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Study on supply chain management of vegetable pea in Prayagraj district of Uttar Pradesh

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Abstract

The present study entitled “A Study on Supply Chain Management of Vegetable Pea in Prayagraj District of Uttar Pradesh” was undertaken to analyze the socio-economic characteristics of vegetable pea growers, existing supply chain structure, marketing channels, marketing costs, price spread, producer’s share in consumer’s rupee, marketing efficiency, post-harvest losses, and major constraints faced by farmers in the study area. The study was based on primary data collected from 120 vegetable pea growers and relevant stakeholders through a structured interview schedule, along with secondary data from published reports and government records. Statistical tools such as averages, percentages, ratios, and marketing efficiency measures were used for data analysis. The socio-economic analysis revealed that most respondents belonged to marginal and small farmer categories, with a majority in the middle-age group and having secondary level education. Vegetable pea cultivation was found to be an important source of income, with significant involvement of family labour in production and marketing activities. Three major marketing channels were identified in the study area: Producer–Consumer, Producer–Retailer–Consumer, and Producer–Wholesaler–Retailer–Consumer. Among these, the Producer–Retailer–Consumer channel was most commonly used due to better market access and quicker sales. However, the Producer–Consumer channel was found to be the most efficient, offering the highest producer’s share and lowest marketing cost. The analysis indicated that marketing costs and price spread increased with the number of intermediaries in the supply chain. Consequently, producer’s share in the consumer’s rupee and marketing efficiency decreased in longer channels. Post-harvest losses were relatively higher among marginal farmers due to inadequate storage, grading, packaging, and transportation facilities. Major constraints identified included price fluctuations, high transportation costs, lack of cold storage facilities, exploitation by middlemen, and insufficient access to market information. The study concludes that shorter supply chains are more efficient and profitable for farmers. It recommends strengthening cold storage infrastructure, improving transportation facilities, promoting direct marketing and Farmer Producer Organizations (FPOs), enhancing market information systems, and providing training on post-harvest management to improve supply chain efficiency and increase farmers’ income in the region.

Keywords: Vegetable Pea, Supply Chain Management, Marketing Channels, Marketing Cost, Price Spread, Producer’s Share, Marketing Efficiency, Post-Harvest Losses, Farmer Producer Organizations (FPOs), Prayagraj District, Uttar Pradesh, Horticulture Marketing, Agricultural Marketing System.

Introduction

Vegetable pea (*Pisum sativum*) is one of the most important cool-season vegetable crops grown widely in India due to its high nutritional value, short duration, and good market demand. It is a rich source of protein, dietary fibre, vitamins (especially vitamin C and vitamin K), and essential minerals, making it an important component of a balanced diet. Because of its versatility in culinary use—both as a fresh vegetable and in processed and frozen forms—vegetable pea has gained significant popularity among consumers in urban and rural areas. In recent years, pea cultivation has also emerged as an economically viable enterprise for farmers, particularly in regions where irrigation facilities and suitable climatic conditions are

available. India ranks among the major producers of vegetable pea, with states such as Uttar Pradesh, Madhya Pradesh, Punjab, Haryana, and Bihar contributing significantly to its production. In Uttar Pradesh, vegetable pea plays an important role in agricultural diversification and income generation for small and marginal farmers. The state benefits from favorable agro-climatic conditions during the rabi season, which support good yield and quality production. Prayagraj district, in particular, has shown considerable growth in vegetable pea cultivation due to increasing demand from urban consumers, hotels, restaurants, and local vegetable markets. Farmers in the district cultivate pea as a cash crop because of its short growing period and quick returns. However, despite its

