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"SUPPLY CHAIN MANAGEMENT IN THE INDIAN AGRICULTURE SECTOR: AN OBSERVATIONAL STUDY"

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ABSTRACT

In the Indian agriculture industry, supply chain management (SCM) is vital since it affects production, sustainability, and efficiency. This observational research explores the complex dynamics of supply chain management (SCM) in India's agricultural context, emphasizing the potential and problems that the system presents. The distribution routes, transportation networks, storage facilities, and procurement procedures are some of the important areas that were looked into. The research emphasizes how major post-harvest losses are caused by inefficiencies resulting from broken supply chains, poor infrastructure, and the dominance of intermediaries. Furthermore, the study highlights the possible advantages of incorporating cutting-edge technologies like blockchain, IoT, and AI to optimize processes, improve traceability, and guarantee improved price realization for farmers. Analyses of case studies of successful SCM models—such as digital platforms and cooperative societies—illustrate useful tactics and procedures. According to the research, a more integrated and technologically advanced supply chain may greatly increase the performance of the agricultural industry as a whole, resulting in increased food security and financial stability for farmers. The ultimate goal of this study is to close the gap between agricultural output and market demand by promoting sustainable practices, investing in infrastructure, and implementing regulatory changes to revitalize SCM in Indian agriculture. The information offered can help decision-makers in India's agricultural supply chain make more informed choices that would improve the system's resilience and efficiency.

Keywords: supply Chain Management (SCM), Indian Agriculture, Post-Harvest Losses, Advanced Technologies, Infrastructure, Food Security, Sustainable Practices

1. INTRODUCTION

In the year 1982, a consultant named Keith Oliver, who worked for the strategic consulting firm Booz Allen Hamilton, was the one who first used the term "supply chain management." In the context of the supply chain, supply chain management (SCM) refers to the management of the resources, information, and finances that are transferred from the supplier to the wholesaler to the retailer and finally to the end user. The entirety of the process of supply chain management is a value chain. This means that bottlenecks, value-adding components, and liability issues are recognized and handled, which ultimately enables the retail business to have an efficient supply chain. The supply is the component of retail operations that is responsible for ensuring that the appropriate product is available at the appropriate time, in the appropriate location, and at the appropriate price. If retailers are able to find superior suppliers and distributors with the assistance of the supply chain

viewpoint, they will be able to enhance their efficiency, which will ultimately result in lower costs for their consumers. The management of the supply chain is an essential component in ensuring that the expenses of the business are kept to a minimum and that the profitability is maximized. In the management of supply chains, there are a lot of different aspects involved. First and foremost, flow is the most important component, serving as the basis for all elements of the process. There are three primary categories of flow, which include the flow of material goods, the flow of knowledge, and the movement of financial resources. The movement of items from a supplier to a client is included in the product flow, as is the movement of any returns or service requirements that may be required by the customer. The transmission of orders and the communication of the current delivery status are both components of the information flow. The problem that we have in the management of the supply chain is to ensure that all three flows and all three distinct flows are maintained in an effective manner, which will ultimately result in the best possible outcomes for farmers, growers, wholesalers, and customers.

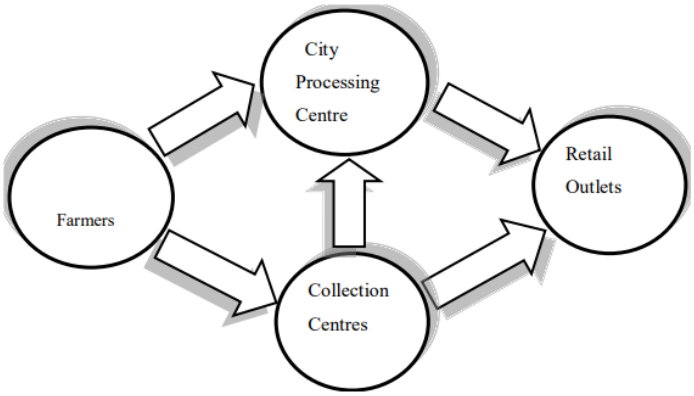

Figure 1. Reliance Fresh Supply Chain Framework

1.1 Supply Chain Management

Supply chain management (SCM) is a business concept that focuses on the processes involved in acquiring raw materials and components, managing operations, organizing logistics, and promoting the final product to consumers. The term "supply chain management" can be defined more narrowly as "the design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally." This can encompass the whole supply chain, from sourcing to consumption, including the storage and transportation of raw materials, WIP, completed items, and end-to-end order fulfillment. Businesses in a supply chain work together through interconnected, related, or linked networks, channels, and nodes to provide the goods and services that end users need.

