

Supply Chain Efficiency: An Insight from Fruits and Vegetables Sector

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Abstract: This paper intends to address the status of supply chain quality in the Bangalore city fruit & vegetables sector and addresses the need and value of an effective supply chain in this industry. The inefficiency of the fruit and vegetables supply chain industry is described by this paper as one of the major business problems in India's agricultural sector. Usually the literatures focuses on the Fruits and Vegetables general supply chain and ignores the supply chain efficiency perspective.

Keywords: Fruits and Vegetables, Supply Chain Efficiency, Logistics, Retail Sector.

1. INTRODUCTION

As the population increases, the demand for such food also increases. In order to meet this demand and provide food in good quality and nutrition, supply chain plays a very vital role in this sector and becomes even more important due to perishability and very short shelf life. India is the world's known basket of fruits and vegetables. It is the world's second-largest producer of fruit and vegetables, behind China. India is the main vegetable manufacturer of ginger and okra, and ranks second in tomato, onion, cauliflowers, brinjal, cabbage, etc. Amongst the fruits, the nation ranks first in banana production (25.7%), papaya (43.6%) and mangoes (including guavas) (40.4%).

In India, the fruit and vegetable processing industry is likely to expand at a compound annual growth rate of 7.62 per cent between FY 2018 and FY 2023 to cross an INR 256.4 billion in FY 2023. Commercial fruit and vegetable manufacturing in India is currently extremely small, with around 2.2% of total production compared to countries such as the Philippines at 78%, China at 23% and the United States at 65%. Due to the presence of a large number of players vying for limited shares in the overall market, the unorganized sector is facing a stiff competition.

Due to the increasing penetration of organized retail in the world, demand for processed fruits and vegetables is expected to rise considerably. Also increasing demand for processed food is increasing in the number of nuclear families. Such families' busy lifestyles have increased their reliance on food items which require less time to prepare.

India's diverse climate ensures all fresh fruit & vegetable varieties are available. It ranks second in world production of fruits and vegetables, after China. Although India's share of the global market remains close to 1 percent only, the country's acceptance of horticultural products is increasing. This was attributed to rapid improvements in the areas of state-of-the-art cold chain systems and quality assurance initiatives.

In addition to large investments poured in by the private sector, the public sector also took initiatives and several Centres for Perishable Cargoes and integrated post-harvest handling facilities were built in the country with APEDA's assistance. Capacity-building initiatives at the level of farmers, processors, and exporters also contributed to this effort.

Supply Chain of Fruits & Vegetables in India

In the Indian context, fresh fruit and vegetables play a vital role, and their marketing functions as an influencing force in the economy. Although retailing fresh fruit and vegetables is a low-margin sector, in a country like India, the market potential is very high. This element has attracted other businesses into this field.

Due to the perishability, seasonality and bulkiness, the marketing of agricultural produce is different and more challenging than many industrial products. The very existence of farmers' small land holdings, varying climatic conditions, development spread across a large geographic area, primarily in remote villages, diversified consuming patterns / habits of Indian consumers and low supply chain (SC) infrastructure render marketing of fruit and vegetables more difficult. At the same time fresh fruits and vegetables are demanded by Indian consumers. Thus SCM plays a crucial role in the fruit and vegetable marketing.

Supply chain productivity not only helps to increase production and consumption per capita but also adds to the country's economic growth. As a consequence, SCM is presenting both challenges and opportunities in fruit and vegetable marketing. Efficient SCM in marketing not only improves retailers' productivity and output but also adds value to various stakeholders such as growers (farmers), consolidators and customers.

Scope of Supply Chain Management in Fruits and Vegetables in India

There is still a huge gap between per capita demand and supply due to enormous waste during post-harvest storing and handling induced by unsuitable bagging without crushing, shortage of temperature-controlled automobiles, unavailability of cold chain facilities in different parts of the country for food survival and substantial processing of agricultural products resulting in enormous losses. The effective control of the supply chain for fruit and vegetables must therefore be strengthened at all levels of production by following best industry practices in preparation, processing, distribution, shipping, value-added operation, etc. Because according to this paper important disadvantages of the current supply chain are high waste level, quality degradation, poor infrastructural facilities and high cost.

