 32. They started selling dairy products, confectionaries, bread & grocery. They planned for a 40% turnover from this diversification. In 2012, KPN farm fresh Pvt. Ltd. with 60% stakes in company and distributing balance 40% among six partners in existing KPN outlets. At present, there are about 56 outlets spread all over Tamil Nadu and Pondicherry. The warehouses are in Coimbatore, Chennai, Vanagaram (outskirts of Chennai). The USP for 'Pazhamudir Nilayam' is to deliver fresh vegetables and fruits. They focus on quality and on-time delivery and they believe in word-of-mouth marketing. In order to reach out to customers and to make it more convenient for customers they started an online

portal 'I Buy Fresh.com'. It takes orders online and via phone and delivers the products within 24 hours.

#### Supply Chain of Pazhamudir:



The procurements are done centrally but the accounts are maintained separately. The vegetables and fruits are procured from their source market across India. Direct procurement from farmers is just around 10 percent of the total supplies. Most of fruits in India are seasonal. Therefore, in order to meet the demand from 2008 they have started importing fruits from different countries. This helps in meeting seasonal shortages and organic demand. Apples come from Washington, New York, and China, and oranges from Australia, South Africa, and Egypt. Other imported fruits include pears, plums, grapes and cherries. Overall the imported procurement contributes to 40% of the total supplies. Other than these, the rest of total supplies are from Nagpur, Ganganagar, Andhra Pradesh and Karnataka. In this way, the enterprise ensures that the demand is met throughout the year. The business is focused on supply side. The expansion of Pazhamudir is done strategically analyzing the demands of the new market.

The price strategy of Pazhamudir is based on their business model. The retail outlet decides on different margins for different price range of products that are available at the stores. The retail chain claimed to price the products in the range of 5 to 20 with a margin of 2 to 5. Similarly, as the price increases the margin also increases. The imported products are priced at premium because Indian government imposes heavy duty on imports to protect the interests of domestic farmers. Also, organic products are priced double the price of normal vegetables.

#### IV. FINDINGS AND DISCUSSIONS

The findings and discussions in this section is based on the sudden risk due to demonetization that happened in the country. This section discusses the different vulnerabilities that occurred with the risks and also talks about some even triggered risks.

##### Effect of Demonetization:

Demonetization came to existence on 9<sup>th</sup> November and left the nation in shock. In Coimbatore (Southern part of Tamil Nadu which is a hub of perishable supply to entire south India)

there are mainly two wholesale vegetable markets. The grocery shop, small scale vendors and retail buyers got affected by the sudden ban of 500 and 100 rupee notes. In less than a week's time the markets in Coimbatore which register nearly Rs. 3 crore sales a day saw business drop by 30% by 14<sup>th</sup> November. There are a total of 920 shops in the two markets which sell about 1500 tonnes of vegetables a day. Some are purchased from Karnataka. The demand for vegetables is high during the wedding season and also in June and drops during Aadi (July-August) and Puratasi (September-October) months. The wholesale traders need to pay everyday for the vehicles that transport the vegetables to the market (logistics costs), workers at the shops and the laborers who load and unload vegetables. Shortage of money for spending these costs resulted in the disruptions in the supply chain. Some traders transfer money online to agents in other States from whom they purchase vegetables. But there are also several local farmers who bring the produce to these wholesale markets. There was no cash to pay them. This resulted in the fall in arrival of vegetables and the reduction in sale is continuing. The prices of the vegetables were not changed despite of these disruptions. A lot of sales from Coimbatore go to Kerala. The hartal in Kerala in the meantime also affected the sales. This can be considered as words as an event triggered risk because it followed the sudden risk demonetization which shook the country.