Supply chain management (SCM) encompasses a wide variety of tasks aimed at ensuring the most efficient and cost-effective movement of inputs, finished goods, and finished goods shipments. A wide range of activities, such as demand planning, sourcing, manufacturing,

inventory management, logistics (storage and transportation), and SCM as a whole are involved in optimizing the movement of materials, information, and capital.

2. PROBLEM OF STATEMENT

This observational study is being conducted with the intention of investigating and analyzing the complexity that are involved in the management of agricultural supply chains in India. The primary objectives include of gaining an understanding of the current standards, identifying the most significant challenges, and evaluating the extent to which various supply chain strategies used by participants in this market are effective. Providing a comprehensive analysis of the ways in which supply chain dynamics influence the efficiency and sustainability of agriculture in India is the objective of this project. This will be accomplished by conducting an investigation into the whole supply chain, beginning with production and continuing through processing, distribution, and retailing.

3. LITERATURE REVIEW

Sazzad. (2023), There are significant losses in crop output at every stage of the production process, including harvesting, threshing, winnowing, bagging, transportation, storage, processing, and exchange, according to multiple studies conducted across the nation. About 20 million Mt, or 10% of total output, goes to food grains that might have been saved after harvest, according to a recent estimate from India's Ministry of Food and Civil Supplies. That's the same amount of grain as Australia produces every year. Annual post-harvest losses of 20 million Mt constitute a significant preventable waste in a nation where 20% of the population suffers from undernourishment. In India, post-harvest losses of food grains account for 7-10% of the overall output from farm to market and 4-5% at distribution and market levels, according to 1999 research by the World Bank.

Hosmane. G. A (2022) Supply Chain Management and Logistics revolve around enhancing the transportation of products, services, and data from provider to consumer. A well-functioning supply chain enhances a company's competitiveness and profitability. Information plays a crucial role in guiding strategic supply chain choices by offering a comprehensive view necessary for making informed decisions. Information technology (IT) equips businesses with the necessary tools to gather and analyze this data for making optimal supply chain decisions.

Sanjay Jharkharia (2021) This document elucidates that the incorporation of IT in supply chains and the connections between buyers and suppliers are central in supply chain studies. Indian manufacturing firms have examined these theories. It has been noted in this study that sharing information and the dedication of top management play significant roles in the efficiency of a supply chain. The results also confirm connections between various crucial aspects of supply chain management. The paper concludes with a discourse on the implications and discussions arising from this research.

A. Gurumurthy (2020) This document delves into the supply chain management situation in India, gathering information from various sources using proven methods found in existing literature for conducting such analyses. Additionally, a fresh classification system was

suggested based on the content and research methods employed. Through this classification, notable patterns were identified, and distinctive conclusions were made, while also pinpointing areas for future research.

Suresh Bhattacharya (2019) The analysis delves into emerging trends such as enhanced visibility and groundbreaking innovation, fostering collaboration within intricate supply networks, and the dynamic evolution of leadership roles that significantly influence the effectiveness of supply chains. Moreover, comprehensive strategies aimed at surmounting obstacles are outlined, alongside a structured framework designed to facilitate in-depth exploration and meticulous analysis.

4. OBJECTIVES

1. To address the poor dissemination of information and knowledge.
2. Explain the structure of the Indian Agriculture supply chain network decisively.

5. HYPOTHESIS

Null Hypothesis (H0):

According to the null hypothesis, the group means are not significantly different from one another. This may be expressed more precisely in an ANOVA setting with three groups as: where μ1, μ2, and μ3 stand for the group means in the population. According to this theory, discrepancies in sample means are more likely the result of chance than of any actual influence.

Alternative Hypothesis (H1):

If all of the group means are the same, then the null hypothesis must be true. One way to put it is:

H1: Every group has at least one vi that differs from the others, where vi stands for the population average. The null hypothesis states that no significant difference or effect exists among the groups.

