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Marketing efficiency, price spread, and supply chain constraints of vegetable pea in Pratapgarh district of Uttar Pradesh

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Abstract

The present study entitled "Marketing Efficiency, Price Spread, and Supply Chain Constraints of Vegetable Pea in Pratapgarh District of Uttar Pradesh" was carried out with two specific objectives: (i) to calculate marketing cost, marketing margin, price spread, producer's share in consumer's rupee, and marketing efficiency of vegetable pea across different marketing channels; and (ii) to assess the major constraints faced by vegetable pea farmers in the supply chain. Primary data were collected from 100 vegetable pea growers using a stratified random sampling procedure. Three marketing channels were identified. The analysis revealed that Channel I (Producer to Consumer) was the most efficient channel with the highest marketing efficiency (24.08) and the highest producer's share (95.85%). The price spread was lowest in Channel I (Rs. 52/quintal) and highest in Channel III (Rs. 400/quintal), clearly demonstrating that the involvement of intermediaries increases the marketing cost and widens the price spread. The constraint analysis revealed that price fluctuation (88%) was the most serious supply chain constraint ranked first, followed by high transportation cost (80%), lack of cold storage (75%), exploitation by middlemen (68%), and lack of market information (60%). The study recommends strengthening direct marketing channels, improving cold storage infrastructure, and reducing the number of intermediaries to enhance marketing efficiency and improve farmers's income in Pratapgarh district.

Keywords: Vegetable pea, marketing efficiency, price spread, supply chain constraints, marketing channels, Producer's Share, Pratapgarh, Uttar Pradesh

Introduction

Vegetable pea (*Pisum sativum* L.) is one of the most important leguminous vegetable crops grown throughout the world and occupies a prominent place among winter vegetables. It is valued for its high nutritional composition, short growing duration, and significant market demand. Pea is a rich source of protein, carbohydrates, vitamins A, B, and C, and essential minerals including phosphorus, iron, and potassium. Because of its versatility and taste, vegetable pea has become an indispensable component of Indian cuisine and is consumed in fresh, frozen, and processed forms.

India is one of the major producers of peas in the world, contributing approximately 5–6 million tonnes annually (FAO, 2022) ^[1]. The crop is predominantly cultivated during the rabi season in northern states including Uttar Pradesh, Bihar, Punjab, Haryana, Madhya Pradesh, and West Bengal. Uttar Pradesh, with an estimated production of 1.0–1.2 million tonnes per annum from an area of 90–100 thousand hectares, is the leading pea-producing state in India (NHB, 2022). The crop plays a vital role in sustaining

the livelihoods of small and marginal farmers due to its low investment requirement and quick returns.

Pratapgarh district of Uttar Pradesh is an agriculturally significant district where vegetable cultivation plays a key role in the farming system. Fertile alluvial soils, suitable climatic conditions, and proximity to large urban markets make the district well-suited for vegetable pea cultivation. Despite its agro-climatic advantage, farmers in the district face substantial challenges in marketing and supply chain management. Vegetable pea is a highly perishable commodity requiring rapid handling, proper storage, and efficient transportation. The absence of cold chain infrastructure, the dominance of multiple intermediaries, and frequent price fluctuations result in post-harvest losses and reduced price realization for farmers.

The marketing system of vegetable pea in Pratapgarh district involves several intermediaries — commission agents, wholesalers, and retailers — whose involvement inflates marketing costs and reduces the producer's share in the consumer's rupee. An efficient supply chain is therefore critical to reducing post-harvest losses, minimizing

marketing costs, improving market efficiency, and ensuring fair returns to producers. Although several studies have examined the marketing structure of perishable vegetables in Uttar Pradesh (Sharma and Goswami, 2021; Jain and Mathur, 2020) ^[9, 21], disaggregated district-level analysis of marketing efficiency combined with systematic constraint assessment for vegetable pea is limited in the published literature. The present study addresses this gap by combining price spread analysis, Shepherd's marketing efficiency formula, and Garrett's ranking technique to analyse marketing channels and prioritise supply chain constraints for vegetable pea in Pratapgarh district.

