

Stakeholder Practices and Marketing Constraints in the Apple Supply Chain: A Study of Shimla and Kullu Districts

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Abstract

Apple is a major temperate fruit crop that plays a crucial role in sustaining the horticultural economy of the north-western Himalayan region. In this context, the present study examines the structure and functioning of the apple supply chain in Shimla and Kullu districts of Himachal Pradesh, with a focus on stakeholder practices, marketing channels and constraints encountered during marketing. Primary data were collected from 120 apple growers and 100 market intermediaries through a multistage sampling approach and Garrett's ranking technique was employed to identify and prioritize the key constraints faced by stakeholders. The findings reveal that apple marketing is predominantly routed through APMC mandis, with almost all growers relying on the commission agent-led marketing system, while alternative channels such as direct sales to traders, processors and corporate retailers exist but remain limited and selectively adopted. The study further highlights variations in operational roles across different actors in the supply chain, particularly in activities such as handling, grading, packaging and storage, which significantly influence cost distribution and overall marketing efficiency. Constraint analysis indicates that financial issues, especially delayed payments along with market-related risks such as price fluctuations and infrastructural limitations including inadequate cold storage, market facilities and poor connectivity are the most critical challenges affecting supply chain performance, while demand-side uncertainties at the retail level and operational delays at intermediary stages further exacerbate inefficiencies. Overall, the study emphasizes the need for strengthening institutional mechanisms, improving post-harvest and market infrastructure, enhancing coordination among stakeholders, promoting digital market integration and ensuring transparency in transactions to improve supply chain efficiency and enable better income realization for apple growers.

Key words: Apple, Marketing practices, Constraint, Supply chain, Intermediaries

JEL Classification: L11, M31, Q13

Introduction

Apple (*Malus domestica*) is one of the most important temperate fruit crops in India, playing a crucial role in the livelihood security of hill farmers and the horticultural economy of the Himalayan region. India is the fifth-largest producer of apples globally, with an annual production of approximately 2.5-2.6 million tonnes (FAS, USDA, 2025). The crop is predominantly cultivated in the north-western Himalayan states, with Himachal Pradesh and Jammu & Kashmir accounting for nearly 96 per cent of the total apple production in the country (MoA&FW, 2024). Within Himachal Pradesh, districts such as Shimla and Kullu contribute significantly to both area and output, making them key centres of apple-based agrarian livelihoods (GoHP, 2025).

The apple sector has transitioned from subsistence-based cultivation to a more commercialized, market-driven enterprise, increasing the importance of efficient supply chain management. This includes key operations such as harvesting, grading, packaging, storage and transportation. The efficiency of these post-harvest and marketing activities significantly influence price realization, making an effective marketing system essential for maximizing farmers' returns (Bharti *et al.*, 2023). In perishable commodities like apples, the efficiency of the supply chain directly influences price realization, quality maintenance and reduction of post-harvest losses. It is estimated that post-harvest losses in fruits and vegetables in India range between 30-40 per cent, largely due to inadequate infrastructure, improper handling and inefficient marketing systems (Juhi and Ramesh, 2023).

Despite its economic importance, the apple supply chain in India continues to be characterized by the dominance

of traditional marketing channels, particularly those operating through Agricultural Produce Market Committee (APMC) mandis. These channels typically involve multiple intermediaries such as commission agents, traders and retailers, which increase marketing costs and reduces the producer's share in the consumer's rupee. Studies have shown that farmers often receive only 30–50 per cent of the final retail price due to inefficiencies and the presence of multiple intermediaries in the supply chain (Bharti *et al.*, 2023; Farheen *et al.*, 2017).

In recent years, alternative marketing channels such as direct marketing, contract farming, farmer producer organizations (FPOs) and linkages with organized retail and processing units have emerged as potential mechanisms to improve supply chain efficiency and enhance farmers' income. However, the adoption of these channels remains limited due to constraints such as lack of infrastructure, weak market linkages, limited access to market information and dependence on commission agents for credit and assured sales. Furthermore, the apple supply chain is increasingly exposed to emerging challenges such as price volatility, rising input and transportation costs, climate-induced production variability and lack of storage facilities. These challenges are compounded by institutional inefficiencies, which affect all actors across the supply chain, from producers to retailers (Kireeti and Sharma, 2017; Firdous and Manoj, 2019).

