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## Logistics and Supply Chain System of Agricultural Output-The Scenario of Assam

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### Abstract

*In India, the farmers still lack real time information about consumers, market demand and prices and are prone to more exploitation by existing intermediaries in the conventional supply chain. With the growth of organized retailing and free global trade, farming is becoming highly knowledge intensive, commercialized, competitive and globalised, making it necessary to digitize, rebuild competitive. In agriculture sector, an efficient supply chains to benefit both the farmer as well as the consumer. Also the urban areas are congested with deteriorating quality of life and highly saturated markets. While nearly 60 per cent of India's population live in rural areas, and forecasts indicate that these numbers will remain the same, even in 2050. There would be approx. 800 million people living in Indian rural areas in the 2040-50s, providing the scale and the markets for commodity supply chains to thrive. Thus, there is a need for transforming rural India into a group of sophisticated vibrant activity centres. Innovations and transformations will be required in every layer of products, processes, business models, and service models. This study aims to find the different aspects of supply chain of agricultural outputs mainly in Assam and India by and large. The state of Assam is capable of producing many sorts of agricultural commodities but yet to reach the ideal position in terms of supplying and distribution.*

**Keywords-** Supply Chain, Organized Retailing, Global Trade, Agricultural Outputs

### 1.0 Introduction

India is an agro-based economy with the agriculture sector continues to provide employment for more than half of the country's massive population. However, the **Agriculture and the allied sector contributes only 18% to the nation's Gross Domestic Product (Economic Survey Report 2016-17)**. According to **FAO UN, right now with nearly 11 percent (1.5 billion ha) of the globe's land surface (13.4 billion ha) is used in crop production**. India is the world's third-largest producer of food grains, the second largest producer of fruits and vegetables and the largest producer of milk; it also has the largest number of livestock. Add to that a range of agro- climatic regions and Agri-produce, extremely industrious farmers, a country that is fundamentally strong in science and technology and an economy which one of the largest in the world with one of the highest growth rate. **According to World Bank (2015), 75 percent of the worlds' poor live in rural areas – 883mn people at the US\$1 per day poverty-level and depend on agriculture as their major source of income**. Agricultural growth can be an effective tool in reducing rural poverty, economic growth and strengthening agricultural value chains in countries like India could

be among the most effective ways to address the socio-economic issues of farmers. In the present day context of globalisation, changing needs of the farmers, increasing pressure of population on the food security system, encouraging the developing economy like India to find alternatives in supply chain management for its efficient and sustainable agricultural development. Agricultural Supply Chains system plays a crucial role in providing producers access to markets; they affect economic, social and environmental sustainability of rural communities.

## 2.0 Need for the study

India's rural markets present opportunities made even large companies seeking to become high performance business cannot afford to ignore. But the volume and scale of those markets (Three-fourth of the country's 1.3 billion people live in rural) have been offset by concerns about the of rural demand. Industry and academic estimates put Logistics and Supply Chain System spending in India at approximately 13% of the Gross Domestic Product (GDP). Global estimates for this vary and are around 13% of GDP in China and about 9% of GDP in the US. According to NTDP report, 2014, the transportation cost in India accounts for nearly 40% of the cost of production, with most of the goods being moved by road. Trucking accounts for nearly 70% of transportation and accounts for 60% of all logistics cost. Road is followed by rail and finally coastal shipping. Out of the total logistic cost, transportation represents 39%, while warehousing, packing and inventory accounts 24% of the total costs. Higher logistic costs are mainly due to poor infrastructure facilities. Insufficient distribution channels and infrastructure bottlenecks restrict the scope to reach consumer of products nationwide. Though over the years India has developed the largest road networks in the world, yet the infrastructural facility is not comparable to developed countries. The rural trend creates a requirement to rethink the manufacturing and distribution footprints for the big centres of demand. The potential benefits include cost efficiency, a shorter logistics chain, and greater product freshness. Therefore, supply chain for Rural India is one of the most critical aspects in the current scenario. It is also important because approximately 60% of India's population is rural & approximately 800 million people is expected to live in rural India in the 2040-50s making rural supply chains in India as the next big opportunity.