economic importance, pea growers face several challenges related to supply chain management, which affect profitability and market competitiveness. The supply chain of vegetable pea involves a series of interlinked activities such as production, harvesting, grading, packaging, storage, transportation, wholesaling, retailing, and final consumption. Being a highly perishable vegetable, pea requires efficient handling and timely movement from farm to market to minimize post-harvest losses. The supply chain generally includes multiple stakeholders such as farmers, village traders, commission agents, wholesalers, retailers, and institutional buyers. In many cases, the produce is packed in sacks or crates and transported quickly to nearby markets to maintain freshness and reduce spoilage. Inefficiencies in any stage of this chain can significantly affect price realization and product quality. The present study titled “A Study on Supply Chain Management of Vegetable Pea in Prayagraj District of Uttar Pradesh” aims to examine the existing supply chain structure and functioning of vegetable pea in the study area. The study focuses on analyzing the socio-economic characteristics of vegetable pea growers, including age, education level, landholding size, farming experience, income level, access to credit, and training exposure. These factors play a crucial role in determining farmers’ participation in the market, adoption of improved post-harvest practices, and access to organized supply chain systems. The study also explores how these socio-economic variables influence decision-making and efficiency in supply chain operations. Further, the study evaluates different supply chain channels, marketing costs, price spread, and profit margins associated with vegetable pea marketing in Prayagraj district. It highlights key constraints such as lack of proper cold storage facilities, inadequate grading and packaging systems, transportation bottlenecks, price fluctuations, dependency on intermediaries, and high post-harvest losses. The role of various stakeholders including farmers, aggregators, wholesalers, retailers, and institutional buyers is also assessed to understand their contribution to the overall supply chain efficiency. By identifying gaps and inefficiencies in the existing system, the study aims to suggest suitable measures for strengthening supply chain infrastructure, reducing wastage, improving price realization for farmers, enhancing market linkages, and promoting a more efficient and sustainable vegetable pea supply chain in Prayagraj district.

Objectives

1. To study the socio-economic Profile of respondents in the study area.
2. To analyze the marketing channel involved in marketing of Vegetable Pea.
3. To calculate marketing cost marketing margin price spread, Producer's share in Consumer's rupee & marketing efficiency of vegetable Pea.

Research Methodology

Sampling Design

For the present study titled “A Study on Supply Chain Management of Vegetable Pea in Prayagraj District of Uttar Pradesh”, a multistage sampling design was adopted to select respondents. At the first stage, Prayagraj district was

selected purposively due to the importance of vegetable pea cultivation and marketing in the area. At the second stage, blocks with higher concentration of pea production were selected, followed by random selection of villages at the third stage. At the final stage, vegetable pea growers and key stakeholders such as wholesalers, retailers, commission agents, traders, and consumers were selected as respondents. This sampling design was used to obtain representative data for analyzing supply chain structure, marketing channels, price spread, efficiency, and constraints in the study area.

Selection of District

selected purposively due to its significant contribution to vegetable production, particularly vegetable pea (*Pisum sativum*). • Significant cultivation of vegetable pea • Favorable agro-climatic conditions • Availability of irrigation facilities • Proximity to major markets like Prayagraj city A large number of farmers in the district are engaged in vegetable cultivation and supply their produce to nearby urban markets such as Varanasi, Lucknow, and local mandis within the district. The presence of fertile alluvial soil, favorable climatic conditions, and irrigation facilities makes the district suitable for vegetable pea cultivation and supply chain analysis.

Selection of Blocks

Prayagraj district comprises several blocks such as Meja, Karchhana, Phulpur, Soraon, Jasra, and Bahadurpur. Out of these, two blocks were selected purposively based on the higher area under vegetable cultivation, particularly vegetable pea. Selected Blocks: • Meja Block – Known for vegetable production and active participation in local markets These blocks were selected due to the higher concentration of vegetable pea growers and better representation of production and marketing practices.

Selection of Villages

A list of villages cultivating vegetable pea in the selected blocks was obtained from the District Agriculture and Horticulture Department. From the total villages, eight villages were selected randomly for the study, namely Meja Khas, Sirsa, Kanti, Karchhana, Basahara, Dighiya, Ghoorpur, and Jasra. From each selected village, 15 vegetable pea growers were chosen randomly, making a total sample size of 120 respondents. These respondents were selected for detailed investigation regarding production practices, marketing channels, marketing costs, price spread, and marketing efficiency in the study area.

Selection of Respondents/Farmers

A list of all vegetable pea growers in the selected villages was obtained from the District Agriculture Office. From this list, 120 farmers were selected randomly for the study. The selected farmers were categorized into different groups based on their size of landholding.

Sr.no	Type of farmers	Area in hectar
1	Marginal	Less than 1 hectare
2	Small	1 – 2 hectares
3	Semi-Medium	2 – 4 hectares
4	Medium	5 – 9 hectares
5	Large	Above 10 hectares

This classification helped in analyzing differences in production practices, marketing channels, costs, and profitability among different categories of farmers.