Given this context, a comprehensive understanding of supply chain structure, stakeholder practices and associated constraints is essential for designing effective policy interventions and improving overall efficiency. Although several studies have examined apple marketing in India, there is a need for location-specific, stakeholder-inclusive analysis that captures inter-district variations in supply chain functioning. The findings of the study are expected to provide insights for improving market efficiency, strengthening value chain linkages and enhancing farmers' income in the apple sector.

Data Sources and Methodology

The present study on the supply chain management of apples was conducted in Shimla and Kullu districts of Himachal Pradesh, which together account for a major share of apple area and production in the state. These districts were purposively selected to capture variations in supply chain practices. A multistage sampling technique was adopted. In the first stage, districts were selected based on maximum area and production. In the second stage, two blocks from each district were chosen, namely Kotkhai and Rohru in Shimla district and Kullu and Naggar in Kullu district. In the final stage, a total of 120 apple growers (60 from each district) were selected randomly and interviewed using a structured questionnaire.

To comprehensively examine the apple supply chain,

100 market intermediaries were selected, comprising 20 commission agents, 20 traders/wholesalers and 10 retailers from each district, mainly from regulated markets (Dhalli and Prala in Shimla district; Bandrol and Bhuntar in Kullu district). The study focused on marketing channels, grading and packaging, storage, payment systems and trade practices across stakeholders. The study is based on primary data collected during the agricultural year 2024-25 through field surveys of selected respondents.

To identify and rank constraints, Garrett's Ranking Technique was employed. Garrett's ranking is applied to rank a set of items or factors as perceived by the sample respondents based on their priority. The order of merit assigned by the respondents was converted into scores using the formula:

$$\text{Percent Position} = \frac{R_{ij} - 0.5}{N_j} \times 100$$

R_{ij} = Rank given for i^{th} factor by j^{th} individual

N_j = Number of factors ranked by j^{th} individual

By referring to Garrett's table, the per cent position estimated was converted into scores. Then, for each factor, the scores of various respondents were added and the mean score was calculated. The factor with the highest mean score was considered to be the most important constraint. Thus, mean scores for each constraint were ranked by arranging them in descending order of the ranks given.

Results and Discussion

Apple marketing and post-harvest practices

Apple marketing in the study area was characterized by the presence of multiple marketing channels through which growers disposed of their produce, depending on factors such as market accessibility, quality of produce, scale of production and availability of buyers. One dominant and a few alternative marketing channels were identified in the study area, reflecting the organization of apple marketing and the movement of produce from growers to end-users in both Shimla and Kullu districts. The identified marketing channels are presented in Figure 1.

Channel-I emerged as the principal channel, used by all growers, indicating a strong reliance on APMC-based intermediary systems for assured market access and bulk handling, largely due to limited on-farm infrastructure and market reach (Rashmi *et al.*, 2016). Alternative channels, including Channel-II, Channel-III and Channel-IV, were present but used selectively depending on growers' scale, market access and linkages. Channel-III facilitates disposal of lower-grade produce and reduces wastage, while Channel-IV offers better price realization but is unsuitable for bulk sales and was absent in Kullu district.