## 3.0 Logistics and Supply Chain Management

Logistics and SCM are often used interchangeably, though there is a subtle difference between the two. The term "Supply Chain Management" was coined in 1982 by Keith Oliver of Booz, Allen and Hamilton Inc. But the discipline and practice has been in existence for centuries. 'Logistics' has a military origin, and used to be associated with the movement of troops and their supplies in the battlefield. But like so many other technologies and terminologies, it entered into the business lexicon gradually and has now become synonymous with the range of activities ranging from procurement of raw materials to the delivery of the final polished good to the consumer. While SCM is more strategic in nature, logistics is more operations-oriented. Failure in the performance of a firm's supply chain courtesy of inefficient logistics activities results in competitive losses and can ultimately lead to collapse. Logistics play a significant role in pursuing supply chain excellence which will leads to improvement in organization performance.

**Agricultural supply chain** is defined as the interlocking chain from the acquisition, processing, transportation, distribution and eventual delivery of agricultural products to customers. Agricultural supply chain is supply and demand networks involving upstream and downstream farmers, manufacturers, wholesalers, retailers and final consumers.

## 4.0 Why Agricultural Logistics & SCM?

Rural markets are small and cater for a definite number of near-by households. The traders in these markets are mostly farmers themselves with well-established small circles of customers. The access to the local market is easy but the supply at the market is very difficult and fluctuates seasonally. Agricultural products play a pivotal role

in the global strategies for fulfilling consumers demand. However, diverse weather conditions, alternative uses of agricultural production, volatile global food demand and instability of commodities' prices lead to a fragile supply of agricultural products. Agricultural supply chain has emerged as a critical issue for the states and nation as well as for the international community.

Agricultural logistics and supply chains are affected by a number of complex and interrelated factors and issues that include: land tenure, farm size, market structure, information flows, the availability finance and banking facilities, available logistics infrastructure and services, government policies and levels of public and private participation. One of the most critical bottlenecks in agricultural produce is the complexity and cost-efficiency of the logistics operations. Modern, Agri-output networks require multi-level supply chain management (SCM) approaches due to the increased flows of goods and information. Now it is becoming globally interconnected systems of complex relationships, affecting the ways in which food is being produced, processed and delivered (**Burch & Lawrence, 2005**).

## **5.0 How Agri-Supply Chain it is different from other Supply Chain**

Many features of the agricultural products entitle the supply chain of agricultural products with several characteristics different from those of the industrial supply chain:

### **5.1 Perishables of fresh agricultural products**

Agricultural products in circulation, for example, require classification, processing, sorting, etc. during the process, part of the agricultural products storage and transportation needs specific containers and equipment, such as the need for dedicated equipment for dairy products logistics. In addition, limited by season, climate and other natural conditions, agricultural products production cycle compared with manufactured goods is much longer, and investment in agricultural production has a longer payback period.

### **5.2 High market uncertainty**

Dispersion of the agricultural production and consumption makes the market information very scattered, difficult to fully grasp the market supply and demand information and competitors, and partners' information; strong seasonal agricultural production, agricultural products listed as if in a short time is difficult to adjust, which can make the market price fluctuations bigger, in addition of fresh agricultural products perishables limits the agricultural products between across different regions and seasons timely adjustment, that makes the agricultural products supply chain more risks.

### **5.3 The disequilibrium of market forces**

Farmers in the developed countries, such as the United States, are usually land owners, but our country is based on the household management of small farmers, and most agricultural products are produced by scattered farmers, which is relative to other market main body while scattered farmers market strength is still very weak. In small farmers as the main body of the country, if there is no "leading enterprises or joint self-cultivated farmers in cooperative organizations", the agricultural management integration is just empty talk.

### **5.4 Agricultural products' supply chain of logistics demand is higher**

Since the agricultural production is mostly regional, and people's demand is diverse, it is necessary to trade flow between different areas and farms with fresh perishable nature. Especially the fresh agricultural products, the higher request for logistics distribute, and this difference obviously interests the logistics distribution works. To improve the level of agricultural products logistics, we must implement the specialized logistics management, reduce the supply chain of agricultural products.

## **6.0 Review of Literature**

Literature review is the base of understanding of subject. The literature review covers many areas related to the nature of the research questions put forward, and thus includes: agriculture, food management, supply chain approaches, information technology and supply chain interfaces. The content analysis is a research tool that determines the presence of certain words or theories within texts or a set of texts. In this paper, the target population is the published articles on various scientific databases like Springer, Taylor & Francis, J-Stor, Open access Journals, Emerald, Science direct etc.