Supply Chain Efficiency

Efficiency in the supply chain is how well the supply chain uses the capital. The most efficient supply chain has the lowest possible cost and, at the same time, meets the expectations of the customer regarding service such as delivery precision and lead time. According to Beamon (1998), efficiency is the measure of how well the expended resources are used. It describes to what extent time, effort or cost is used well for the intended task or purpose. It is often used with the specific purpose of relaying the ability of a specific application of action to successfully achieve a particular outcome with a minimum or quantity of loss, cost, or excessive energy.

There is a comprehensive research obligation in this field not only to better understand the challenges of supply chains management, but also to recognise opportunities for improvement and to the some supply chains inefficiencies. F&V is highly perishable in nature; and due to the high level of waste and inefficiency in this industry, an effective supply chain has become an absolute necessity after the farm gate to the final consumer, so there is an urgent need to build smart supply chains to curb losses and improve the shelf-life of F&V and ensure safety and desired quality.

Several researchers have found inefficiency in the supply chain as the major problem in India's supply chain of the F&V industry, leading to supply chain delays and wastes that eventually lead to higher prices charged by final customers and lower incomes for farmers and other stakeholders. Only the proper and efficient supply chain can reduce the extent of the wastage. The efficient supply chain is therefore a necessity for the F&V sector and its importance has been discussed in the next section in this sector.

Importance of Efficient Supply Chain in Fruits and Vegetables sector

It is expected that improving the efficiency and performance of the entire supply chain in the F&V sector will significantly reduce perishable food waste and increase farmers' and other stakeholders' incomes. Efficient supply chain in the F&V industry is very significant and will result in an increase in the benefit of the companies participating in the chain and, most significantly, a decrease in the losses and wastes in this business. It will also reduce the likelihood of deterioration in the quality of F&V products and help to increase the value and make reliable delivery to the consumer with the right quality and at the right price at the right time.

Players in the Supply Chain of F&V Sector in India

In the supply chain management of F&V, there are several players involved throughout meeting the needs of the customer. These are farmers, local traders, transporter agents, auctioneers, whole salaries, processors, traditional retailers of all kinds of family run stores, roadside shops, pavement shops and cart vendors apart from farmers and consumers.

Scenario of Fruits and Vegetables Production

The supply of fruits and vegetables per capita in India is quite low due to post-harvest losses that account for about 25% to 30% of production. Nevertheless, by the time it reaches the market, the price of a significant amount of goods often deteriorates. Most of the problems related to fruit and vegetable marketing can be attributed to their perishability. High marketing costs, market gluts, price fluctuations and other similar problems are responsible for perishability. There is an increase in fruit and vegetable output but there is also a significant increase in the region of cultivation which results in low production per hectare. This phenomenon is caused by various factors which lead the race by economic and technological factors. This needs to be educated the producers of the latest available technologies, and also aid them by providing support to procure them, and there should be good supply chain management in the country that would help prevent farmers from being abused and help increase their income.

Cold Storage

Status of cold storage and its potential in India

The country's estimated annual fruit and vegetable production is about 130 million tons. This represents 18 per cent of our agricultural output. Output is growing slowly due to complex agro-climate conditions and better availability of the kit of activities. Although there is sufficient room to increase production, the shortage of cold storage facilities and cold chain facilities are becoming significant bottlenecks in maximizing capacity. The cold storage facilities currently open are mostly for a single commodity such as cabbage, peach, strawberry, strawberries, pomegranates, roses, etc. resulting in inadequate use of space.

Storage of fruits and vegetables and storage conditions

Fruit and vegetables and many other commodities can be preserved by low-temperature storage, which delays microorganisms activities. Microorganisms are the agents of spoilage, and consist of bacteria, yeasts and molds. Low temperatures do not destroy these spoilage agents as well as high temperatures, but significantly reduce their activities, providing a practical way to preserve perishable foods in their natural state that otherwise cannot be heated. The low temperature needed for survival depends on the time necessary for storage, also referred to as short-term or long-term scarcity and product type.

Wastage of fruits and vegetables

Only 10-11 per cent of fruit and vegetables produced in India are reported to be using cold storage. To avoid wastage, storage capacity must be increased by 40 per cent. In the southern and western regions of India, there is more fruit and vegetable wastage due to the tropical and humid climate.

2. LITERATURE REVIEW

The supply chain is a network of organizations that, through upstream and downstream linkages, are involved in different processes and activities that produce value in the form of products and services in the hands of the ultimate customer (Christopher, 1998).