Post-harvest practices further differentiate the

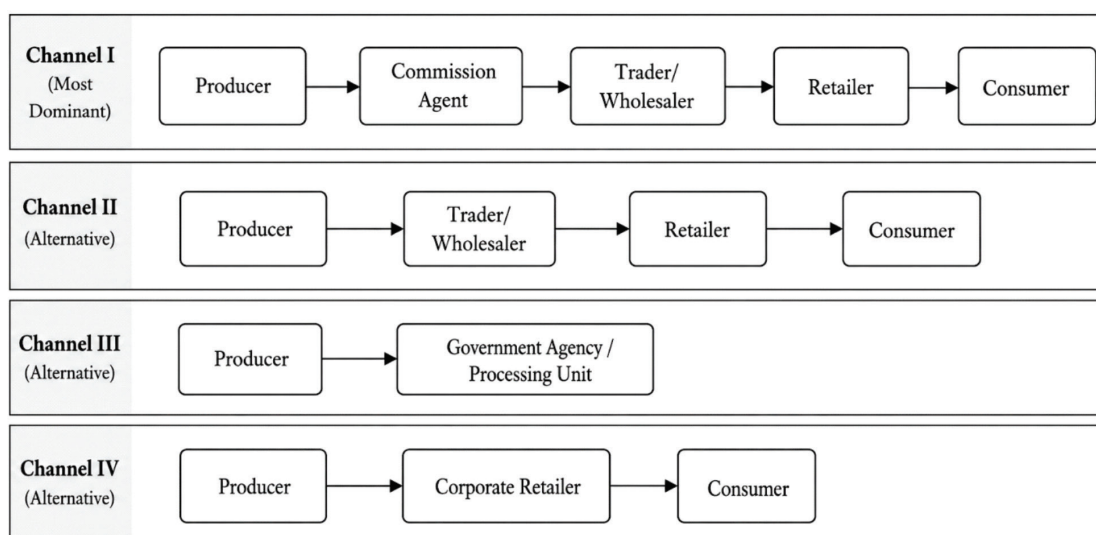


Figure 1. Identified marketing channels of apples in the study area

Table 1: Marketing channel and practices followed by the apple growers in the study area

Sl. No.	Particulars		Shimla (n=60)	Kullu (n=60)
I.	Marketing channels	Channel-I	60 (100.00)	60 (100.00)
		Channel-II	12 (20.00)	5 (9.00)
		Channel-III	36 (60.00)	7 (11.66)
		Channel-IV	12 (20.00)	-
II.	Adoption of Grading practice	Yes	60 (100.00)	60 (100.00)
III.	Mode of grading (based on size, shape and colour)	Manual	-	50 (83.33)
		Mechanical	60 (100.00)	10 (16.67)
IV.	Adoption of packaging practice	Yes	60 (100.00)	15 (25.00)
		No	-	45 (75.00)
V.	Agent selection criteria	Price	16 (26.67)	17 (28.33)
		Payment method	14 (23.33)	10 (16.67)
		Trust/Long-term acquaintance	17 (28.33)	23 (38.33)
		Both price and payment method	13 (21.67)	10 (16.67)
VI.	Payment settlement period by the agent	Within 1-2 weeks	45 (75.00)	44 (73.33)
		More than a month	15 (25.00)	16 (26.66)
VII.	Storage of produce	Yes	24 (40.00)	6 (10.00)
		No	36 (60.00)	54 (90.00)
VIII.	Place of trading apple produce	Channel-I	Fruit mandi/APMC	
		Channel-II	Farm gate	
		Channel-III	Collection centre	
		Channel-IV	Collection centre/ Store	-

Note: Figures in parentheses indicate the percentages of the respective values

two districts, with Shimla district demonstrating higher mechanization through complete adoption of mechanical grading and standardized packaging, enabling improved quality control and access to premium markets. In contrast, Kullu district relies predominantly on manual grading and minimal packaging, thereby limiting competitiveness and shifting additional handling responsibilities to downstream actors such as traders. Relational and institutional factors also shape the functioning of the supply chain, as growers in both districts primarily select commission agents based on trust and long-term relationships, highlighting the continued importance of informal credit systems and relational contracting in marketing decisions (Sristi *et al.*, 2024). This reinforces the central role of intermediaries despite the presence of alternative marketing channels, while APMC mandis continue to serve as key platforms for aggregation and price discovery, linking producers with distant buyers.

