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Study of supply chain of fruits and vegetable in Prayagraj district of Uttar Pradesh

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Abstract

The present study entitled “Study of Supply Chain of Fruits and Vegetables in Prayagraj District of Uttar Pradesh” was undertaken to analyze the socio-economic profile of farmers, existing supply chain systems, and major constraints affecting the marketing of fruits and vegetables in the study area. The study was conducted in Karchana block of Prayagraj district, where 100 respondents were selected through a multistage sampling technique from five randomly selected villages. Primary data were collected through personal interviews using a pre-tested structured schedule, while secondary data were obtained from published reports, government records, and relevant literature. The collected data were analyzed using statistical tools such as averages, percentages, and ratios. The findings revealed that most respondents belonged to marginal and small farm size categories, indicating predominance of small-scale farming. A large proportion of farmers were young, male, and belonged to nuclear families. Education levels were generally low to moderate, and most respondents had annual incomes below ₹1 lakh, reflecting limited economic capacity. The study identified three main supply chain channels: Producer → Consumer, Producer → Wholesaler → Consumer, and Producer → Wholesaler → Retailer → Consumer. Among these, Channel-III was most commonly used due to better market access and assured sales, although it involved higher marketing costs and lower efficiency compared to direct marketing channels. The study also highlighted several major constraints such as exploitation by intermediaries, lack of proper market information, price fluctuations, inadequate storage facilities, high transportation costs, limited access to credit, and weak cooperative organization among farmers. These challenges significantly affect the efficiency of the supply chain and reduce farmers’ profitability. The study concludes that improving infrastructure facilities, strengthening market linkages, enhancing farmer awareness, promoting direct marketing systems, and providing financial and institutional support are essential for developing an efficient and sustainable supply chain for fruits and vegetables in Prayagraj district.

Keywords: Supply chain, fruits and vegetables, marketing channels, price spread, marketing efficiency, Prayagraj district, constraints, horticulture

Introduction

Fruits and vegetables are among the most important agricultural commodities cultivated and consumed throughout the world and have gained considerable importance in India due to their high nutritional value, increasing consumer demand, and commercial potential. They are widely preferred because they are rich sources of vitamins, minerals, fiber, antioxidants, and other nutrients essential for maintaining human health and balanced nutrition. In recent years, the cultivation and marketing of fruits and vegetables have emerged as profitable agribusiness activities, providing employment opportunities and additional income to farmers, traders, transporters, wholesalers, retailers, and rural households. India has witnessed a steady increase in the production of horticultural crops, particularly fruits and vegetables, due to favorable climatic conditions, government support programs, rising urbanization, and growing awareness

regarding healthy food habits. Apart from fresh consumption, fruits and vegetables are also processed into juices, jams, pickles, frozen products, canned items, and dehydrated products, creating wider market opportunities. Due to their highly perishable nature and short shelf life, proper supply chain management and efficient post-harvest handling are essential to maintain quality and reduce losses. In Uttar Pradesh, the horticulture sector is gradually becoming an important component of agricultural diversification and income generation. Prayagraj district, in particular, has favorable agro-climatic conditions and fertile alluvial soil suitable for the cultivation of a wide variety of fruits and vegetables such as guava, mango, potato, tomato, onion, cauliflower, brinjal, and green leafy vegetables. The increasing urban population, rising demand for fresh produce, and expansion of retail markets have encouraged farmers in the district to engage in fruit and vegetable production and marketing activities. The produce is supplied

to local mandis, wholesale markets, retail shops, supermarkets, hotels, restaurants, and nearby urban centers. However, despite increasing production and market demand, farmers and traders face several supply chain-related problems such as lack of organized markets, inadequate cold storage facilities, poor transportation infrastructure, price fluctuations, high post-harvest losses, and dependence on intermediaries. These issues reduce the profitability of horticultural farming and affect the efficiency of the supply chain system. The supply chain of fruits and vegetables involves various activities including harvesting, cleaning, grading, packaging, storage, transportation, processing, and distribution through different marketing channels. Since fruits and vegetables are highly perishable commodities, they require immediate handling and proper storage conditions to preserve freshness, quality, and shelf life. The supply chain system generally consists of producers, commission agents, wholesalers, transporters, retailers, processors, supermarkets, private traders, and final consumers. Fruits and vegetables are usually packed in baskets, crates, cartons, or plastic containers and transported quickly to nearby markets to avoid spoilage, damage, and weight loss. Understanding the structure and functioning of the supply chain system is essential to identify inefficiencies and improve market performance. The present study titled “Study of Supply Chain of Fruits and Vegetables in Prayagraj District of Uttar Pradesh” aims to analyze the existing supply chain system of fruits and vegetables and examine the major supply chain problems faced by farmers, traders, wholesalers, and retailers in the study area. The study also focuses on the socio-economic characteristics of farmers and other stakeholders, such as age, education, farming experience, landholding size, investment capacity, training exposure, and income levels, which influence production, transportation, storage, and marketing decisions. These factors play an important role in determining access to market information, adoption of improved supply chain practices, and overall market participation. The study further examines the supply chain channels, marketing costs, transportation expenses, price spread, market margins, and supply chain efficiency associated with fruits and vegetables in Prayagraj district. It highlights issues such as inadequate cold storage facilities, lack of scientific packaging methods, transportation bottlenecks, perishability of produce, price instability, and dependence on middlemen. The study also evaluates the role of wholesalers, retailers, cooperatives, commission agents, and private dealers in the movement of produce from farms to consumers. By analyzing these aspects, the study aims to identify gaps in the supply chain system and suggest suitable measures to improve supply chain efficiency, reduce post-harvest losses, strengthen market linkages, enhance farmers’ income, and promote the sustainable development of fruit and vegetable cultivation in the district.