In other words, the supply chain consists of multiple parties / companies, both upstream (i.e. supply) and downstream (i.e. distribution) and the end customer. Planning and monitoring of the distribution of complete content from producers to retailers to dealers and eventually to end users (Jones & Riley, 1985). Ballou (2004) states that the supply chain applies to all activities related to the production and flow of goods.

According to Simchi-Levi et al. (2008) Supply Chain Management (SCM) may be defined as a set of approaches used to efficiently integrate suppliers, manufacturers, warehouses and warehouses, so that goods are produced and distributed in the right quantity, in the right place and at the right time, in order to minimize system-wide costs while meeting service level requirements. It involves a number of independent organizations and develops through intra-and inter-organizational integration and coordination, including the initial stage for the end user.

The competitive advantages for any firm come from an increase in productivity and value. Advantage of efficiency improves by achieving better performance with reduced resource utilization relative to others. Value comes from the provision of customized products or services, reliability and responsiveness that require innovation and resources (Christopher, 1998).

Integration and coordination is achieved through a supply chain partnership that requires healthy interactions between partners over time, sharing information, risks and rewards (Ellram & Krause, 1994).

In both research writing and inventory network practice, the expressions "benchmark" and "benchmarking" are regularly utilized loosely and are deciphered in a disturbing assortment of ways. This examination investigates Taylor's (1911/1998) logical administration hypothesis and Forrester's (1958) frameworks elements fill in as antecedents to the present benchmarking ideas and binds them to the establishment of production network the executives (SCM). Financial matters and business hypotheses – Principal Agent Theory (PAT), Transaction Cost Theory (TCT), Resource-Based View (RBV), and System Theory (NT)- - are investigated to build up the hypothetical area for production network the executives. An outline of the present store network the board goals and models is exhibited and consolidated into the serious condition of the present store network. While concentrating on the requirement for an integrative way to deal with production network the executives, this examination too surveys writing relating store network the board practices to operational effectiveness. This survey centres around exact investigations that dissect store network the board rehearses and exercises trying to distinguish those practices that acceptably affect inventory network proficiency.

Significance of Benchmarking in Supply Chain Management

The term "benchmark" is used to articulate a specific objective that an operating unit wants; it is formulated as a metric (meaning a standard measure), which is the basis for comparison with another operating unit, and it may be stated as a standard (as a measure rule) on which a judgment may be made, or simply as a specific "trigger point" which indicates that some management action is necessary. The term "benchmarking" originally referred to a permanently marked item and a reference point for land geometry measurement (Pulat, 1994). "Benchmark(s)" and "benchmarking" are often used interchangeably but are not strictly synonymous.

The managerial insistence on "benchmarking" became part of the consistency movement, largely influenced by Deming's earlier work in the late 1970s and early 1980s. Recent scholarly work related to benchmarking has taken place in the manufacturing sector, where Xerox Corporation is credited with the application of benchmarking to American companies. Camp, a logistics specialist, has popularized the use of benchmarking methods since leading the Xerox benchmarking project. According to Camp, benchmarking is the quest for industry best practices that contribute to superior efficiency.

SUPPLY CHAIN IN FRUITS & VEGETABLES (F&V) SECTOR

Over the years, the definitions have changed and have broadened the scope of SCM, but these definitions are still limited to manufactured products and services with little attention paid to agriculture.

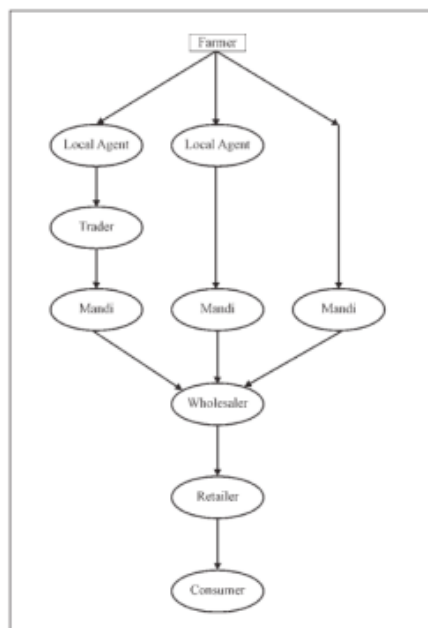
F&V is a big part of the world economy and a raw material for many sectors. Among agricultural products, perishable food items such as F&V have earned the least attention. The SCM of F&V is the cycle from production to distribution of agro-fresh goods, i.e. from the farmer to the consumer.