Description	Author(s)
The terms “supply chain”, “value chain”, “commodity chain”, and “Agri-food system” are used interchangeably, with slight differences in meaning depending on the focus and context.	Chen, Shepherd and da Silva(2005)
The fundamental difference between food supply chains and others is the continuous and significant changes in the quality of food products throughout the supply chain network.	Sloof, Tijskens and Wilkinson, 1996
SCM of perishable food produce is complex as compared to other SCMs due to the perishable nature of the produce, high fluctuations in demand and prices, increasing consumer concerns for food safety & quality	Vorst & Beulens, 2002
SCM in Agriculture dependence on climate conditions.	Salin, 1998
There are several players involved in fulfilling the needs of the consumer in the supply chain management of F&V like farmers, local traders, transporters, processors, retailers etc. From a farm gate to a consumer, a horticulture product passed through six-seven different distribution channels.	Viswanadham, 2007
Perishable food produced in the farmer’s field reaches the end consumer through a chain of intermediaries. These intermediaries carry out various functions, such as transfer of ownership of commodities, its movement, maintenance and preservation of quantity & quality, payment to the seller and commodity delivery to the buyer.	Halder & Pati, 2011
Coordination issues due to cost associated with contracting farmers, a collection of large volumes of fresh farm products from small and marginal farmers, inadequate infrastructural facilities, and the geographical distance between farmers and supermarkets in cities	Mikkola, 2008
The trends towards rapid Agri-food production cycles, volatile nature of product demands, complex methods of Agri-supply chain partnerships are reflected by the emergence of contract farming and farmer cooperatives and the perishable nature of the agri-food products	Christopher, Peck, Towill, 2006

Also, **Sachan, (2005)** quoted that the Agriculture is inherently a fragmented and unorganized sector involving a diverse range of distinct stakeholders such as inputs supplier, farmers, traders, commission agents, processors and distributors. As compared to developed countries, the Indian agriculture supply chain is far more complex and difficult to manage due to its unorganized nature and a large number of intermediaries. About 25-30 percent of agricultural production gets wasted due to improper handling and storage, pest infestation, poor logistics, inadequate storage and lack of transportation infrastructure.

**Sahay and Mohan, (2003)** found another important reason for inefficient supply chain is the inadequacy of logistics infrastructures- roads, railways, airport, seaports, information technology, telecommunications and energy production, which is simply poor compared to other developed and developing countries.

**Ahya, (2006)**, mentioned that agriculture supply chain suffers from inefficiency at every stage. Lack of proper infrastructure for procuring agricultural produce from the farm gate to the consumer has led to huge losses in transit. The farmers hardly benefit by any price rise while the many layers of intermediaries enjoy high margins. Also, farmers are forced to sell their produce at throwaway prices in times of bumper crops. This has also led to large mark- ups in pricing due to extra layers of intermediaries.

**Mittal, (2007)** reported that approximately 60 percent of quality is lost while produce is transported from the farm to the final consumer in fresh produce supply chain in India. The efficient supply chain management of practices in fresh produce supply chain certainly benefits in terms of low price to customers and high revenues to producers.

**Deshingkar, (2003)** found that Post-harvest losses vary significantly among commodities and varieties, in different regions and seasons. The wastage levels are as high as 24-40 percent in India but as low as 4 to 6 percent in developed countries.

A study by **Ziggers & Trienekens, (1999)** mentioned that six fundamental requirements for an efficient supply chain between fresh produce growers and the major retail customers include: scale of operation, strategic alliances, production flexibility, continuity of supply, quality control and communication.

**Lambert and Cooper, (2000)** found Agri-supply chains are also economic systems which distribute benefits and which apportion risks among participants. Thus, supply chains enforce internal mechanisms and develop chain wide incentives for assuring the timely performance of production and delivery commitments

## 7.0 Objectives of the Study

Agriculture is the most significant sector of the economy of India. The entire supply chain of Agricultural output in India is laden with the major issue of post-harvest losses and wastages due to various factors. Since the identification of the issues and challenges may pave a path for planning and implementation of effective mitigation strategies. Hence the present study has been conducted with the following objectives:

1. To assess the importance of Supply chain and Logistics in Indian Agriculture.
2. To identify the factors affecting supply chain of agricultural outputs in India.
3. To explore the issues, importance and scope of further research in Agricultural Logistics and Supply Chain.