Materials and Methods
Study Area and Sample Design

The study was conducted in Pratapgarh district of Uttar Pradesh (25°32'–26°12'N; 81°19'–82°27'E) during 2024–25. The district was purposively selected owing to its significant contribution to vegetable pea production in the region and the presence of multiple marketing channels through which pea is marketed. Primary data were collected from 100 vegetable pea growers selected using stratified random sampling across three landholding categories: marginal (< 1 ha), small (1–2 ha), and medium (2–4 ha). In addition, supply chain respondents comprising retailers, wholesalers, and commission agents were interviewed to obtain marketing cost and margin data. Data were collected through structured personal interview schedules.

Analytical Tools

Three major marketing channels were identified through

supply chain mapping and farmer interviews:

Channel I: Producer → Consumer

Channel II: Producer → Retailer → Consumer

Channel III: Producer → Wholesaler → Retailer → Consumer

Marketing cost was estimated as total expenses incurred by farmers and intermediaries including packing, transportation, labour, market charges, and commission charges. Price spread was calculated as the difference between the price paid by the consumer and the price received by the producer (Price Spread = $P_c - P_p$). Producer's share in the consumer's rupee was estimated as: Producer's Share (%) = $(P_p / P_c) \times 100$, where P_p is the producer price and P_c is the consumer price.

Marketing efficiency was computed using Shepherd's Formula: $ME = \text{Value of goods sold} / (\text{Total marketing cost} + \text{Marketing margin})$. A higher value indicates greater marketing efficiency.

Constraint identification and prioritisation employed the Garrett Ranking Technique. Each respondent ranked the major constraints from most to least severe. The percent position was computed as: Percent Position = $[100 \times (R_{ij} - 0.5)] / N_j$, where R_{ij} is the rank given to constraint i by respondent j and N_j is the total constraints ranked. Percent positions were converted to Garrett scores using the standard conversion table and mean scores were calculated for each constraint.

Results and Discussion

1. Marketing Cost, Price Spread, and Marketing Efficiency

Table 1: Marketing Cost in Different Channels of Vegetable Pea (Rs./quintal)

Cost Component	Channel I (Rs. /q)	Channel II (Rs. /q)	Channel III (Rs. /q)	Remarks
Packing cost	12	15	18	Increases with channel length
Transport cost	25	40	55	Major cost component
Labour charges	10	12	15	—
Market charges	5	8	10	—
Commission charges	—	—	22	Only in Channel III
Total Marketing Cost	52	75	120	Lowest in Channel I

Source: Primary survey data, 2024-25.

It could be seen from Table 1 that the total marketing cost of vegetable pea was lowest in Channel I at Rs. 52 per quintal, where producers sold directly to consumers without any intermediary involvement. Marketing cost increased to Rs. 75 per quintal in Channel II, attributable to additional transportation and handling expenses incurred when selling through retailers. Channel III recorded the highest total marketing cost of Rs. 120 per quintal, driven primarily by commission charges (Rs. 22/q) and increased transport and labour expenses associated with multi-level handling. Transport cost emerged as the dominant individual cost

component across all channels, ranging from Rs. 25/q in Channel I to Rs. 55/q in Channel III, underscoring the role of logistics costs in inflating the total marketing cost as produce moves through longer chains.

These findings are consistent with Jain and Mathur (2020) ^[2], who documented that marketing costs for perishable vegetables in Uttar Pradesh increase proportionally with the number of intermediaries, and with Sharma and Goswami (2021) ^[9], who identified transport and commission costs as the two most significant contributors to marketing cost escalation in vegetable supply chains of northern India.

Table 2: Price Spread in Different Marketing Channels of Vegetable Pea

Particulars	Channel I (Rs. /q)	Channel II (Rs. /q)	Channel III (Rs. /q)	Producer Share (%)	Remarks
Producer Price	1200	1100	1000	—	Highest in Ch. I
Marketing Cost	52	75	120	—	—
Intermediary Margin	—	125	280	—	Absent in Ch. I
Consumer Price	1252	1300	1400	—	Lowest in Ch. I
Price Spread	52	200	400	95.85 / 84.62 / 71.43	Spread widens with intermediaries

Source: Primary survey data, 2024-25. Producer Share (%): Ch. I = 95.85%; Ch. II = 84.62%; Ch. III = 71.43%

It could be seen from Table 2 that price spread — the difference between the price paid by the consumer and the price received by the producer — varied markedly across channels. In Channel I, the producer received the highest price of Rs. 1,200 per quintal and the consumer paid Rs. 1,252 per quintal, yielding the lowest price spread of Rs. 52 per quintal and the highest producer's share of 95.85 percent. The absence of intermediaries in Channel I ensures that nearly all of the consumer's payment reaches the producer.