SCM F&V is complex compared to other SCMs due to the perishable nature of the products, high fluctuations in demand and prices, increasing consumer concerns about food safety and quality (Vorst & Beulens, 2002) and dependence on climate conditions (Salin, 1998).

The existing supply chain in the F&V sector involves a number of intermediaries who consume all of the shares of around 75% of the total net margin of the entire supply chain (Modi et al. 2009).

From the farm gate to the consumer, the horticultural product passed through six-seven different distribution channels (Viswanadham, 2007). F&V generated in the farmer's field meets the final customer through a series of intermediaries. These intermediaries perform various roles, such as transfer of ownership of items, transport, management and protection of quantity and quality, payment to the seller and delivery of goods to the consumer (Halder & Pati, 2011)

Figure 3. Supply Chain for Fruits & Vegetables sector in India



Source: Modi, P et al, 2009

Players in the Supply Chain of F&V Sector in India

Many players are involved in meeting the needs of customers in the supply chain management of F&V. These are farmers, local traders, agents (commission agents), transporters, auctioneers, wholesalers, processors, traditional retailers of all types of family formats run' mom and pop' stores, roadside shops, pavement shops and cart vendors, except for farmers and customers. Farmers are manufacturers of goods and suppliers of production. They are small by land holdings and crop yields and are highly fragmented across geographical areas. Agents, auctioneers and wholesalers are dealers in the supply chain.

Cold Chain

The cold chain prevents a wide variety of F&V products in order to deteriorate throughout the supply chain by offering a temperature controlled environment. It is a logistic system that provides for a set of regulated temperature storage and transport conditions from the point of origin to the point of consumption, i.e. from farm to fork. This protects new products from oxidation, heat, excessive temperature treatment and keeps them frozen, healthy and cooled (Bishara, 2006). Some temperature or time-distance disturbance in the cold chain may obstruct the net present value and their added value (Bogataj et al., 2005). The cold chain starts at farm level and protects temperatures up to the level of the customer.

Figure 4. The Cold Supply Chain Infrastructure

Supply Procurement	Transport	Storage	Transport	End Customer
<ul style="list-style-type: none"> •Precooling System •Farms (Rural Markets) •Manufacturers 	<ul style="list-style-type: none"> •Refrigerated Trucks •Refrigerated Railway Wagons •Refrigerated 	<ul style="list-style-type: none"> •Cold Storage •Warehouses 	<ul style="list-style-type: none"> •Refrigerated Trucks •Refrigerated Railway Wagons •Refrigerated 	<ul style="list-style-type: none"> •Retail, Terminal, Markets, Factory, Ports, Airport

Source: Sapra & Joshi (2011)

In 2010, the cold storage difference was approximately 370 lakh MT, as shown in Table 1 on the basis of peak season production and the highest monthly arrival / harvest of storable F&V (NCCD, 2012). Existing cold storage facilities are only located on or near the wholesale market. The local market or regional market does not have a cold storage facility where the main fresh produce is sold by the farmer.

Table 1. Gap in Cold storage capacity in various states in India

State	Cold Storage Requirement in lakh MT	Present Capacity in lakh MT	Gap in lakh MT
Andhra Pradesh	23.24	9.01	14.23
Assam	9.19	0.88	8.31
Bihar	42.41	11.47	30.94
Chhattisgarh	5.43	3.42	2.01
Gujarat	27.48	12.67	14.81
Haryana	8.04	3.93	4.11
Himachal Pradesh	4.87	0.20	4.67
Jammu & Kashmir	7.37	0.43	6.94
Jharkhand	7.96	1.70	6.26
Karnataka	24.04	4.07	19.97
Kerala	27.71	0.58	27.13
Maharashtra	62.73	5.47	57.26
Manipur	0.80	0.00	0.80
Meghalaya	2.39	0.03	2.36
Mizoram	0.74	0.00	0.74
Madhya Pradesh	12.13	8.08	4.05
Nagaland	0.70	0.06	0.64
Orissa	18.35	2.91	15.44
Punjab	13.18	13.45	0.00
Rajasthan	3.91	3.24	0.67
Tamil Nadu	79.06	2.39	76.67
Tripura	1.63	0.30	1.33
UP & Uttaranchal	122.28	101.87	20.41
West Bengal	105.66	56.82	48.84
Total	611.30	242.98	368.32

Source: NCCD (2012)