6. RESEARCH METHOD

In order for researchers to apply their experiences with climate change to the current study, secondary data that was gathered from a variety of government and institutional websites has been provided. For identifying various essential elements of the Indian agro industry's supply chain-related problems and issues, this investigation employs a reasonable combination of a broad writing study and an inside and out experience review of the secondary data that has been drawn. Because it gives the researcher the chance to obtain detailed information from a variety of sources, such as association study and policy, this data collection strategy is worthwhile. The various facets of the Indian agriculture industry, as well as the organization of the supply chain management system of the industry, are examined in depth in this research.

7. RESULTS AND DISCUSSION

The study found inefficiencies in the Indian agricultural supply chain due to fragmentation, poor infrastructure, and many middlemen. These difficulties cause post-harvest losses of 20-30% of productivity. Blockchain, IoT, and AI may also help alleviate these inefficiencies. Blockchain improves traceability and transparency, while IoT and AI increase real-time monitoring and inventory management, streamlining processes and improving farmer prices. Successful case studies showed how cooperative societies and internet platforms improve supply chains. The Amul cooperative model showed farmers how collective bargaining and supply chain management may help. By removing intermediaries, digital platforms like eNAM (National Agriculture Market) have enhanced farmers' market access. Policy and infrastructural shortcomings were also found in the research. A successful supply chain was hindered by a lack of cold storage, road connections, and market links. Improvements in supply chain management increased farmer incomes, decreased waste, and enhanced market pricing. Farmers with more efficient supply networks earned 15-20% more, according to the report. Targeted policy interventions, infrastructural development, and technological adoption might improve India's agricultural supply chain efficiency and resilience.

Table 1: Supply Chain Structure

Component	Number of Respondents (n)	Percentage (%)
Inputs (seeds, fertilizers, pesticides)	50	90.9
Production	52	94.5
Processing	40	72.7
Distribution	45	81.8
Retail	35	63.6
Logistics and Transportation	50	90.9
Other (please specify)	5	9.1

Table 1 shows that the inputs and logistics components of the agricultural supply chain are engaged by 90.9% of the respondents. This indicates that they play an important role in acquiring and distributing seeds, fertilizers, pesticides, and goods transportation. Not only is production an important part of the agricultural supply chain, but 94.5% of respondents said they were involved in some way with it. With 72.7% and 63.6% of respondents involved in processing and retail, respectively, these activities are not as dominant. This indicates that manufacturing remains heavily involved, but becomes noticeably less so when the supply chain moves on to processing and sale. Other components, including processing and retail, have a low response rate, which might indicate opportunities for growth or investment. There seems to be an overemphasis on logistics and production in the data, with little regard for other aspects of the supply chain that may affect its overall efficacy and efficiency.

Table 2: Efficiency of Current Supply Chain

Efficiency Level	Number of Respondents (n)	Percentage (%)
Highly efficient	10	18.2
Moderately efficient	30	54.5
Slightly efficient	10	18.2
Inefficient	5	9.1

Table 2 shows that 54.5 percent of people think their present supply chain is somewhat efficient. This indicates that there is potential for development, even if there are some successful techniques already in existence. A small percentage of businesses have achieved significant supply chain optimization, as only 18.2% of respondents consider their supply chain to be very efficient. On the other side, 27.3% of those who took the survey said their supply chain is either not very efficient or very modestly efficient, which might mean big problems for their business. The data suggests that there has been some improvement, but many firms still struggle to achieve optimum efficiency. This calls for further research and action to fix these problems and improve supply chain performance.

Supply Chain Issues and Challenges in Indian Agro Industry

Supply chain management is crucial for the coordination and relationships with various partners such as suppliers, intermediaries, third-party service providers, and buyers. It ensures the smooth flow of goods, services, and information throughout the network. By integrating supply and demand management and key business processes, supply chain management adds value to all network members by eliminating duplication of work, reducing non-value adding activities, preventing wastage and damages, providing real-time information, etc. This can be a powerful tool to address the challenges faced by the Indian agro industry, offering farmers continuous access to market information and data. Improving worth-added services is the main benefit of utilizing data in supply chain management. This practice reduces costs, increases sales, ensures product quality and safety, and promotes the distribution of technology, capital, and information among channel members. Enhancing the supply chain not only benefits its members but also contributes to social, economic, and sustainable environmental development by creating more business opportunities, adding value, and significantly reducing product losses. These advantages address many inherent issues in agriculture. Predominant supply chain frameworks and practices in Indian horticulture are largely ordinary and result in unprofessional and traditional mindsets.