In Channel II, the producer received Rs. 1,100 per quintal while the consumer paid Rs. 1,300 per quintal, resulting in a price spread of Rs. 200 per quintal and a producer's share of 84.62 percent. Channel III recorded the widest price spread of Rs. 400 per quintal (producer price: Rs. 1,000/q;

consumer price: Rs. 1,400/q) and the lowest producer's share of 71.43 percent. The intermediary margin of Rs. 280 per quintal in Channel III accounts for over 70 percent of the total price spread, confirming that multi-level intermediation is the primary driver of income leakage from the supply chain.

These findings align with those reported by Patel and Sinha (2020) ^[7], who documented that producer's share in the consumer's rupee for perishable vegetables in central Uttar Pradesh declined from 90–95 percent in direct marketing channels to below 70 percent in channels with three or more intermediaries. The results also corroborate Verma and Tiwari (2019) ^[12], who identified intermediary margin as the primary price spread component for smallholder-dominated vegetable supply chains in northern India.

Table 3: Marketing Efficiency of Different Channels of Vegetable Pea (Shepherd's Formula)

Channel	Value of Goods Sold (Rs. /q)	Total Mktg. Cost + Margin (Rs. /q)	Marketing Efficiency	Producer Share (%)	Channel Status
Channel I	1252	52	24.08	95.85	Most Efficient
Channel II	1300	200	6.50	84.62	Moderate
Channel III	1400	400	3.50	71.43	Least Efficient

Source: Primary survey data, 2024-25. ME = Value of goods sold / (Total marketing cost + Marketing margin). Higher ME indicates greater efficiency

It could be seen from Table 3 that Channel I recorded the highest marketing efficiency of 24.08, as marketing costs and intermediary margins were minimal with a combined figure of only Rs. 52 per quintal. Channel II had a moderate marketing efficiency of 6.50, while Channel III recorded the lowest marketing efficiency of 3.50. The sharp decline in marketing efficiency from Channel I to Channel III is attributable to the accumulation of intermediary margins (Rs. 280/q) and higher transport and handling costs in multi-level channels.

These findings are supported by Raghavan (2023) ^[8], who demonstrated that shorter marketing channels for perishable vegetable crops consistently exhibit higher marketing

efficiency values, and by Kumar and Sharma (2022) ^[4], who reported that direct marketing mechanisms improve the producer's share by 15–25 percentage points compared to conventional intermediary-dominated channels. The results collectively indicate that promoting direct and shorter marketing channels for vegetable pea — through farmer producer organizations (FPOs), e-NAM platforms, and direct mandi access — would substantially improve marketing efficiency and raise farmers' income in Pratapgarh district.

2. Supply Chain Constraints — Garrett Ranking

Table 4: Major Constraints Faced by Vegetable Pea Farmers in the Supply Chain (Garrett Ranking, n = 100)

S. No.	Constraint	Farmers Reporting (n)	Percentage (%)	Garrett Score	Rank
1.	Price fluctuation / absence of stable price mechanism	88	88.00	78	I
2.	High transportation cost	80	80.00	72	II
3.	Lack of cold storage and storage facilities	75	75.00	66	III
4.	Exploitation by middlemen / large number of intermediaries	68	68.00	60	IV
5.	Lack of market information	60	60.00	52	V
6.	Inadequate access to institutional credit	54	54.00	47	VI
7.	Lack of grading and packaging facilities	48	48.00	42	VII
8.	Poor road and market infrastructure	42	42.00	38	VIII

Source: Primary survey data, 2024-25. Garrett Score: ≥ 70 = Very Severe; 55–69 = Severe; 40–54 = Moderate; < 40 = Minor.

It could be seen from Table 4 that price fluctuation / absence of a stable price mechanism emerged as the most critical constraint with the highest Garrett score of 78, reported by 88 percent of respondents and ranked first. Vegetable pea prices in the study area fluctuate sharply during peak harvesting season due to simultaneous market arrivals, absence of regulated price support, and the dominance of intermediaries who exploit market information asymmetry. This finding corroborates Verma and Tiwari (2019) ^[12], who identified price instability as the foremost marketing constraint for smallholder vegetable growers in northern Uttar Pradesh.