Operational inefficiencies are also transmitted across the chain. Limited access to storage facilities, particularly in Kullu district, compels growers to undertake immediate post-harvest sales, thereby weakening their bargaining power and adversely affecting price realization. Although most payments to growers are received within 1-2 weeks, instances of delayed payments create liquidity constraints, influencing farm-level financial planning and cascading through other stakeholders.

At the intermediary level, commission agents in both districts are predominantly middle-aged and operate largely as sole proprietorships, with all transactions conducted through auction-based systems during the peak marketing season (July-October). Higher volumes handled in Shimla district, along with greater adoption of storage facilities, indicate relatively better infrastructure and market connectivity compared to Kullu district. However, delays in payments from buyers, particularly in Shimla district, suggest the presence of financial bottlenecks within the system.

Traders largely depend on commission agents for procurement (Shimla: 90%; Kullu: 95%), while auction-based pricing ensures market-driven price discovery in a volatile environment (Sristi *et al.*, 2024). At the same time, the absence of grading practices at the producer level in Kullu district necessitates additional sorting and packaging by traders (85%), increasing transaction costs and reducing overall efficiency, whereas in Shimla district, such activities are largely completed upstream. Storage practices among traders are moderate but comparatively higher in Shimla district, further reflecting infrastructural disparities.

At the retail level, operations remain small-scale and localized, with procurement primarily from APMC mandis and sales conducted through local markets and roadside outlets. Retailers in Shimla district handle relatively higher volumes compared to Kullu district, while procurement frequency varies based on demand conditions and storage

capacity. Payment systems at this stage involve a mix of cash and bank transfers and retail dynamics are influenced by demand variability and price fluctuations.

Overall, these findings align with earlier studies (Rashmi *et al.*, 2016; Paulranjan and Fatima, 2010), confirming the continued dominance of traditional marketing structures and small-scale retail operations in horticultural supply chains.

Apple marketing constraints

The analysis of marketing constraints across the apple supply chain reveals that inefficiencies are multidimensional and interlinked, affecting growers, commission agents, traders and retailers in both Shimla and Kullu districts. Among growers, delayed or partial payments emerged as the most critical constraint in Shimla district (Rank I; 71.79), whereas price volatility and low returns were the most severe in Kullu district (Rank I; 70.96), indicating regional variation in financial stress. Other major concerns included inadequate cold storage, import competition and poor road connectivity, with infrastructural limitations being more pronounced in the Kullu district. These constraints are closely connected to broader supply chain inefficiencies, where price volatility reflects exposure to fluctuating market conditions and competition, while delayed payments create liquidity stress and disrupt reinvestment and transaction cycles for growers. Similar financial constraints were also evident among commission agents, for whom delayed settlements ranked first in both Shimla (71.20) and Kullu districts (71.53), highlighting systemic payment bottlenecks within the marketing system. Additional issues such as congested market yards, lack of trader registration and limited cold storage further point to institutional and infrastructural gaps that restrict efficient operations.

At the trader level, constraints varied across districts but remained linked to upstream inefficiencies, as traders in Shimla district reported market price instability (Rank I; 66.80) and inadequate APMC facilities as key issues, whereas in Kullu district, lack of grading and packaging infrastructure (Rank II) and poor road connectivity (Rank III) were more prominent. This reflects how the absence of proper post-harvest practices at the producer level, particularly in Kullu district, shifts the burden of grading and packaging downstream, increasing handling costs and reducing overall efficiency. In contrast, in Shimla district, pre-packed produce often leads to quality disputes due to limited inspection, resulting in mismatches between expected and actual quality. Infrastructural deficiencies, especially inadequate cold storage and weak APMC facilities, emerge as common constraints across all actors, often forcing distress sales by growers and limiting storage and handling flexibility for intermediaries, consistent with findings of Kireeti and Sharma, (2017), Firdous and Manoj, (2019), and Abhishek *et al.*, (2023). Transport and connectivity issues further exacerbate these challenges, particularly in Kullu district,

Table 2: Demographic profile and trade practices of commission agents in the apple supply chain

