



An Analysis of Challenges Across the Kinnow Value Chain in Punjab: Evidence from Value Chain Actors

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ABSTRACT

The experiment was conducted during December, 2023 to November, 2024 in the districts of Fazilka, Muktsar Sahib, and Hoshiarpur of Punjab to examine the marketing constraints encountered by key actors in the Kinnow value chain. Kinnow, a hybrid citrus fruit developed by crossing King and Willow Leaf mandarins, was introduced in Punjab during the mid-twentieth century and had emerged as one of the state's leading commercial fruit crops. Its wide adaptability, high yield potential, and strong domestic and export demand had made it a significant contributor to farm income, rural employment, and export earnings in the state. Despite its economic importance, the Kinnow sector had continued to face persistent marketing, infrastructural, and institutional constraints that adversely affected the efficiency, competitiveness, and sustainability of the value chain. The study was based on primary data collected from 80 intermediaries, including pre-harvest contractors, wholesalers, local traders, and retailers. The respondents were selected through random sampling from the selected districts of Punjab to ensure adequate representation of marketing intermediaries. The findings revealed that high post-harvest losses, orchard theft, unregulated market competition, inadequate grading and packaging facilities, and insufficient cold storage infrastructure were the most critical constraints affecting Kinnow marketing operations. These constraints had increased transaction risks, reduced marketing efficiency, and eroded profit margins of both farmers and intermediaries, thereby weakening the overall performance and resilience of the Kinnow value chain. The study emphasized targeted policy interventions, investment in post-harvest management and cold chains, and stronger coordination among value chain actors for sustainability in Punjab.

KEYWORDS: Actors, constraints, intermediaries, kinnow

Citation (VANCOUVER): Jairath and Virk, An Analysis of Challenges Across the Kinnow Value Chain in Punjab: Evidence from Value Chain Actors. *International Journal of Bio-resource and Stress Management*, 2026; 17(3), 01-07. [HTTPS://DOI.ORG/10.23910/1.2026.6797](https://doi.org/10.23910/1.2026.6797).

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Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Conflict of interests: The authors have declared that no conflict of interest exists.

1. INTRODUCTION

The hybrid citrus fruit Kinnow (King×Willow Leaf) has emerged as a major horticultural crop in Punjab, India, accounting for over 60% of the total citrus area and contributing significantly to seasonal employment, agro-industrial linkages, and rural livelihoods (Guleria et al., 2022). Its high juice content, desirable sweetness, and adaptability to Punjab's agro-climatic conditions have encouraged widespread adoption among growers (Sharma et al., 2017). The expansion of Kinnow cultivation has created diverse employment opportunities across the value chain, including orchard management, harvesting, and transportation, processing, and marketing activities (Singh et al., 2016; Shah and Kaur, 2022). Large-scale production is further supported by favourable climatic conditions and well-developed irrigation infrastructure, with Fazilka, Muktsar Sahib, and Hoshiarpur emerging as leading Kinnow-producing districts in Punjab. Despite its commercial potential, the Kinnow sector in Punjab faced significant constraints due to inefficiencies in post-harvest handling, marketing strategies, and institutional coordination (Manhas and Sharma, 2024; Kumar et al., 2014). Post-harvest losses of 15–25% occurred because of improper handling, inadequate grading, and lack of cold chain infrastructure (Kaur and Singh, 2025; Singh et al., 2014). Price volatility, seasonal fluctuations, market gluts during peak harvest, and limited access to market information further exacerbated farmer distress (Anoop and Kameswari, 2022; Yeasin et al., 2024). Traditional marketing channels involve multiple intermediaries—pre-harvest contractors, wholesalers, and retailers—adding cost but limited value, leaving producers with a small share of the consumer price (Singh et al., 2021; Shruti et al., 2019). Understanding these challenges is crucial for improving efficiency, inclusivity, and profitability across Punjab's Kinnow value chain (Guleria et al., 2022). The Kinnow value chain comprises a network of actors—pre-harvest contractors, wholesalers, local traders, and retailers—each facing unique challenges. Intermediaries struggle with inconsistent supply, inadequate infrastructure, and low levels of value addition (Anoop and Kameswari, 2022; Mahapatra and Mishra, 2023), while producers' bargaining power is diminished due to informal marketing channels and a lack of farmer collectivisation. Improving the overall efficiency and inclusivity of the Kinnow value chain requires understanding these actor-specific limitations. Using a value chain analysis approach, this study assessed marketing channels through price spread and efficiency measures, identified the roles and challenges of key stakeholders, and provided practical recommendations to improve the sustainability and profitability of Punjab's Kinnow sector (Guleria et al., 2022; Manhas and Sharma, 2024). The Kinnow value chain in