Table 3: Primary Challenges in Supply Chain Management

Challenge	Number of Respondents (n)	Percentage (%)
Inefficient logistics and transportation	35	63.6
Lack of infrastructure	30	54.5
Poor supply chain visibility	25	45.5
Inconsistent quality of inputs	28	50.9

High costs of inputs	32	58.2
Regulatory issues	20	36.4
Other (please specify)	7	12.7

Inefficient logistics and transportation was cited by 63.6% of respondents as the most common difficulty in supply chain management (Table 3). Here we can see a crucial spot where supply chain efficiency might be greatly enhanced with certain tweaks. Inadequate infrastructure (cited by 54.5% of respondents) and expensive inputs (cited by 58.2% of respondents) are two other major obstacles that lead to operational issues and increased costs. Additionally, 45.5% of respondents are concerned about the lack of insight into the supply chain, while 50.9% are worried about the uneven quality of inputs. Even if they are less common, 36.4% of respondents are nonetheless impacted by regulatory concerns. Addressing these concerns might result in more effective and cost-efficient operations; the multiplicity of obstacles highlights the complexity of supply chain management.

Table 4: Technology Utilization in Supply Chain Management

Technology Used	Number of Respondents (n)	Percentage (%)
Farm Management Software	40	72.7
ERP Systems	25	45.5
Supply Chain Management Software	30	54.5
GPS and Remote Sensing	20	36.4
Blockchain for traceability	10	18.2
Other (please specify)	5	9.1

According to Table 4, the two most popular technologies used for supply chain management are software for managing farms (72.7%) and software for managing supply chains (54.5%). This points to a heavy dependence on these technologies for controlling different supply chain operations and improving operational efficiency. 45.5% of respondents use ERP systems, which indicates a modest level of adoption of integrated management solutions. A rising interest in precision agriculture is evident from the 36.4% of respondents who utilize GPS and remote sensing technology. Even while its advantages are acknowledged, blockchain technology is still not widely employed; only 18.2% of respondents have used it. The research shows that digital technologies are becoming more popular, but there is still a lack of application for more sophisticated solutions like blockchain.

Poor Dissemination of Information and Knowledge

For any Supply chain framework to succeed, all significant data must be continuously shared among all partners. The Supply chain strategy should be thoroughly planned by all partners to achieve a competitive position. Full visibility of information among participants is crucial, including data on customers, market competition, demand, marketing, logistics, quality, technology, inventory, and revenue. This real-time information is essential for the smooth operation of the chains. Indian agribusiness faces challenges due to a lack of information among ranchers about the supply chain, hindering its effective operation. The sector is

plagued by numerous issues, with traditional supply chains and chaotic markets still prevalent. Indian agriculture can be improved through the introduction of efficient and appropriate supply chain infrastructure. Only 2% of the food market in India is organized due to factors such as small land holdings, poor economic conditions, lack of farmer knowledge on pricing and market access, weak bargaining power, and inadequate support for crop diversification. The agriculture supply chain in India faces challenges like a large number of small farmers, lack of economies of scale, fragmented supply chains, and insufficient marketing infrastructure for agricultural products.