Sl. No.	Particulars		Shimla (n=20)	Kullu (n=20)
1.	Age	<25 years	-	-
		25-35 years	4 (20.00)	2 (10.00)
		36-45 years	4 (20.00)	4 (20.00)
		46-55 years	6 (30.00)	10 (50.00)
		>55 years	6 (30.00)	4 (20.00)
2.	Education	Primary School (upto 5)	2 (10.00)	3 (15.00)
		Middle School (6-8)	2 (10.00)	2 (10.00)
		Secondary School (9-12)	9 (45.00)	9 (45.00)
		Degree and above	7 (35.00)	6 (30.00)
3.	Experience in trading	<10 years	5 (25.00)	-
		10-20 years	5 (25.00)	12 (60.00)
		21-30 years	6 (30.00)	8 (40.00)
		31-40 years	4 (20.00)	-
		>50 years	-	-
4.	Types of ownership	Sole Proprietor	16 (80.00)	16 (80.00)
		Partnership	4 (20.00)	4 (20.00)
5.	Peak season of trade	July-Oct	20 (100.00)	20 (100.00)
6.	Source of fruits	Producer	20 (100.00)	20 (100.00)
7.	Method of trading	Auction	20 (100.00)	20 (100.00)
8.	Average quantity handled per season (tonnes)		2715.15	1731.26
9.	Sale recipient	Only traders	4 (20.00)	7 (35.00)
		Both traders and retailers	16 (80.00)	13 (65.00)
10.	Mode of payment to growers	Cash and bank transfer	12 (60.00)	14 (70.00)
		Cash and cheque	8 (40.00)	6 (30.00)
11.	Mode of payment by buyers	Cash and bank transfer	20 (100.00)	16 (80.00)
		Cash and Cheque	-	4 (20.00)
12.	Payment settlement period to the growers	Within 1-2 weeks	19 (95.00)	18 (90.00)
		Within a month	1 (5.00)	2 (10.00)
13.	Payment settlement period by buyers	Within the week	4 (20.00)	10 (50.00)
		Within a month	7 (35.00)	6 (30.00)
		5-6 months	5 (25.00)	1 (5.00)
		Within a year	4 (20.00)	3 (15.00)
14.	Adoption of grading and packaging practice	No	20 (100.00)	20 (100.00)
15.	Storage of produce	Yes	10 (50.00)	2 (10.00)
		No	10 (50.00)	18 (90.00)

Note: Figures in parentheses indicate the percentages of the respective values

Table 3: Demographic profile and trade practices of trader cum wholesalers in the apple supply chain

Sl. No.	Particulars		Shimla (n=20)	Kullu (n=20)
1.	Age	<25 years	2 (10.00)	2 (10.00)
		25-35 years	4 (20.00)	5 (25.00)
		36-45 years	2 (10.00)	8 (40.00)
		46-55 years	12 (60.00)	5 (25.00)
		>55 years	-	-
2.	Education	Primary School (upto 5)	2 (10.00)	2 (10.00)
		Middle School (6-8)	3 (15.00)	5 (25.00)
		Secondary School (9-12)	9 (45.00)	8 (40.00)
		Degree and above	6 (30.00)	5 (25.00)
3.	Experience in trading	<10 years	4 (20.00)	7 (35.00)
		10-20 years	8 (40.00)	8 (40.00)
		21-30 years	4 (20.00)	5 (25.00)
		31-40 years	4 (20.00)	-
		>50 years	-	-
4.	Types of ownership	Sole Proprietor	16 (80.00)	17 (85.00)
		Partnership	4 (20.00)	3 (15.00)
5.	Source of fruits	Commission Agent	18 (90.00)	19 (95.00)
		Both CA and Producer	2 (10.00)	1 (5.00)
6.	Method of trading	Auction	18 (90.00)	19 (95.00)
		Direct	2 (10.00)	1 (5.00)
7.	Average quantity handled per season (tonnes)		571.00	420.23
8.	Mode of payment to the commission agent or producer	Cash and bank transfer	18 (90.00)	20 (100.00)
		Cash and cheque	2 (10.00)	-
9.	Mode of payment by buyers	Cash and bank transfer	18 (90.00)	20 (100.00)
		Cash and cheque	2 (10.00)	-
10.	Payment settlement period to the commission agent or producer	Within 10-15 days	12 (60.00)	15 (75.00)
		Within 1-2 months	8 (0.00)	5 (25.00)
11.	Payment settlement period by buyers	Within 10-15 days	14 (70.00)	18 (90.00)
		Within a month	4 (20.00)	2 (10.00)
		Within a year	2 (10.00)	-
12.	Adoption of grading/sorting and packaging practice	Yes	-	17 (85.00)
		No	20 (100.00)	3 (15.00)
13.	Storage of produce	Yes	10 (50.00)	7 (35.00)
		No	10 (50.00)	13 (65.00)