Punjab consisted of a network of interlinked actors whose coordinated functioning determined the flow of produce from orchards to end consumers and shaped marketing efficiency and value realization. At the initial stage, pre-harvest contractors played a dominant role by purchasing orchards prior to harvest and undertaking harvesting, handling, transportation, and marketing activities. Although this reduced production and marketing risks for farmers, it also limited their participation in post-harvest operations, value addition, and price negotiation, as documented in citrus marketing research (Guleria et al., 2022). Wholesalers and local traders aggregated bulk produce and facilitated its movement from regulated markets to major urban and inter-state destinations, thereby expanding market reach; however, their operations largely emphasized volume-based trade with minimal investment in grading and packaging, consistent with broader findings on tropical fruit value chains and supply constraints in India (Anand, 2024). At the terminal stage, retailers connected the produce directly to consumers and played a crucial role in price realization in local markets. Despite their importance, retailers generally operated with insufficient cold storage and handling infrastructure, leading to quality deterioration and post-harvest losses, a common issue identified in fruit marketing efficiency studies (Chand et al., 2021). Collectively, inadequate post-harvest infrastructure and weak coordination among value chain actors constrained value addition and reduced the overall efficiency of the Kinnow value chain in Punjab. In this context, the study was undertaken with the specific objective of identifying the major constraints faced by value chain actors across the Kinnow value chain in Punjab.

2. MATERIALS AND METHODS

2.1. Study sites

The present study was conducted in the major Kinnow-growing districts of Fazilka, Muktsar Sahib, and Hoshiarpur in the state of Punjab, India. These districts together constituted the core of Punjab's citrus belt and accounted for a substantial share of the state's Kinnow acreage and production (Shah and Kaur, 2022; Guleria et al., 2022). The study areas were purposively selected to capture regional diversity in production practices, marketing systems, and the participation of actors across the Kinnow value chain.

2.2. Sampling and data collection

The current investigation was based on primary data pertaining to the year 2023–24 and utilized a non-disguised structured questionnaire to collect information from 80 intermediaries, including pre-harvest contractors, wholesalers, local traders, and retailers, selected from three major Kinnow-producing districts of Punjab—Fazilka, Muktsar Sahib, and Hoshiarpur. The questionnaire

was designed to capture the socio-economic profile of respondents, marketing practices, infrastructure access, and key constraints faced in the value chain. A random sampling technique was employed to select respondents, ensuring adequate representation of all major value chain actors. The study evaluated statements relevant to the challenges encountered by various actors in the Kinnow value chain. The statements included in the questionnaire were developed based on an extensive review of peer-reviewed literature on citrus marketing, value chain analysis, and post-harvest management (Singh et al., 2021; Chand et al., 2021; Guleria et al., 2022).

2.3. Profile of the sample

- For the study, a pre-harvest contractor was defined as a person operating as a pre-harvest contractor for the kinnow crop for the last 5 years at the time of data collection.
- For the study, a wholesaler was defined as a person or a firm that has been operating as a wholesaler for Kinnow crop for the last 5 years at the time of data collection.
- For the study, a local trader was defined as a person or a firm that has been operating as a local trader for Kinnow crop for the last 5 years at the time of data collection.
- For the study, a retailer was defined as a person operating as a retailer for the Kinnow crop for the last 5 years at the time of data collection.

3. RESULTS AND DISCUSSION

3.1. Problems faced by value chain actors across the value chain of kinnow

After farmers, several participants were involved in Punjab's Kinnow value chain, including pre-harvest contractors, wholesalers, local traders, and retailers. Each of these actors faced unique challenges that reduced the overall effectiveness of the value chain.

3.2. Perception of problems of the pre-harvest contractor in the value chain of kinnow in Punjab

The study aimed to understand the problems faced by value chain actors in the Kinnow value chain in Punjab. In this context, "problems of pre-harvest contractors" referred to a range of challenges and difficulties that these actors had encountered, influenced by environmental, technological, and socio-economic factors, which had hindered the smooth functioning of the agriculture segment and affected overall value chain efficiency. Pre-harvest contractors were assessed on these issues using a set of 20 statements to examine their perception of problems in the Kinnow value chain in Punjab. Responses had been recorded on a 5-point Likert scale, where 1 represented "strongly disagree" and 5 represented "strongly agree." To analyse the data, the statements were tested using a one-sample t-test, with the null hypothesis

mean (μ) set at 3 ($H_0=3$), as shown in Table 1.