Analysis of data/ analytical tools used

The present study titled “A Study on Supply Chain Management of Vegetable Pea in Prayagraj District of Uttar Pradesh” was based on both primary and secondary data. The primary data were collected from vegetable pea growers, village traders, wholesalers, retailers, commission agents, transporters, and other stakeholders involved in the supply chain system, while secondary data were obtained from published reports, records of the Department of Agriculture and Horticulture, research studies, and relevant literature.

The collected data were systematically compiled, tabulated, and analyzed using appropriate statistical tools such as averages, percentages, and ratios. For examining the supply chain management of vegetable pea, indicators such as supply chain channels, marketing costs, price spread, transportation facilities, storage and handling practices, market margins, supply chain efficiency, and constraints faced by vegetable pea growers were used to evaluate 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

1) Cost and returns per hectare vegetable pea in the study area

Cost of vegetable pea production

Cost- A1

value of hired human labour

Value of hired bullock labour

Value of owned bullock labour

Value of owned machinery labour

Hired machinery charges

Value of seed (both farm produced and purchased)

Value of insecticide and pesticide

Value of manures (owned and purchased)

Value of fertilizer

Depreciation on implements and farm buildings

Irrigation charges

Land revenue, cases and other taxes

Interest on working capital

Miscellaneous expenses (artisans etc.)

Cost A2: Cost A1 + rent paid for leased in land

Cost B1: Cost A1 + interest on value of owned fixed capital assets (excluding Land)

Cost B2: Cost B1+ rental value of owned land (net of land revenue) and rent paid for leased-in land

Cost C1: Cost B1+ imputed value of family labour

Cost C2: Cost B2+ imputed value of family labour

Cost C2: Cost C2 adjusted to take into account valuation of human labour at market rate or statutory minimum wage

rate whichever is higher

Cost C3: Cost C2+ value of management input at 10% of total cost (C2)

Cost C is the total cost of cultivation

1. Farm business income = Gross income – Cost A1 or A2

2. Family labour income = Gross income – Cost B

3. Net income = Gross income – Cost C

4. Farm investment income = Farm business income – imputed value of family labour

1) Benefit Cost (B:C) Ratio

The ratio of economic yield to biological yield. Also the ratio of present worth of gross returns to the present worth of costs. It is the ratio of the sum of the project's or policy's discounted benefits to the sum of its discounted costs. If $BCR > 1$ go ahead with the project/policy.

$$BCR = \frac{|PV[Benefits]|}{|PV[Cost]|} = \frac{\sum_{t=0}^N \frac{|CF_t[Benefits]|}{(1+i_t)^t}}{\sum_{t=0}^N \frac{|CF_t[Costs]|}{(1+i_t)^t}}$$

Formula Where,

PV[Benefits] = Present value of benefits, PV[Cost] = present value of costs,

$CF_t[Benefits]$ = Benefits in the t^{th} year,

$CF_t[Costs]$ = Costs in the t^{th} year, t = Number of years,

i = Interest (discount) rate.

2) Marketing Cost

The total cost, incurred on marketing either in cash or in kind by the producer seller and by the various intermediaries involved in the sale and purchase of the commodity reaches the ultimate consumer.

$$C = C_f + C_{m1} + C_{m2} + C_{m3} + \dots + C_{mn}$$

Where,

C = Total cost of marketing of commodity

C_f = Cost paid by the producer from the time of produce leave farm till he sale it

C_{mn} = Cost incurred by the nth middleman in the process of buying and selling the product.

3) Price spread

Price spread is defined as the difference between the price paid by the consumer and the net price received by producer for an equivalent quantity of farm produce.

$$\text{Price spread} = \frac{\text{Consumer price} - \text{Net price of producer}}{\text{Consumer price}} \times 100$$

4) Marketing Efficiency

The ratio of price paid by the consumer's (total value of goods) to total marketing cost is used as a measure of marketing efficiency.

$$ME = \frac{V}{I} \times 100$$

Where,

ME = Marketing efficiency

V = Price paid by consumer (value of goods purchased) I = Total Marketing Cost (Cost + margins)

5) Producer's share in consumer's rupee

It is the price received by the farmer expressed as a percentage of the retail price (i.e., price paid by the consumer)

$$P_s = \frac{PF}{Pr} 100$$

Where

P_s = Producer's share

PF = Price received by the farmer

Pr = Retail price paid by the consumer

Results and Discussion

The socio-economic characteristics of vegetable pea growers play an important role in influencing production practices, supply chain participation, and income generation. Factors such as age, education, family size, farming experience, landholding size, and investment capacity significantly affect the cultivation, marketing decisions, and adoption of improved supply chain practices in vegetable pea farming.