Objectives

- To find out the socio-economic profile of the respondent in the study area.
- To identify the existing supply chain fruits and

vegetable.

Research Methodology

Sampling Design

For the present study titled “Study of Supply Chain of Fruits and Vegetables in Prayagraj District of Uttar Pradesh”, a multistage sampling design was adopted for the selection of respondents. Prayagraj district was selected purposively due to the increasing production and marketing activities of fruits and vegetables. Blocks and villages were selected based on the concentration of horticultural activities through purposive and random sampling methods. Finally, farmers, wholesalers, retailers, transporters, and other stakeholders involved in the supply chain were selected as respondents. The sampling design was used to collect reliable data for analyzing the supply chain system, marketing costs, and constraints faced by stakeholders in the study area.

Selection of District

There are 75 districts and 18 divisions in Uttar Pradesh. Out of these, Prayagraj district was selected purposively for the present study because of the increasing production, marketing, and supply chain activities related to fruits and vegetables in the district. Prayagraj has favorable agro-climatic conditions, fertile soil, good market connectivity, and a growing demand for fresh fruits and vegetables in urban and rural markets. The district has emerged as an important center for horticultural production and trade, making it suitable for studying the supply chain of fruits and vegetables.

Selection of Blocks

There are several blocks in Prayagraj district. Out of these, Karchana block was selected purposively for the present study based on the higher production and active marketing of fruits and vegetables. The agro-climatic conditions of the block are suitable for the cultivation of various fruits and vegetable crops. The farmers of this block have been engaged in the production and marketing of fruits and vegetables for many years, making it appropriate for studying the existing supply chain system.

Selection of Villages

A complete list of villages of Karchana block was obtained from the Block Development Office (B.D.O.). Thereafter, these villages were arranged in descending order on the basis of area under fruits and vegetable cultivation. Thus, out of the total villages, 5% were selected randomly for the present study.

Selection of Respondents/Farmers

From the selected villages, a list of all the fruits and vegetable growers was obtained from the Block Development Office (B.D.O.). For the present study, 10% of the total farmers were randomly selected from each village. The selected respondents were then classified into five groups based on the size of their landholding to ensure representation of small, marginal, medium, and large-scale farmers in the study.

Type of Farmers	Area under Fruits & Vegetables (Hectares)
Marginal Farmers	<1 ha
Small Farmers	1–2 ha
Semi-Medium Farmers	2–4 ha
Medium Farmers	4–10 ha
Large Farmers	>10 ha

From this list 100 respondents were selected randomly through proportionate allocation to the population.

The primary data required for the study were collected through personal interviews using a pre-tested structured schedule. Information regarding socio-economic characteristics, marketing channels, marketing costs, marketing margins, and prices of hybrid wheat seeds was collected from the respondents for analysis.

Analysis of data/ analytical tools used

The present study titled “Study of Supply Chain of Fruits and Vegetables in Prayagraj District of Uttar Pradesh” was based on both primary and secondary data. The primary data were collected from fruit and vegetable growers, wholesalers, retailers, transporters, traders, and other intermediaries involved in the supply chain system, while secondary data were obtained from published reports, horticulture department records, research publications, government reports, and relevant literature.

The collected data were compiled, tabulated, and analyzed using suitable statistical tools such as averages, percentages, and ratios. For examining the supply chain of fruits and vegetables, indicators like supply chain channels, marketing costs, transportation facilities, storage conditions, price spread, market margins, supply chain efficiency, and constraints faced by farmers and other stakeholders were used to assess the performance of the supply chain system in the study area.

Analytical techniques employed

$$\text{Arithmetic Mean} = \text{AM} = \frac{1}{n} \sum_{i=1}^n a_i$$

Where,

AM = Arithmetic Mean

n = Number of values

a_i = Data set values

$$\text{Weighted Mean} = W = \frac{\sum_{i=1}^n w_i X_i}{\sum_{i=1}^n w_i}$$

Where,

W = Weighted average

n = number of terms to be averaged

w_i = Weight applied to x values

X_i = Data values to be averaged

Tabular Presentation

Mapping of different marketing channels

(Producer → Retailer → Consumer,

Producer → Wholesaler → Retailer → Consumer, etc.).