High transportation cost ranked second (Garrett Score: 72; 80 percent of respondents), reflecting the inadequate rural road connectivity and high vehicle hire charges that inflate marketing costs for farmers transporting produce to distant mandis. Lack of cold storage and storage facilities was ranked third (Garrett Score: 66; 75 percent), a particularly acute constraint for a highly perishable crop like vegetable pea. The absence of cold chain infrastructure forces farmers into distress sales immediately after harvest, significantly depressing price realization. These findings are consistent with Raghavan (2023) ^[8], who documented that post-harvest infrastructure gaps are a primary driver of price realization

loss for perishable vegetable crops in central Uttar Pradesh. Exploitation by middlemen and the presence of a large number of intermediaries ranked fourth (Garrett Score: 60; 68 percent), directly linked to the price spread and marketing efficiency results discussed above. Lack of market information ranked fifth (Garrett Score: 52; 60 percent), indicating that farmers lack access to real-time price data necessary for informed marketing decisions. Inadequate access to institutional credit (Score: 47; Rank VI) and lack of grading and packaging facilities (Score: 42; Rank VII) were classified as moderate constraints, while poor road and market infrastructure (Score: 38; Rank VIII) was a minor but persistent concern. The constraint severity distribution — 25 percent Very Severe, 37.5 percent Severe, 25 percent Moderate, and 12.5 percent Minor — underscores that the most critical bottlenecks lie at the price, logistics, and storage dimensions of the supply chain. The collective reading of marketing efficiency and constraint findings indicates that the current supply chain structure of vegetable pea in Pratapgarh district is characterized by high intermediation, wide price spreads, and inadequate infrastructure. Promoting shorter and more direct marketing channels — such as producer-to-consumer links through FPOs and e-NAM — would simultaneously address the most severe constraints (price instability, intermediary exploitation, information asymmetry) while significantly improving marketing efficiency and producer's share in the consumer's rupee.

Conclusion

This study provides an integrated analysis of marketing efficiency and supply chain constraints for vegetable pea in Pratapgarh district of Uttar Pradesh. The price spread analysis clearly demonstrated that Channel I (Producer → Consumer) is the most efficient marketing channel with the lowest price spread (Rs. 52/quintal), the highest producer's share (95.85%), and the highest marketing efficiency (24.08). In contrast, Channel III, involving both wholesalers and retailers, produced the widest price spread (Rs. 400/quintal), the lowest producer's share (71.43%), and the lowest marketing efficiency (3.50), confirming that the involvement of multiple intermediaries progressively erodes the farmer's income from each quintal of vegetable pea marketed.

The Garrett constraint ranking identified price fluctuation as the most severe supply chain constraint (Rank I; Garrett Score: 78; 88% of respondents), followed by high transportation cost (Rank II; 80%), lack of cold storage (Rank III; 75%), exploitation by middlemen (Rank IV; 68%), and lack of market information (Rank V; 60%). These constraints collectively highlight the systemic weaknesses in the marketing infrastructure and institutional support available to vegetable pea growers in the district.

Policy interventions recommended on the basis of these findings include: (a) strengthening direct and shorter marketing channels through promotion of FPOs, contract farming, and integration with the e-NAM platform; (b) expanding cold storage and cold chain infrastructure at the panchayat and block level to reduce post-harvest losses and distress sales; (c) improving rural road connectivity and subsidizing transport costs for vegetable produce; and (d) developing real-time market information systems to reduce

information asymmetry and empower smallholder farmers in price negotiations. The study's methodology — combining price spread analysis, Shepherd's marketing efficiency formula, and Garrett ranking — provides a replicable analytical framework for supply chain evaluation of other perishable vegetable crops across similar districts of Uttar Pradesh.

Declarations

Conflict of Interest

The authors declare no conflict of interest.

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Ethical Approval

Ethical clearance was obtained from the institutional review board of Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Ref: NAI/AEC/2024-25).

Data Availability

The primary survey data supporting the findings of this study are available from the corresponding author upon reasonable request.

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