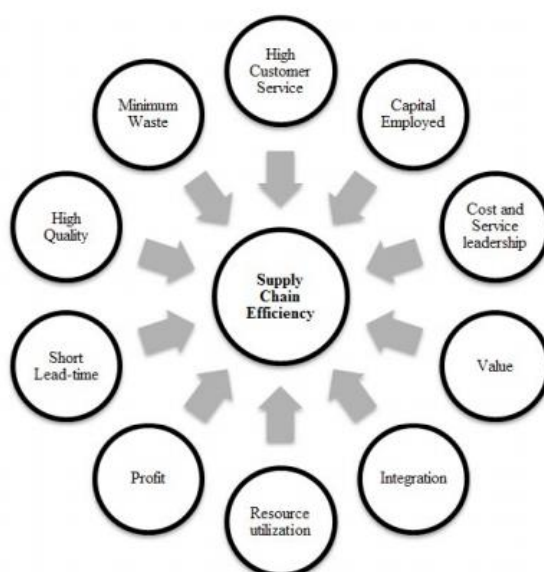
Supply Chain Efficiency

Efficiency according to Beamon (1998) is a calculation of how well the services expended are used. In general, it represents the degree to which time, energy or expense is well expended on the intended mission or purpose.

It is often used for the specific purpose of relaying the potential of a particular effort to produce a specific outcome successfully with a minimum amount or quantity of time, cost or excessive energy. Supply chain productivity is how well the supply chain manages the money.

The most effective supply chain has the lowest possible expense and, at the same time, exceeds customer expectations with resources such as distribution quality and lead time (Pettersson, 2008).

Figure 5. Factors Defining Supply Chain Efficiency



SUPPLY CHAIN EFFICIENCY IN FRUITS AND VEGETABLES (F&V) SECTOR

Supply chains in the case of the F&V sector may vary from product to product in terms of the number of players / parties involved and the value of the product at each stage. Value added depends on the type and sector of the product / commodity.

Some players are involved in the export business and some are involved in the food processing business, so in this case the value added is higher and very low in the F&V domestic supply chain. The supply chain of the F&V industry is affected by the availability and efficiency of infrastructure, such as bridges, storage facilities, communication and communications networks, and technology, etc.

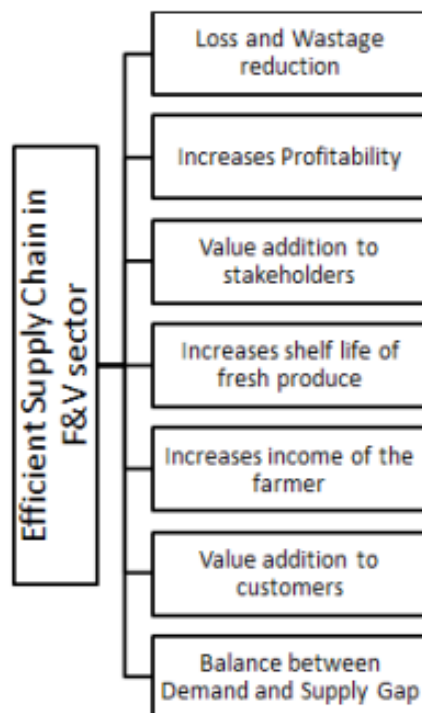
The current supply chain in the F&V market, which connects farmers to both organized and unorganized retail, is still in a very pitiful state and highly inefficient with a range of intermediaries and manual handling. As a result, there is a lot of waste as much as almost 30% and also less remuneration for farmers (Viswanadham, 2007). A large share of the realizable value of a farmer is lost as commission, mishandling of the supply chain and losses (Narula, 2011).

Due to the inefficient supply chain, the price received by farmers is only about 24 to 58 per cent of the consumer price. It is the dysfunctional supply chain that costs middlemen, customers and producers more (Veena et al., 2011). Without an effective supply chain, there is a high cost of loss for businesses (Rathore et al., 2010). Inefficiency in the supply chain of the F&V industry leads to high losses and profits resulting in the sale of inferior quality products to the market and lower prices to producers.

Importance of Efficient Supply Chain in F&V sector

The Efficient Supply Chain is very important in the F&V industry and will lead to an increase in the income of the companies engaged in the chain and, most significantly, to a decrease in costs and losses in the business. It will also reduce the chances of degradation in the quality of F&V supply and help to improve performance and ensure consistent distribution to the customer at the right time, with the right quality and at the right prices. Throughout Literature, various authors addressed the importance of an effective supply chain in the F&V sector in India.