Note: Figures in parentheses indicate the percentages of the respective values

Table 4: Characteristics and sales practices of retailers in the apple supply chain

Sl. No.	Particulars		Shimla (n=10)	Kullu (n=10)
1.	Age	<25 years	2 (20.00)	1 (10.00)
		25-35 years	1 (10.00)	3 (30.00)
		36-45 years	4 (40.00)	2 (20.00)
		46-55 years	2 (20.00)	2 (20.00)
		>55 years	1 (10.00)	2 (20.00)
2.	Education	Primary School (upto 5)	1 (10.00)	1 (10.00)
		Middle School (6-8)	3 (30.00)	4 (40.00)
		Secondary School (9-12)	5 (50.00)	4 (40.00)
		Degree and above	1 (10.00)	1 (10.00)
3.	Experience in marketing	<10 years	1 (10.00)	1 (10.00)
		10-20 years	4 (40.00)	5 (50.00)
		21-30 years	3 (30.00)	3 (30.00)
		31-40 years	2 (20.00)	1 (10.00)
		>50 years	-	-
4.	Shop ownership	Owned	10 (100.00)	8 (80.00)
		Rented	-	2 (20.00)
5.	Product range	Only fruits	8 (80.00)	6 (60.00)
		Fruits and vegetables	2 (20.00)	4 (40.00)
6.	Source of purchase	Fruit Mandis (APMC)	8 (80.00)	7 (70.00)
		Direct from traders/wholesalers	2 (20.00)	3 (30.00)
7.	Average quantity handled/season (tonnes)		1.59	0.84
8.	Periodicity of purchase	Daily	4 (40.00)	4 (40.00)
		Weekly	2 (20.00)	4 (40.00)
		Fortnightly	4 (40.00)	2 (20.00)
9.	Mode of payment to the commission agent	On-spot cash	5 (50.00)	2 (20.00)
		Cash and bank transfer	5 (50.00)	8 (80.00)
10.	Suitable place for selling the produce	Local market	7 (70.00)	6 (60.00)
		Road side	2 (20.00)	4 (40.00)
		Near busstand	1 (10.00)	-

Note: Figures in parentheses indicate the percentage of the respective values

where poor road infrastructure leads to delays and higher transaction costs, while labour shortages during peak periods intensify operational inefficiencies, as also reported by Setu *et al.*, (2020).

At the retail level, demand-side constraints such as inconsistent sales volume (Rank I) and unsellable inventory losses (Rank II) were most critical in both districts, followed by low consumer affordability, indicating the impact of demand variability and perishability on retail operations. Price instability further affected retailers in the Kullu district, while storage and quality issues were more relevant in the Shimla district. These findings align with Faridullah *et al.*,

(2023).

Building on these findings, addressing the identified constraints in the apple supply chain requires a coordinated policy approach that emphasizes modernization of APMC infrastructure, strengthening of extension services and enforcement of transparent market practices. In addition, promoting decentralized storage facilities, ensuring timely payments through digital and regulatory mechanisms, enhancing accountability among market participants and expanding integration with e-NAM can collectively improve supply chain efficiency and enhance stakeholder welfare.