## 8.0 Methodology

Descriptive research has been used for this study. The supply chain of only Agricultural outputs has been explained and attempt has been made towards identifying the factors affecting the supply chain of the sector. The scope of the study is confined to India only. The research is based on the conceptual framework of supply chain and its impact on rural livelihoods, contributing to the development of North East India in General and Assam The present study undertakes a thorough review of basic and contemporary literature available and identified the issues which are affecting the supply chain of agricultural products. Research databases such as Emerald([www.emeraldinsight.com](http://www.emeraldinsight.com)), EBSCO([Search.ebscohost.com](http://Search.ebscohost.com)), ResearchGate, Wiley ([www.wiley.com](http://www.wiley.com)), Springer([www.springerlink.com](http://www.springerlink.com)) and Elsevier ([www.sciencedirect.com](http://www.sciencedirect.com)) were searched for related papers.

## 9.0 About agriculture in Assam

The state, Assam is rich in water resources and has vast tracts of fertile land. As the highest tea producer in the country, during 2018-19, production of tea in the state stood at 701.35 million kgs. The agriculture is the major contributor to the state economy. It also provides livelihood to a significant proportion of the population of the state. The two major rivers the Brahmaputra and the Barak support the favourable agro-climatic condition of the state which support cultivation of a wide range of horticultural crops, including plantation crops and various fruits and vegetables, flowers, spices, medicinal and aromatic plants, nut crops and tuber crops. Pineapple, banana, cauliflower, Broccoli, rose, rice, papaya, sugarcane, turmeric, jute, potato and Bougainvillea are among high yielding varieties of horticulture crops in Assam. But the state is still in a backward position in using these techniques like other Indian states. Every year, especially during the rainy season (May-August), the Brahmaputra and its tributaries generate terrible floods in almost the whole valley. And this flood destructs everything, from people's lives to agriculture. Moreover, the access to mainland India market is still not smooth due to the geographic location and the inadequate means of road and transportation.

## **10.0 Issues and Challenges in the Supply Chain of Agricultural output in India**

From the secondary sources, the present study identifies the factors affecting the supply chain of Agricultural outputs in India. The input or inward supply chain is not covered under this study. The major factors identified from the study are pertaining to the category of infrastructure, processing & value addition, financial and information. Some of the major identified key challenges are Lack of Infrastructure Facilities, Low Processing and Value Addition, Low farmer income, Supply Chain inefficiency, large number of intermediaries, Poor Quality & Safety standards. Overcoming these issues will benefit the farmers, state government, transporters and food processing unit in the form of reduced losses and wastage, increase in the price share of the farmer, provides employment opportunities to the local people etc. There are numerous factors which are acting as roadblocks for the efficient supply chain of Agricultural output in India. The sorted issues have been divided into factors, which are further expanded into different variables and their observations.

### **10.1 Cold Storages/Chain**

There are various issues related to cold chain in India, such as lack of cold chain facilities, inadequate capacity of cold chain, lack of cold chain network. Because of this concern it has become difficult for the agri-producers to get proper remuneration for their produce. The concerned factor effecting the Supply Chain of Agricultural output in every corner in India.

### **10.2 Fragmentation**

One of the main issues in the supply chain of Agricultural output in India is the infinite number of local trader and intermediaries who eat all the share of farmer's income. The whole supply chain in India is dominated by local traders. The overall process of carrying forward of agri outputs are highly unorganized.

### **10.3 Integration**

Linkage and integration between the multi-level players in the supply chain plays a very important role to make the whole supply chain effective and profitable. But in the supply chain of Agricultural output in India there is a lack of forward and backward integration between the farmers and the other partners.

### **10.4 Infrastructure**

Supply chain infrastructure plays an important role in the Agricultural output. Proper and adequate infrastructure helps farmers help to deliver the goods in the right time with right condition. In India, Infrastructure in the main impediment in the supply chain of agricultural products which leads to high amount of losses.

### **10.5 Packaging & Storing**

Packaging is very important for Agricultural output as they are mostly perishable and requires proper packaging for the handling of these fresh produce. Without proper packaging and then storing, it is very difficult to maintain their

shelf life. Cost is very important factor for this issue. High cost of packaging material makes thing even difficult for the farmers.

### **10.6 Technological**

The technology is surrounded by many technical issues, such as advancement issues, inefficient technology, obsolete techniques, and old machineries. Due to these concerns it has become difficult for the farmers to use an appropriate minimum technologies and techniques to reduce the post-harvest losses and time in operational activities.

### **10.7 Farmer's Awareness and Preparation**

Farmer's in India have very poor knowledge regarding the use of modern farming to work effective and efficient. They have very poor knowledge regarding the management of post-harvest produce, quality of seed etc. Without proper knowledge and awareness level of the farmer the supply chain of Agricultural output cannot be efficient, because farmers are the main source of this chain.