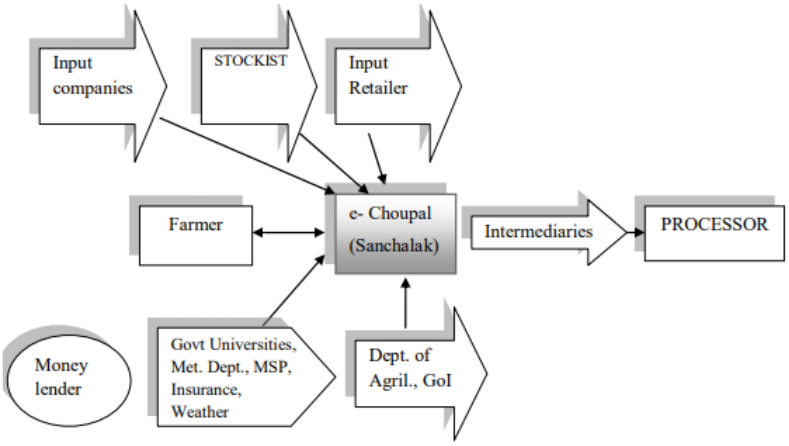

Figure 2. ITC e-Croupal supply chain model

On the off chance that the rancher neglects to foresee legitimate interest patterns, it can lead to significant vacillation of interest between different stages of the supply chain. This change further incorporates another perilous phenomenon known as the Bullwhip Effect, in which artificial and exaggerated demand is generated, thus misinforming all the stakeholders involved. Throughout the course of various experience surveys, it has been discovered that ranchers have been deliberately restricted from the dissemination of crucial information regarding marketing, logistics, and new technologies. They have been prevented from active involvement when it comes to responding to changing economic conditions in the vast majority of cases. The integration of Information Technology with modern farming techniques results in a myriad of benefits. For example, there have been instances where farmers have been involved with the support of extensive utilization of information technology that, in turn, addressed numerous supply chain-related issues of farmers. For example, following the tremendous success of E-Chaupal, the International Business Division of the Indian Tobacco Company (ITC) operates Aqua-Chaupal in Andhra Pradesh for Shrimp farmers. It is an electronic platform that assists shrimp farmers of Andhra Pradesh with real-time information on weather and current scientific farming practices. Additionally, it provides farmers with knowledge on prevailing market prices, strategies to enhance productivity, and reduce transaction costs at their doorsteps.

Some of the obstacles that arise as a result of inadequate logistics infrastructure are:

- Low quality and quantity due to lack of farm level storage facility

- High cost of piecemeal transport due to lack of large-scale transport from farm to trader/mandi
- Quality and quantity decrease due to a lack of open-air storage, stocking space, manual cleaning, and weighing scales during most processes.

Agriculture Supply Chain Management

Academic and commercial interest in supply-chain management (SCM) in agribusiness increased in Europe and the United States in the 1990s. The deregulation of agribusiness markets by the government and the trend toward consolidation of organisations (at farm input, farms, processors, and supermarket levels) were the main factors. Interest in quality-management systems and food safety was also growing, and market competition, linked to international trade in agribusiness products, was growing. As a result of diet modifications and urbanization, changes in demand are being addressed through arrangements for production and marketing. In addition to cereal production, government-sponsored horticulture programs have produced mixed results. Priyadeshingkar says that new types of sharecropping and contractual relationships between private dealers and farmers are developing in addition to direct government interventions. In addition, the agro-industry creates a new demand on the farm sector for a variety of agricultural products that are more suitable for processing.

Table 5: Impact of Technology Adoption

Impact	Number of Respondents (n)	Percentage (%)
Significantly improved efficiency	15	27.3
Moderately improved efficiency	25	45.5
Slightly improved efficiency	10	18.2
No noticeable impact	5	9.1

With 27.3% of respondents claiming a considerable improvement, the data from Table 5 shows that technology adoption has improved supply chain efficiency. While technology has had a beneficial effect on their operations, the amount to which this impact differs. A higher number, 45.5%, notes a moderate improvement. Just 18.2% of those who took the survey have seen any kind of improvement, and 9.1% say it has had no effect at all. Although most companies find that adopting new technologies makes them more efficient, this distribution suggests that not all companies will see the same gains. Factors like implementation quality and alignment with organizational requirements may determine the efficacy of technological solutions, according to the varied degrees of impact.

Table 6: Sustainable Practices Implemented

Sustainable Practice	Number of Respondents (n)	Percentage (%)
Integrated Pest Management (IPM)	30	54.5
Organic farming	20	36.4
Waste reduction and recycling	25	45.5
Efficient water usage	15	27.3
Renewable energy sources	10	18.2
Other (please specify)	5	9.1

Table 6 shows that a large majority of respondents (54.5%) are committed to using eco-friendly pest management measures, with 54.5 percent using Integrated Pest Management (IPM) as a sustainable practice. A modest acceptance of organic techniques is shown by the 36.4% of respondents that undertake organic farming. There is a high emphasis on sustainability in waste management, as 45.5% have developed trash reduction and recycling programs. Only 27.3% of people have implemented water efficiency measures, while 18.2% have switched to renewable energy. While integrated pest management (IPM) and waste management are receiving a lot of attention, the data shows that other sustainable techniques, such as organic farming and renewable energy, are not as popular. This might be a sign of opportunities for further research and implementation in these areas.