3.3. Perception of problems of wholesalers in the value chain of kinnow in Punjab

"Problems of wholesalers" in the Kinnow value chain referred to a range of challenges and difficulties that wholesalers had encountered, influenced by environmental, technological, and socio-economic factors, which had hindered the smooth

Table 1: Perception of problems of the pre-harvest contractor in the value chain of kinnow in Punjab

Sl. No.	Statements	Mean	S.D.	t-value $H_0=3$	p-value
1.	Limited access to credit	3.90	1.49	2.89	0.001*
2.	Crop damage	4.00	1.25	3.89	0.001*
3.	Price fluctuations	4.05	1.14	4.09	0.001*
4.	Delay in payments	3.58	1.35	2.81	0.001*
5.	Export barriers	3.70	1.59	2.84	0.001*
6.	Problem of theft	4.40	0.75	8.30	0.001*
7.	Price setting issue	4.00	1.37	3.24	0.004*
8.	Inadequate storage facility	4.20	1.19	4.48	0.001*
9.	Perishability/Prone to post-harvest losses	4.20	1.05	5.08	0.001*
10.	Far off location of markets	4.10	1.15	4.22	0.001*
11.	Seasonality of kinnow	4.15	1.19	4.35	0.001*
12.	Problem of rural road access	4.25	1.05	5.22	0.001*
13.	Inadequate market information	4.30	0.73	7.93	0.001*
14.	Availability of reliable buyers	3.55	1.50	2.33	0.001*
15.	Contractual disputes and informal agreements	4.15	1.30	3.92	0.001*
16.	High transportation cost	4.25	1.06	5.22	0.001*
17.	High brokerage fee	4.16	1.10	4.35	0.001*
18.	Overbidding	4.35	0.93	6.46	0.001*
19.	Inadequate market infrastructure	4.30	0.92	6.29	0.001*
20.	Absence of effective government policies	4.25	1.06	5.22	0.001*

*Significant at a 5% level of significance ($p < 0.05$)

functioning of the agriculture segment and affected overall value chain efficiency. Wholesalers were asked to indicate their agreement with a set of 20 statements to assess their perception of problems in the Kinnow value chain in Punjab, using a 5-point Likert scale, where 1 represented “strongly disagree” and 5 represented “strongly agree.” The statements were analysed using a one-sample t-test, with the null hypothesis mean (μ) set at 3 ($H_0=3$), as shown in Table 2.

Table 2: Perception of problems of wholesalers in the value chain of kinnow in Punjab

Sl. No.	Statements	Mean	S.D.	t- value $H_0=3$	p- value
1.	Limited access to credit	4.05	1.09	3.86	0.001*
2.	Export barriers	4.29	0.50	12.45	0.001*
3.	Price fluctuations	4.20	0.41	13.07	0.001*
4.	Lack of demand	3.75	0.51	12.70	0.001*
5.	Shortage of supply	3.50	0.51	13.07	0.001*
6.	Problem of theft	4.40	0.50	12.45	0.001*
7.	Price setting issue	4.40	0.50	12.45	0.001*
8.	Inadequate Storage facility	4.45	0.51	12.70	0.001*
9.	Perishability/Prone to post harvest losses	4.65	0.48	15.07	0.001*
10.	Far off location of markets	4.50	0.51	13.07	0.001*
11.	Seasonality of kinnow	4.60	0.50	14.23	0.001*
12.	Problem of rural road access	4.20	0.41	13.07	0.001*
13.	Lack of Market information	4.20	1.19	4.48	0.001*
14.	Lack of coordination of actors in value chain	4.50	0.70	8.81	0.001*
15.	Quality issues	4.40	0.50	12.45	0.001*
16.	High transportation cost	4.30	0.57	10.17	0.001*
17.	High brokerage fee	4.60	0.50	14.23	0.001*
18.	High commission rate	4.40	0.75	8.30	0.001*
19.	Inadequate market infrastructure	4.50	0.76	8.81	0.001*
20.	Absence of effective government policies	4.45	0.51	12.70	0.001*

*Significant at a 5% level of significance ($p<0.05$)

3.4. Perception of problems of local traders in the value chain of kinnow in Punjab

“Problems of local traders” in the Kinnow value chain referred to a range of challenges and difficulties that local traders had encountered while distributing agricultural produce from farmers or collectors to suppliers, which had been influenced by environmental, technological, and socio-economic factors that hindered the smooth functioning of the agriculture segment and reduced overall value chain efficiency. Local traders were asked to indicate their agreement with a set of 18 statements to assess their perception of problems in the Kinnow value chain in Punjab, using a 5-point Likert scale, where 1 represented “strongly disagree” and 5 represented “strongly agree.” The statements were analysed using a one-sample t-test, with the null hypothesis mean (μ) set at 3 ($H_0=3$), as shown in Table 3.