### **10.8 Quality**

Quality has a strong impact on the supply chain, so it leads to efficiency and less rejection by the customer. Also, quality is a very important factor in food industry, because it directly relates to the health of the people. It is very important for supply chain to deliver the fresh goods in a timely manner and in a proper quality to the customer. Proper supply chain helps to maintains the shelf life of produce and prevent from deteriorating the quality. In India, there is a lack of quality standards to meet international quality for export.

### **10.9 Processing and Value addition**

Processing and Value addition is a way to increase the shelf life of outputs produced and reduce the losses. High amount of processing may lead to low wastage of Agricultural output. It gives an immense opportunity to export the processed food to the various destinations. But, in India the processing and value addition is very low as compare to other countries.

### **10.10 Financial**

Income of farmers is very low in the state. They don't get proper income for their agricultural produce and maximum amount of share eat up by the intermediaries. The difference between the final consumer price and farmer's realization is very high (Farmers get only 25 % of the total consumer price share's) in the state. There are lack of transparencies in pricing at all Mandis in India due to which farmer don't get right prices for their efforts and fresh produce

### **10.11 Transportation**

Transportation plays a vital role in the supply chain. Without proper transportation the goods can't be delivered to the customer in a right time and in a right quality. It plays even a more important role in Perishable foods because of shorter shelf life, high perishable, required controlled temperature. Transportation related challenges are very high in the India because of unavailability of well transportation mode, high cost of transportation, lack of temperature controlled vehicle for the movement of goods etc.

### **10.12 Market Demand and Information**

Proper information is the basis of efficient supply chain. Without proper information regarding market demand the supply chain cannot run successfully. In India, farmers have lack of information regarding the prices in the market, demand, food processing units etc. Poor information leads to poor realization of prices, high amount of losses, late delivery of goods in the market place etc. The National Agriculture Market (NAM) is a PAN-India electronic trading portal which networks to create a unified national market for agricultural commodities. The NAM Portal provides a single window service for all related information and services. Aggregators like eNAM brings together farmers and large buyers, including manufacturers and e-Choupal, ITC's initiative to link directly with rural farmers for the procurement of raw material) are helping not just farmers get better prices.

## 11.0 Measures for improving supply chain and its effectiveness

There has to be structural changes at different levels – farmers to intermediaries to end users. The government, corporates, cooperatives, technology providers, and even media can play a crucial role. Infrastructure like roads, transport, information and communication technology and cold storage are basic requirement for better results in Supply chain.

1. Demand forecasting is one of the important requirements for improving SC effectiveness. Due to poor forecasting of information, there is an imbalance between supply and demand.

2. The concerned Department acts as the facilitator for creation of infrastructure facilities for marketing of fruits and vegetables in the states. The Department of Agricultural Marketing is facilitating the marketing of agricultural/horticultural produces in the states.

3. Vertical coordination of farmers through cooperatives, contract farming and retail chains would facilitate better delivery of output, reduce market risks, provide better infrastructure, attract more public interest, acquire better extension services, and creation of awareness regarding the adoption of new technologies.

4. Customized logistics is another important immediate requirement to make logistic effective. This reduces the cost, facilitates the maintenance of quality of the produce and fulfils the requirements of targeted customers.

5. The Government must introduce subsidised schemes for construction/modernization of cold storage units. Cold storages are classified as Agro Food Processing Industry for providing incentives and concessions available to Agro Food Industry.

6. Information system for better coordination among different stakeholders from farmers to consumers is the need of the hour. The internet and mobile communication can also be used to enable information and financial transfer between the stakeholders.

7. Public private partnership(PPP) is another strategic solution. Supply chain processes like washing, grading, sorting, packing, pre-cooling, handling facilities, insurance, finance, transport and processing facilities would add value to supply chain functioning.

## 12.0 Recent issues

Like any other state in India, in Assam also several organizations initiated supply chain makeover of certain commodities. But the implementation of the same is yet to be acknowledged in a large scale. The current spike of COVID-19 pandemic, many have witnessed plenty of incidents with farmers whose agri-outputs got readily wasted in hundreds of quintals in the field itself because of failure to access proper market. But the situation could have been favourable if there was a proper supply chain network within the state itself. To counter the challenges posed by COVID -19 pandemic, the Indian agriculture sector would need more modern and professionally managed agritech set-ups which can address the challenges posed by the pandemic. But, there haven't been any significant instances of Agri supply chain disruption from anywhere in the country.