Figure 6. Importance of Efficient Supply Chain in F&V Sector



Objectives of the study:

- 1) To study the current trends in supply chain in fruits and vegetable sector in Bengaluru City
- 2) To find out the inefficiencies in supply chain in fruit and vegetable sector in Bengaluru City
- 3) To understand the methods adopted by vendors to overcome these inefficiencies

3. RESEARCH METHODOLOGY

Research Methodology

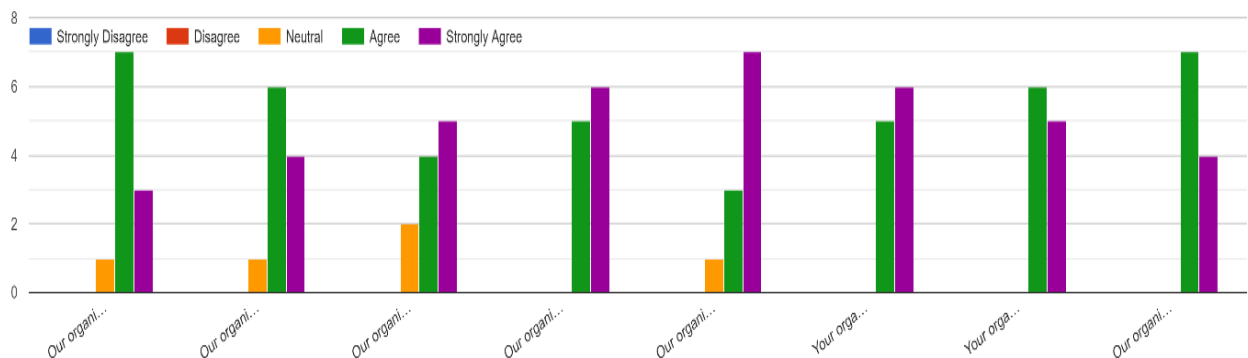
This research is exploratory and includes research tools such as in organized retailing in-depth interviews with players. The approach will be to find out what issues this business faces, its logistical processes and what tools they use to tackle them.

This paper uses case based approach where instead of relying solely on the awareness of problem domain or creating correlation with abstract relationships between problem descriptor and conclusion, we can make use of previously encountered information and particular problem circumstances or cases.

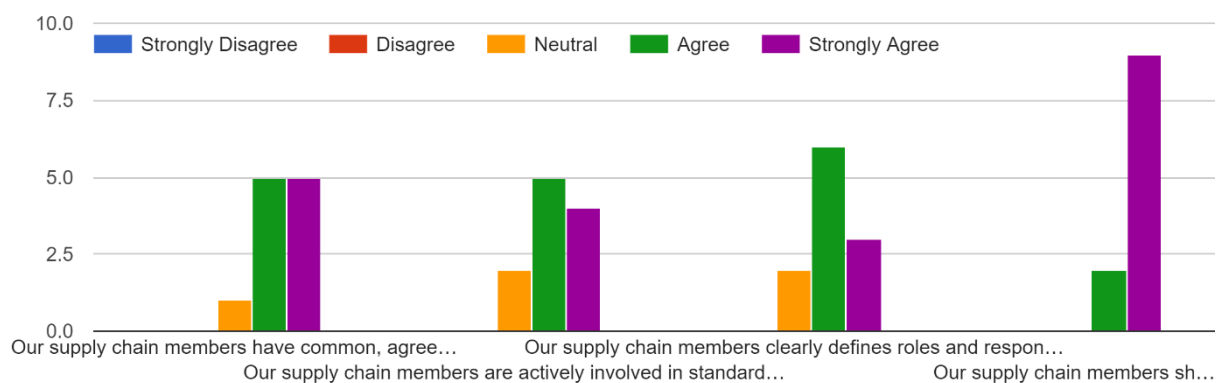
It is possible to solve the problem in one market by searching for its solution in another market where similar situation had been faced earlier. This methodology will also help in incremental and sustained learning which, if future problems arise, can once again act as solution.