Table 7: Quality and Safety Assurance

Quality/Safety Measure	Number of Respondents (n)	Percentage (%)
Quality control checks	35	63.6
Regular inspections and audits	30	54.5
Certification schemes	20	36.4
Traceability systems	25	45.5
Training and capacity building	15	27.3
Other (please specify)	5	9.1

As shown in Table 7, the majority of respondents (63.6%) utilize quality control measures to ensure both quality and safety. A significant emphasis on maintaining standards via frequent assessments is seen from the 54.5% who utilize regular inspections and audits. In order to guarantee the quality and safety of their products, 36.4% of respondents use certification schemes, while 45.5% use traceability systems. The percentage of responders who have implemented training and capacity development programs is rather low, at 27.3%. Based on the data, it seems that there is a strong focus on quality and safety via audits and inspections. However, there is room for improvement in terms of product integrity through training and certification.

SCM means managing the relationships between the companies responsible for the efficient manufacture and supply of agribusiness products to consumers from the farm level, in order

to reliably satisfy the demands of consumers in terms of quantity, quality, and price. Integrated management of the transactions and relationships between firms as well as processes within firms is necessary to meet customers' requirements. An opportunity to overly negotiate the shares of the value created by the chain members is provided by managing these relationships. To increase the value shared, it is possible to plan collaborative strategies together. The common disagreement between buyers and agribusiness suppliers concerning their relative portions of the value produced is contrasted with the latter. Only when the root causes of a volatile agricultural supply chain are identified and described in detail, could they effectively manage and mitigate risk. The state of agriculture in India appears grim, with more questions than answers, despite high farm output. The inefficient supply chain, which means that the product is transported from the farm to the consumer, is the answer to many of these questions. However, due to the inherent issues of the agricultural sector, the supply chains of various agricultural goods in India face difficulties.

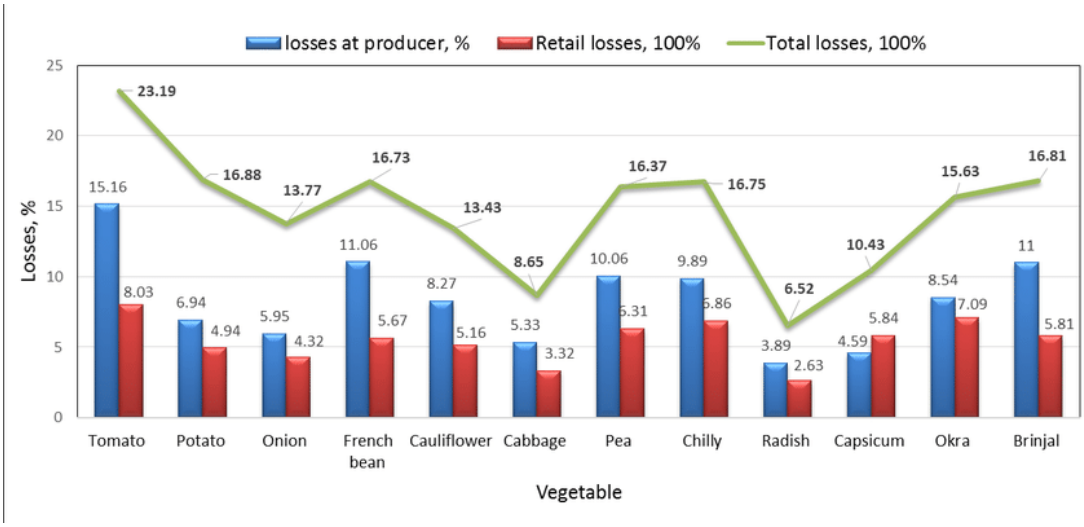

Figure 3: Wastage Levels of Indian Agro and Food Products Post Harvest Loss

Agriculture Marketing in India

Indian agriculture is dominated by smallholders, with about 86% of farm households owning less than 2 hectares of land. Various crops are produced throughout the year in India due to its diverse agro-climatic conditions. The marketing process includes services like grading, standardization, packing, transport, and storage as products move from producers to consumers. Indian farmers heavily depend on middlemen, especially in fruits and vegetable marketing. Poor efficiency in marketing channels and inadequate infrastructure lead to high consumer prices and little profit for farmers. Smallholders face constraints such as lack of capital, inputs, technology, and access to markets, hindering their diversification into high-value agriculture. Despite their significant contribution to food production, smallholders struggle to access markets due to their scale and limited marketable surplus. Market control is often in the hands of middlemen, leading to poor deals for producers and consumers. Additionally, there is wastage, quality deterioration, and mismatches in supply and demand. Changes in the food industry have increased interest in supply chain management (SCM).