## 13.0 Conclusion

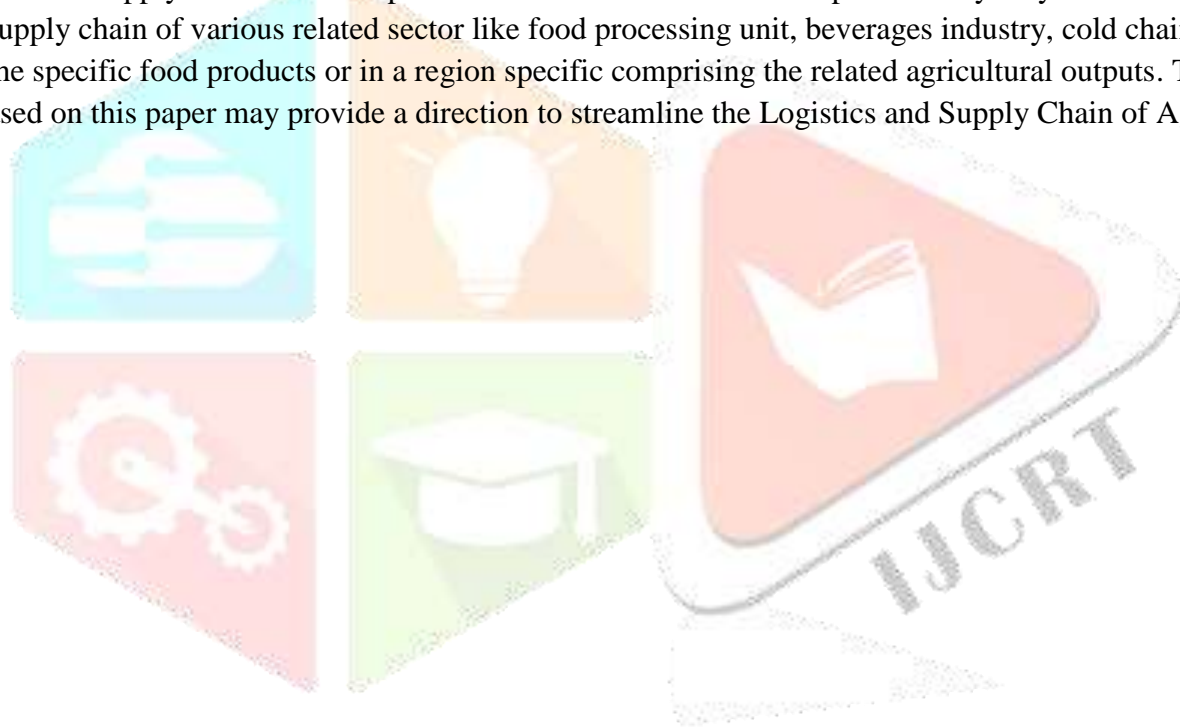
In India, each state has its own culture, language, preference, suitable geo location and most importantly the core competency for Agricultural production. Agriculture sector can realize its full potential by applying the principal of supply chain management by strengthening the collaboration between various stakeholders, non-



exploitative vertical and horizontal integration, market reforms, precision farming, contract farming, demand-led diversification, and the extensive and intensive use of information technology for real time communication across the chain. The development of a Agro only information system model for continuous flow of information among the different stakeholders in the chain is very much necessary. The fundamental idea behind Supply Chain is the management of information instead of the management of inventory. Further, the scenario of pandemic COVID-19 or SARS-CoV-2 brings out the actual importance of having an efficient and robust supply chain in the country. Inclusive innovation combining significant improvement in products and processes as well as in business and service models is readily essential to transform rural India to a confluence of profitable business activities.

### 15.0 Limitations and Future directions for research

The paper has been prepared based on the data collected from the published secondary sources. The findings are based on the limited coverage of selected literature and data available. This study is based on descriptive research only. But, there is ample scope of further research by establishing certain supply chain models or structure. There can also be a sample survey research considering different stakeholders of the chain to understand the problems and probable solutions. This paper is just an assessment of present situation of Logistics and supply chain of post-harvest agricultural output. The factors identified may further be tested and validated on the agricultural supply chain of other/specific commodities. A similar empirical study may further be carried out for the supply chain of various related sector like food processing unit, beverages industry, cold chain industry and also in the specific food products or in a region specific comprising the related agricultural outputs. The further study based on this paper may provide a direction to streamline the Logistics and Supply Chain of Agricultural output.



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