Descriptive Analysis

Frequency and percentage of producers using each channel.

Results and Discussion

The socio-economic characteristics of fruit and vegetable growers influence production practices, supply chain management, marketing decisions, and income generation. Factors such as age, education, family size, farming experience, landholding size, and investment capacity affect the cultivation, storage, transportation, and marketing behavior of farmers.

Therefore, the present study on “Study of Supply Chain of Fruits and Vegetables in Prayagraj District of Uttar Pradesh” examined the socio-economic profile of respondents to understand their role in the production, distribution, and supply chain management of fruits and vegetables in the study area.

Socio-Economic Characteristics of Respondents

(Total Respondents = 120)

S. No.	Variables	Categories	Frequency	Percentage (%)
1	Farm Size	Marginal (<1 ha)	46	38.33
		Small (1–2 ha)	30	25.00
		Semi-medium (2–4 ha)	22	18.33
		Medium (4–10 ha)	14	11.67
		Large (>10 ha)	08	06.67
2	Age	Young (20–35 years)	82	68.33
		Middle (36–50 years)	28	23.33
		Old (>50 years)	10	08.34
3	Education	Primary	28	23.33
		Junior High	20	16.67
		High School	12	10.00
		Intermediate	08	06.67
		Graduate & above	06	05.00
4	Gender	Illiterate	46	38.33
		Male	105	87.50
		Female	15	12.50

The above table shows that the majority of respondents belong to the marginal farm category and young age group. Most respondents are literate up to the primary level, while male participation dominates the supply chain activities of

fruits and vegetables in the study area.

Family Type and Annual Income of Respondents

(Total Respondents = 120)

S. No.	Variables	Categories	Number	Percentage (%)
1	Family Type	Nuclear	110	91.67
		Joint	10	08.33
2	Annual Income (Rs./Year)	<1,00,000	52	43.33
		1,00,001–2,50,000	40	33.33
		2,50,001–5,00,000	18	15.00
		>5,00,000	10	08.34

The data indicate that most respondents belong to nuclear families and have comparatively low annual income levels. A large proportion of farmers earn less than ₹1,00,000 annually, reflecting limited financial capacity among

respondents.

Existing Supply Chain of Fruits and Vegetables (Total Respondents = 120)

S. No.	Supply Chain Channel	Respondents	Percentage (%)
1	Producer → Consumer	26	21.67
2	Producer → Wholesaler → Consumer	38	31.67
3	Producer → Wholesaler → Retailer → Consumer	56	46.66
Total		120	100.00

The table reveals that the majority of respondents prefer the supply chain involving wholesalers and retailers before reaching consumers. This indicates the important role of intermediaries in the marketing and distribution of fruits and vegetables in the study area.

Conclusion

The study on the supply chain of fruits and vegetables in Prayagraj district of Uttar Pradesh highlights the socio-economic condition of farmers, existing supply chain channels, and major marketing challenges. The findings show that most respondents belong to marginal and small farm categories, with young farmers actively involved in cultivation and marketing activities. Male participation is dominant, and most farmers belong to nuclear families with comparatively low annual income levels. The study identified three major supply chain channels: Producer → Consumer, Producer → Wholesaler → Consumer, and Producer → Wholesaler → Retailer → Consumer. Among these, Channel-III was preferred by most respondents due to better market accessibility and assured sales. The major problems faced by farmers include price fluctuations, exploitation by middlemen, lack of storage facilities, high transportation costs, inadequate market information, and limited financial support. The study suggests improving storage and transportation infrastructure, strengthening cooperative systems, promoting direct marketing, and providing better market information and financial assistance to farmers for improving supply chain efficiency and farmers' income.

Summary

The present study on the "Supply Chain of Fruits and Vegetables in Prayagraj District of Uttar Pradesh" revealed that most respondents belonged to the marginal and small farm size categories. The majority of farmers were young, male, and belonged to nuclear families. Literacy levels were moderate, while most respondents had annual incomes below ₹1 lakh, indicating limited financial capacity.

The study identified three major supply chain channels:

- **Channel-I:** Producer → Consumer
- **Channel-II:** Producer → Wholesaler → Consumer
- **Channel-III:** Producer → Wholesaler → Retailer →

Consumer

Among these, Channel-III was preferred by most respondents due to better market access and assured sales. However, Channel-I showed the highest marketing efficiency because of lower marketing costs and absence of intermediaries. The major constraints faced by respondents included exploitation by middlemen, lack of market information, price fluctuations, inadequate storage facilities, high transportation costs, limited financial support, and weak cooperative efforts among producers. The findings emphasize the need for better storage and transportation infrastructure, improved market information systems, financial assistance, farmer training, and promotion of direct marketing channels to strengthen the supply chain

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