3.5. Perception of problems of retailers in the value chain of kinnow in Punjab

“Problems of retailers” in the Kinnow value chain referred to a range of challenges and difficulties that retailers had encountered, influenced by environmental, technological, and socio-economic factors, which had hindered the smooth functioning of the agriculture segment and reduced overall value chain efficiency. Retailers were asked to indicate their agreement with a set of 17 statements to assess their perception of problems in the Kinnow value chain in Punjab, using a 5-point Likert scale, where 1 represented “strongly disagree” and 5 represented “strongly agree.” The statements were analysed using a one-sample t-test, with the null hypothesis mean (μ) set at 3 ($H_0=3$), as shown in Table 4.

4. RESULTS AND DISCUSSION

The study explored the constraints faced by intermediaries, each of whom had played a unique yet interconnected role in the Kinnow value chain of Punjab. The findings revealed that the severity and nature of challenges had varied significantly across actor categories, reflecting both structural and operational weaknesses in the marketing system.

4.1. Pre-harvest contractors (PHCs)

Among all intermediaries, pre-harvest contractors reported theft of fruit from orchards as the most critical problem, with the highest mean score ($M=4.40$). As PHCs bore responsibility for the produce until harvest, theft and damage caused by trespassers resulted in considerable financial risk. In addition, PHCs faced multiple logistical and managerial constraints, including difficulties in organizing labour, limited access to transport facilities, and uncertainty in negotiating market prices. Similar constraints were reported among intermediaries in perishable horticultural value chains, where inadequate transport infrastructure and

Table 3: Perception of problems of local traders in the value chain of kinnow in Punjab

S1. No.	Statements	Mean	S.D.	t- value $H_0=3$	p- value
1.	Limited access to affordable credit	3.40	1.27	2.80	0.001*
2.	Problem of theft	4.40	0.75	8.30	0.001*
3.	Problem of price setting	4.41	0.75	8.30	0.001*
4.	Low bargaining/ negotiation power	4.40	0.94	6.65	0.001*
5.	Shortage of supply	3.85	1.46	2.45	0.001*
6.	Storage problem	4.05	1.27	3.67	0.001*
7.	Lack of demand	3.30	1.34	2.33	0.001*
8.	Perishability/ Prone to post harvest losses	3.75	1.44	2.77	0.001*
9.	High brokerage fee	4.55	0.51	13.58	0.001*
10.	Problem of rural road access	4.10	1.16	4.22	0.001*
11.	Inadequate market information	4.30	0.92	6.29	0.001*
12.	Lack of effective branding	4.15	1.19	3.87	0.001*
13.	High competition with unlicensed traders	4.56	0.52	14.02	0.001*
14.	Quality problem	4.15	0.87	5.87	0.001*
15.	Absence of effective government policy	4.30	0.73	7.93	0.001*
16.	High transportation cost	4.40	0.94	6.65	0.001*
17.	Lack of proper infrastructure of market	4.15	1.03	4.94	0.001*
18.	High commission rate	4.00	1.25	3.55	0.001*

*Significant at a 5% level of significance ($p<0.05$)

weak market linkages were identified as key contributors to operational inefficiencies and increased transaction risk (Chand et al., 2021; Kilelu et al., 2024). Price volatility, dependence on local labour, and the prevalence of informal transactions were also identified as major obstacles that heightened uncertainty and reduced profitability. Recent value chain analyses further emphasized that fragmented infrastructure, limited grading and packaging, and poor post-harvest logistics significantly increased economic

Table 4: Perception of problems faced by retailers of kinnow in Punjab

Sl. No.	Statements	Mean	S.D.	t- value $H_0=3$	p-value
1.	Lack of availability of credit	3.90	1.41	2.31	0.001*
2.	Problem of theft	4.25	0.91	6.14	0.001*
3.	Problem of price setting	4.25	1.06	5.22	0.001*
4.	Problem of scaling weighting	4.35	0.93	6.46	0.001*
5.	Shortage of supply	4.30	0.92	6.29	0.001*
6.	Storage problem	4.42	0.94	6.65	0.001*
7.	Lack of demand	3.80	1.60	3.55	0.001*
8.	Limited access to bulk buyers	4.20	0.89	6.00	0.001*
9.	High brokerage fee	4.15	1.18	4.35	0.001*
10.	Problem of rural road access	3.75	1.44	2.77	0.001*
11.	Inadequate market information	4.20	1.05	5.08	0.001*
12.	High competition with other retailers	4.25	0.91	6.14	0.001*
13.	Quality problem	4.40	0.75	8.30	0.001*
14.	Absence of effective Government Policies	4.20	0.89	6.00	0.001*
15.	High transportation cost	4.25	0.71	7.80	0.001*
16.	Lack of proper infrastructure of market	4.20	1.19	4.48	0.001*
17.	High commission rate	4.10	1.02	4.81	0.001*

*Significant at a 5% level of significance ($p<0.05$)

risk exposure for intermediaries handling perishable crops (Guleria et al., 2022; Anand, 2024). These constraints underscored the need for improved market infrastructure, capacity building, and stronger coordination across the value chain to enhance efficiency and reduce risk for pre-harvest contractors.