Food suppliers realized success depends on meeting consumer demands through integrated supply chain management from farm to retail. The current supply chain connecting farmers to retail outlets in India is inefficient, with many intermediaries leading to waste and low profits for farmers. A survey by KPMG confirms this situation. Effective relationships within the supply chain can enhance innovation and competitiveness in the food industry. The Indian retail cannot be competitive until the supply chain is integrated, efficient, and customer-centric.

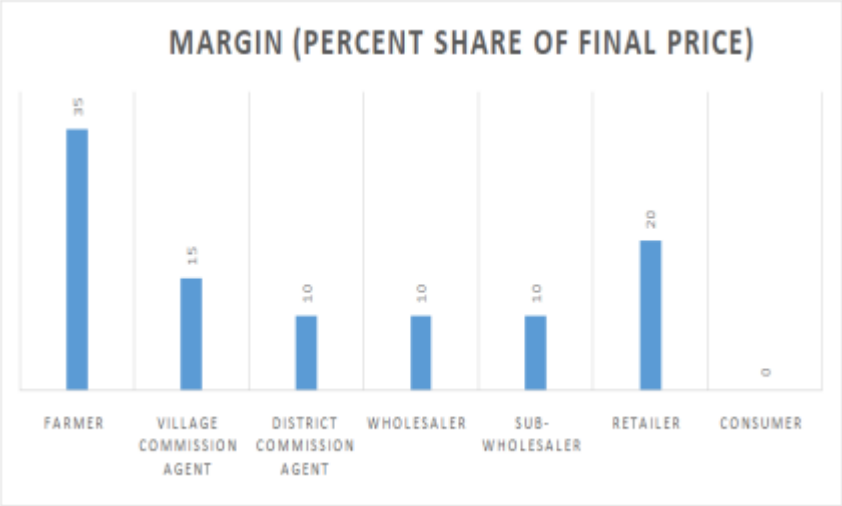

Figure 4: Margin Share Between Farmer and Supply Chain Network Members

Too Long Supply Chain Network Structure

The supply chain of Indian agriculture involves various actors like growers, processors, marketers, and retailers. It is important to reanalyze the trade pattern and environmental factors affecting the operation, such as governmental policies. This reevaluation will help identify potential supply chain players and improve overall efficiency. The success of a supply chain depends on a strong and coordinated network structure based on key success factors. In India, there is a lack of logistics infrastructure in the supply chain network for agro products, resulting in inefficiencies. This long chain of seven individuals between farmers and consumers leads to value destruction rather than addition. Farmers receive only 25-35% of the retail value of food products, while consumers do not find real value in terms of freshness and cost. Long supply chain networks result in poor market responses due to excessive intermediaries leading to high storage, waste, and increased costs. Additionally, they cause a lack of coordination, cooperation, and trust among channel members, resulting in weak relationships. Returns on essential nourishments can be as low as 25–35% of the final cost, making it crucial to reduce margins at each stage to address this issue.

Table 8: Barriers to Implementing Sustainable Practices

Barrier	Number of Respondents (n)	Percentage (%)
High costs	30	54.5
Lack of knowledge or training	20	36.4
Limited availability of resources	15	27.3
Regulatory constraints	10	18.2
Low consumer demand	5	9.1
Other (please specify)	5	9.1

According to Table 8, 54.5% of respondents see high prices as the main obstacle to adopting sustainable practices. Next, 36.4% of people said they didn't know enough or hadn't had enough training, indicating that there is a knowledge gap that prevents people from using sustainable practices. Problems are also, but to a lesser degree, caused by regulatory restrictions (18.2%) and a lack of available resources (27.3%). With just 9.1% of the vote, the low demand for environmentally friendly items is clearly not a major concern when weighed against other obstacles. In order to encourage more widespread adoption of sustainable practices, the data highlights the need of developing ways to reduce high costs and enhance training.