Therefore, the present study on "A Study on Supply Chain Management of Vegetable Pea in Prayagraj District of Uttar Pradesh" examined the socio-economic profile of respondents to understand their role in production, marketing behaviour, and efficiency of the supply chain system in the study area.

Socio-Economic Profile of Sample Respondents (n = 120)

Particulars	Value	Percentage
Male members	3.15	45.32
Female members	2.50	35.97
Children	1.30	18.71
Total family size	6.95	100

The table shows that male members form the largest share (45.32%), followed by females (35.97%) and children (18.71%), indicating active family participation in farming activities.

Education, Occupation and Age of Respondents (n = 120)

A. Education Level

Education Level	Number	Percentage
Illiterate	12	10.00
Primary	28	23.33
Secondary	50	41.67
College	30	25.00

B. Occupation Pattern

Occupation	Number	Percentage
Agriculture only	50	41.67
Agriculture + Dairy	30	25.00
Agriculture + Business	22	18.33
Agriculture + Service	18	15.00

C. Age Distribution

Age Group	Number	Percentage
Below 30	24	20.00
31-50	60	50.00
Above 51	36	30.00

Brief Explanation

Most farmers are middle-aged (50%) and moderately educated (secondary level 41.67%). Agriculture remains the main occupation, though many diversify income sources.

Farm Size and Area under Vegetable Pea

Category	Farmers	Avg. Farm Size (ha)	Area under Pea (ha)
Marginal	48	0.75	0.30
Small	36	1.80	0.70
Semi-medium	20	3.10	1.20
Medium	16	5.20	2.00
Overall	120	2.21	1.05

Marginal and small farmers dominate the study area. Vegetable pea is cultivated across all farm categories, with larger farmers producing higher market surplus.

Marketing Cost and Price Spread (Rs./quintal)

Particulars	Channel I	Channel II	Channel III
Marketing Cost	62	90	150
Marketing Margin	0	180	350
Consumer Price	1362	1470	1600
Price Spread	62	270	500

Marketing cost and price spread increase as intermediaries increase. Channel I is the most efficient, while Channel III shows the highest cost and price gap.

Producer's Share & Marketing Efficiency

A. Producer's Share in Consumer Rupee

Channel	Producer Price	Consumer Price	Share (%)
Channel I	1300	1362	95.45
Channel II	1200	1470	81.63
Channel III	1100	1600	68.75

B. Marketing Efficiency

Channel	Value	Cost + Margin	Efficiency
Channel I	1362	62	21.97
Channel II	1470	270	5.44
Channel III	1600	500	3.20

Producer's share and marketing efficiency decline with longer marketing channels. Direct marketing (Channel I) is the most efficient and beneficial for farmers.

Conclusion

The present study on "Supply Chain Management of Vegetable Pea in Prayagraj District of Uttar Pradesh" found that most farmers were marginal and small holders with middle-age and secondary education, and vegetable pea cultivation was an important source of income. Three main marketing channels were identified, where direct marketing provided the highest producer's share and efficiency, while longer channels increased marketing cost, price spread, and

reduced farmers' returns. Post-harvest losses were higher among marginal farmers due to poor storage, grading, and transport facilities. Major constraints included price fluctuation, high transportation cost, lack of cold storage, middlemen exploitation, and inadequate market information. The study concludes that shorter supply chains are more efficient and profitable, and suggests policy measures such as development of cold storage, better transport facilities, promotion of direct marketing and FPOs, improved market information systems, training of farmers, value addition, and price stabilization to enhance efficiency and increase farmers' income in the region.

Summary

The present study on "Supply Chain Management of Vegetable Pea in Prayagraj District of Uttar Pradesh" revealed that most respondents were marginal and small farmers with medium family size and secondary-level education. Vegetable pea cultivation was an important income source, with three main marketing channels identified, of which Channel II was most commonly used. Marketing costs, price spread, and intermediary margins increased with longer channels, while producer's share and marketing efficiency were highest in direct marketing (Channel I) and lowest in Channel III. Post-harvest losses were higher among marginal farmers due to poor storage and handling facilities. Major constraints included price fluctuations, high transportation costs, lack of cold storage, middlemen exploitation, and inadequate market information. Overall, the study concluded that shorter supply chains are more efficient and profitable, and improvements in infrastructure and market support are essential to enhance farmer income and reduce losses.

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