Data Analysis and Interpretation

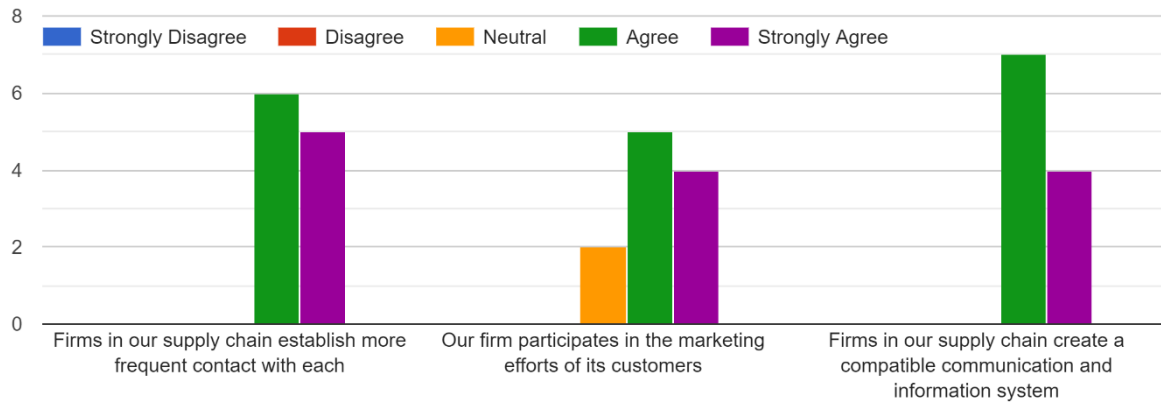
Please indicate your level of agreement on the following statements about Suppliers?



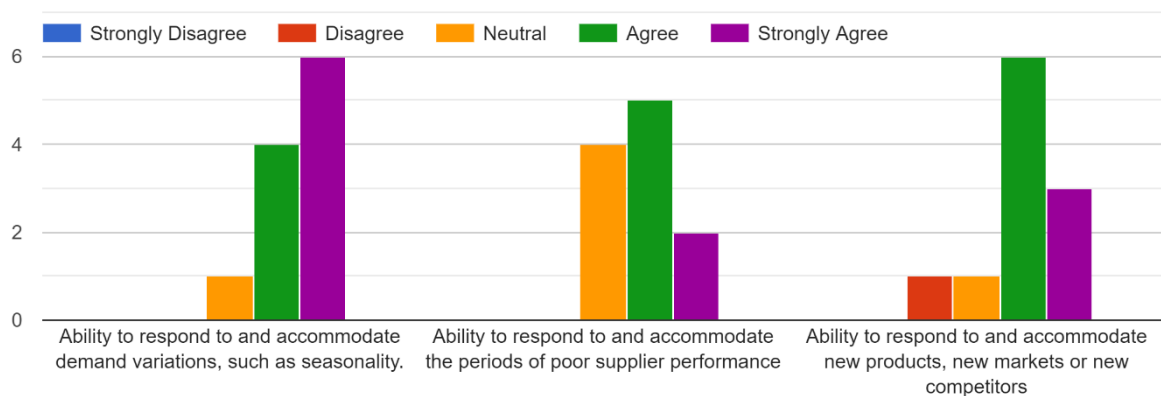
Please indicate your level of agreement on the following statements about Supply Chain?



Please indicate your level of agreement on the following statements about Supply Chain Communication?



Please indicate your level of agreement on the following statements about Supply Chain Flexibility.



4. CONCLUSION

In the case of agriculture and the allied sector in India, the fruit and vegetable sector (F&V) account for a significant share of world production. This paper presents the status of the F&V supply chain sector in India, the efficiency of the supply chain, and highlights the need and importance of an efficient supply chain to remove various bottlenecks and reduce losses and losses in this sector. Research and research conducted on the supply chain of the F&V industry in India show that the supply chain is highly inefficient, leading to huge profits and damages and reduced revenues for stakeholders.

The development of an intelligent and efficient supply chain will play a key role in reducing losses and losses, increasing farmers' incomes, increasing export earnings, generating employment opportunities for local people, and improving the livelihoods of local peoples, as India's economy is based on agriculture and has a vast potential to serve domestic or global markets through a variety of value additions.

The paper discusses the current position of the F&V industry in India. Since offering a quantitative overview of supply chain management, the supply chain for the F&V industry is being analyzed. The efficiency of the F&V supply chain is then analyzed and the need & importance of research for an efficient supply chain in the F&V sector has been discussed. It has been clear from the literature that the supply chain of the F&V is highly inefficient. The present study undertakes a thorough review of the available basic and contemporary literature and aims to define the business problem in the supply chain of the F&V sector in India.

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