Table 5: Marketing constraints in apple cultivation faced by growers in the study area

Sl. No.	Constraints	Shimla		Kullu	
		Garrett Score	Rank	Garrett Score	Rank
1.	Delayed or partial payment	71.79	I	64.47	III
2.	Insufficient cold storage	58.79	II	62.65	IV
3.	Price volatility and low prices	58.05	III	70.96	I
4.	High cost of packaging material	55.26	IV	55.04	IX
5.	Competition from imported apple	54.89	V	62.14	V
6.	Inadequate regulated market	54.39	VI	59.00	VI
7.	Malpractices by the middleman	52.35	VII	47.79	X
8.	Inadequate APMCs infrastructure	45.34	VIII	55.52	VIII
9.	High transportation cost	44.39	IX	42.82	XI
10.	Shortage of skilled labour for grading and packing	43.82	X	56.13	VII
11.	Peak Season transport constraints	39.64	XI	37.29	XII
12.	Lack of all-weather roads	34.00	XII	67.19	II

Table 6: Constraints in apple trade faced by the commission agent in the study area

Sl. No.	Constraints	Shimla		Kullu	
		Garrett Score	Rank	Garrett Score	Rank
1.	Delayed settlements	71.20	I	71.53	I
2.	Lack of trader's registration and identification system	61.70	II	52.47	III
3.	Congested market yards	53.60	III	70.27	II
4.	Credibility concerns in produce quality	52.50	IV	26.00	IX
5.	Limited cold storage facilities	49.30	V	52.46	IV
6.	Lack of modern market amenities	48.80	VI	47.13	V
7.	Logistical bottlenecks at peak times	46.80	VII	40.80	VIII
8.	Fluctuating buyer participation	41.50	VIII	45.00	VI
9.	Commodity price variability	24.60	IX	44.33	VII

Table 7: Constraints in apple trade faced by the traders/marketers

Sl. No.	Constraints	Shimla		Kullu	
		Garrett Score	Rank	Garrett Score	Rank
1.	Market price instability	66.80	I	50.20	IV
2.	Inadequate APMC facilities	65.50	II	63.27	I
3.	Credibility concerns in produce quality	61.80	III	43.47	VII
4.	Increased logistics expenses	58.50	IV	49.87	V
5.	Operational delays in freight movement	53.70	V	43.20	VIII
6.	Labour scarcity	52.90	VI	49.47	VI
7.	Unforeseen weather-related harvest delays	41.10	VII	38.80	X
8.	Inadequate warehousing capacity	40.30	VIII	43.13	IX
9.	Inadequate road networks	38.30	IX	58.27	III
10.	Lack of grading and packaging infrastructure	18.00	X	60.33	II

Table 8: Constraints faced by the retailers in Apple market

Sl. No.	Constraints	Shimla		Kullu	
		Garrett Score	Rank	Garrett Score	Rank
1.	Inconsistent sales volume	56.50	I	59.00	I
2.	Unsellable inventory loss	55.33	II	57.00	II
3.	Economic affordability constraint of the consumer	52.33	III	51.33	III
4.	Quality assurance gaps	47.67	IV	23.00	V
5.	Storage deficiency	44.83	V	22.10	VI
6.	Commodity price instability	36.67	VI	48.67	IV

Conclusions and Policy Implications

The apple supply chain in both districts indicated strong dependence on intermediaries and APMC-based marketing systems. Although alternative channels exist, their adoption remains limited due to infrastructural and institutional constraints. Post-harvest practices further influence marketing performance, as Shimla district exhibits relatively better mechanization, storage and market connectivity, Kullu district faces greater constraints in terms of grading, packaging and transport infrastructure. The presence of multidimensional and interlinked constraints ranging from delayed payments and price volatility to inadequate storage, weak market infrastructure and demand-side uncertainties adversely affects efficiency and value realization across all stakeholders. Overall, the findings suggest that with targeted improvements in infrastructure, strengthening of institutional support and enhanced market integration, the existing supply chain holds significant potential for improving efficiency, value realization and overall stakeholder welfare.

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