Even though there was a reduction in the sales, Pazhamudir put its priority to the demand. It ensured that there is proper supply to meet the demand and was not willing to indulge in competitive pricing and underpricing products. Pazhamudir stand out by their unique sourcing, distributions, operational and product varieties. They sourced mainly from local markets and imported the exotic varieties. The distribution was managed centrally by a Centralized inventory management. Smooth store operations were ensured by availability of staffs. Staffs are accommodated in dormitories near to stores. The products included wide varieties of fruits & vegetables, fresh fruit chat / juice to utilize inventory. They understood the target consumers before entering the market and forming the strategy. They focused on F&V segment, strong sourcing and lean retail. To reduce the waste new product variants from these F&V were included like fruit chat and fresh juices which helped them to reduce their inventory and wastage. They also introduced technology into their retail chain. Though it increased the cost of operations by 2-5% due to logistics, labor and rent, it allowed stocking more fruits and vegetables. They also invested in cold storage. It helped to keep the perishables fresh for a long time. Overall, they managed to reduce the wastage to 4-5% from 8%. The risk management strategies

were not formulated considering risks in mind. They followed mitigation strategies to avoid the wastage, successfully reaching out to customers and managing the in-house failure.

## V. IMPLICATION FOR FUTURE RESEARCH

This study was limited to a single retail enterprise. This can be extended to a few other retail enterprises and a model for perishable retail enterprise can be found combining the waste and risks. A more effective model for understanding the risk associated with perishable supply chain and the remedial measures need to be researched in order to benefit small scale and large scale business and help the country use the resources in a better way. Also, the relation between the demand and supply can be studied extensively to determine an accurate model for the future business. The study can be extended to understand the bullwhip effect in firms like this on a broader prospect.

## REFERENCES

- [1] Hendricks, K. B. and Singhal, V. R., "Managing Disruptions in Contemporary Supply Chains," *Dynamic Supply Chain Alignment*, edited by J. Gattorna, Aldershot: Gower, pp. 85-96, 2009.
- [2] Graham C. Stevens, (1990) "Successful Supply-Chain Management", *Management Decision*, Vol. 28 Iss: 8
- [3] Douglas M. Lambert, Martha C. Cooper, Janus D. Pagh, (1998) "Supply Chain Management: Implementation Issues and Research Opportunities", *The International Journal of Logistics Management*, Vol. 9 Iss: 2, pp.1 – 20
- [4] March J.G., Shapira, Z. (1987) "Managerial Perspective On Risk And Risk Taking" *Management Science*, 33, Pp1404-1418
- [5] Gyula Laszlo FLORIAN Alexandru CONSTANGIOARA ,The Impact of Risks in Supply Chain on Organizational Performances: Evidence from Romania, 2014
- [6] Christopher S. Tang, (2006) "Perspectives In Supply Chain Risk Management"
- [7] Kim, Minkyun. Impact of strategic sourcing, e-procurement and integration on supply chain risk mitigation and performance. State University of New York at Buffalo, 2010.
- [8] Meredith, Jack. "Theory building through conceptual methods." *International Journal of Operations & Production Management* 13.5 (1993): 3-11.
- [9] Iris Heckmann, Tina Comes, Stefan Nicke, A critical review on supply chain risk – Definition, measure and modeling, October, 2014
- [10] Heti Mulyati Jutta Geldermann , Managing risks in the Indonesian seaweed supply chain, May 2016
- [11] Omar Ahumada, J. Rene Villalobos Application of planning models in the agri-food supply chain: A review, February 2008
- [12] Behnam Fahimnia, Christopher S. Tang, Hoda Davarzani, Joseph Sarkis ,Quantitative models for managing supply chain risks:A review, April, 2015
- [13] James R. Bradley , An improved method for managing catastrophic supply chain disruptions ,2014
- [14] Stefan Minner , Sandra Transchel, Production, Manufacturing and Logistics Order variability in perishable product supply chains , December 2016
- [15] Chaaben Kouki , M.Zied Babai , Zied Jemai, Stefan Minner ,A coordinated multi-item inventory system for perishables with random life time, January 2016
- [16] Constantin Blome , Tobias Schoenherr , Supply chain risk management in financial crises—A multiple case-study approach , January 2011
- [17] Apte, Aruna. "Supply chain networks for perishable and essential commodities: design and vulnerabilities." (2010)
- [18] Raghuram, P, Saleeshya, P.G. (2016), "Assessing the responsiveness of supply chain -structural equation modelling based approach", *International Journal of Logistics Systems and Management* Volume 25, Issue 4, 2016, Pages 558-579
- [19] Saleeshya, P.G., Sachin B (2015), "Modelling and analysis of an agile supply chain", *International Journal of Productivity and Quality Management*, Volume 15, Issue 4, 2015, Pages 486-51