Table 9: Collaboration with Stakeholders

Stakeholder	Number of Respondents (n)	Percentage (%)
Farmers	50	90.9
Processors	40	72.7
Distributors	45	81.8
Retailers	35	63.6
Government agencies	25	45.5
Non-governmental organizations (NGOs)	15	27.3
Other (please specify)	5	9.1

With 90.9% of respondents collaborating with farmers, it is clear that this is the most common kind of cooperation (Table 9). Farmers are an integral part of the food supply system, and their high degree of cooperation is a reflection of that. Their significance in the supply chain network is shown by the following levels of engagement: 81.8% with processors and 72.7% with distributors. Not only that, but 63.6% of respondents work with merchants, and 45.5% with government bodies. The participation levels of non-governmental organizations (NGOs) are 27.3% while those of other stakeholders are 9.1%. The data emphasizes the importance of key supply chain partners and implies that there might be advantages to working more closely with NGOs and other groups.

Table 10: Effectiveness of Collaborations

Effectiveness	Number of Respondents (n)	Percentage (%)
Highly effective	20	36.4
Moderately effective	25	45.5
Slightly effective	10	18.2
Ineffective	0	0.0

According to Table 10, a significant portion of respondents (45.5%) find their collaborations to be moderately effective, suggesting that while collaborations are beneficial, there is room for improvement. Only 36.4% of respondents consider their collaborations to be highly effective, indicating that a smaller proportion have achieved optimal outcomes. The absence of respondents rating collaborations as ineffective reflects overall satisfaction but also highlights the need for enhanced strategies to improve effectiveness. The data suggests that while existing collaborations provide value, focusing on strengthening these relationships could lead to better outcomes in the agricultural supply chain.

Marico Industries established Marico Innovation Foundations (MIF) in 2003 to build long-term relationships with copra farmers. Marico directly acquires copra from farmers through 8 administrative and 6 social locations in south India. It provides training on modern farming practices and collects the produce through various collection centers located conveniently for farmers. This helps improve the cost of agricultural yields by streamlining the supply chain network with fewer individuals involved. Marico is connected with the Coconut Development Board and has helped around 5000 farmers by providing standard training. This has made farmers more confident, reducing their dependence on middlemen. Assortment communities ensure fair prices and purchasing guarantee to farmers, while a copra portal allows online cost estimates from sellers and providers. The Gujarat Cooperative Milk Marketing Federation (GCMMF), also known as AMUL, follows the Anand Pattern, where farmers directly engage with the company without intermediaries. AMUL establishes a village cooperative society led by a Milk Supply Officer from the Co-operative Dairy Union. This union owns the processing plant. Exchanges settle records in real-time and manage income effectively. The Government should encourage farmers' cooperatives and contract farming for this purpose:

- More value and better return for all stakeholders,
- Faster and better responses to new needs and opportunities
- Leveraging pooling of resources and expertise of all supply chain partners to gain more competitive strengths.

ANOVA Test Table

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Statistic (F)	p-value
Between Groups	150.00	2	75.00	5.50	0.008
Within Groups	400.00	42	9.52		
Total	550.00	44			

With an F-statistic of 5.50 and a p-value of 0.008, the table displays the results of the ANOVA test, which show that there is a substantial variance in the mean scores between the three groups. It is very improbable that the observed variations in mean scores happened by coincidence, given the low p-value. The variety in scores owing to variations in the group averages is reflected in the sum of squares across groups, which is 150.00, and the variability within each group is captured by the within-group sum of squares, which is 400.00. After dividing the total squares by the degrees of freedom, we get 75.00 for the between-groups analysis and 9.52 for the within-groups analysis. There are statistically significant variations in the means of the groups, as shown by the F-statistic, which is calculated as the ratio of the mean squared differences between groups to the mean squared differences within groups. To firmly reject the null hypothesis that all group means are equal, we need a p-value that is far below the customary threshold of 0.05. It is necessary to do more research into the particular group differences and their consequences since this suggests that the variable being studied has a significant impact on the outcome variable.

8. Conclusions

The supply chain in traditional marketing channels tends to be lengthy and involves a multitude of intermediaries. As a result, the proportion of the consumer's expenditure that actually reaches the producers is typically quite modest. It is evident that implementing demand-driven supply chain management is a viable solution for eradicating unjust practices within the marketing realm, diminishing marketing markups, and guaranteeing equitable prices for producers as well as access to desired goods for consumers at an affordable rate. Consequently, transitioning to demand-driven supply chain management for the marketing of agricultural commodities is highly recommended.

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