3.1. Wholesalers

Wholesalers primarily reported problems related to perishability and post-harvest losses, particularly when fruits were not moved swiftly through the value chain or when adequate packaging and cold storage facilities were lacking.

Given the large volumes handled, even a small proportion of loss translates into substantial financial implications. High spoilage costs, inadequate storage infrastructure, and delays in payments from retailers and commission agents further constrained their operations. Similar challenges have been documented in recent studies on fruit and vegetable supply chains in India, which emphasize the role of weak cold chain integration and inefficient logistics in increasing post-harvest losses at the wholesale level (Chand et al., 2021; Kilelu et al., 2024). Evidence from citrus value chain studies also indicates that payment delays and lack of quality-linked pricing discourage wholesalers from investing in grading, packaging, and value addition (Guleria et al., 2022; Mazhar et al., 2023). Collectively, these constraints adversely affected market efficiency and limited incentives for quality enhancement and value addition within the Kinnow marketing system.

3.2. Local traders

Unregulated competition from unlicensed or informal traders operating within mandis without required registration or regulatory compliance increasingly affected local traders in Punjab. Such practices compromised the integrity of market operations, distorted price signals, and created unfair competition. The predominance of informal marketing networks further constrained legitimate traders' ability to maintain stable supply chains and negotiate reasonable prices. Similar findings were reported in studies on agricultural market regulation in India, highlighting how informal trade weakened price transparency and undermined the functioning of regulated markets (Chand et al., 2021; Kilelu et al., 2024). Evidence also indicated that the presence of unregistered intermediaries reduced market efficiency and discouraged compliance with quality standards and formal contracting (Saha and Ghosh, 2024; Guleria et al., 2022). Collectively, these issues limited the operational viability of local traders, reduced overall marketing efficiency, and impeded the profitability and sustainability of Punjab's Kinnow value chain.

3.3. Retailers

The last link in the value chain, retailers, reported that their most significant constraint was the lack of suitable storage facilities. Many small retail units did not possess organised storage spaces or refrigerated infrastructure, which led to spoilage and quality deterioration, particularly during the warmer months. Their operational vulnerability was further exacerbated by fluctuating consumer demand, inconsistent fruit quality, and limited access to formal procurement channels. Retailers also indicated that inadequate sorting and grading facilities, along with irregular supply, made it difficult to maintain uniform quality standards. Similar challenges faced by fruit retailers have been documented

in recent studies, which highlight inadequate cold storage, weak backward linkages, and demand uncertainty as major constraints affecting retail-level efficiency and profitability in horticultural value chains (Chand et al., 2021; Kilelu et al., 2024; Guleria et al., 2022). Evidence from recent retail-focused assessments further suggests that limited infrastructure discourages quality-based pricing and increases post-harvest losses at the consumer end of the chain (Mohan et al., 2023).

Overall, the findings indicated that constraints across actor categories had been deeply interlinked inefficiencies faced by upstream actors, such as PHCs and wholesalers, had cascaded down to traders and retailers, cumulatively reducing value realization across the entire chain.

4. CONCLUSION

In Punjab, operational and structural issues had affected all actors in the Kinnow value chain. Market inefficiencies, weak institutional support, fragmented coordination, and poor infrastructure had reduced value realisation and competitiveness. Multiple intermediaries and limited coordination had further lowered marketing margins and efficiency. Addressing these bottlenecks required strategies focusing on capacity building, value chain integration, improved infrastructure, transparent pricing, farmer collectivisation, and stronger institutional support, which enhanced efficiency and ensured fair value distribution among all stakeholders.

5. SCOPE FOR FURTHER RESEARCH

The findings of this study highlight several operational and structural inefficiencies within the Kinnow value chain in Punjab. To address these challenges, a coordinated effort among policymakers, research institutions, and value chain actors is required. Strengthening institutional linkages through the formation of Farmer-Producer Organizations (FPOs), investment in cold chain infrastructure, and promotion of digital trading platforms such as e-NAM can enhance transparency and efficiency in the marketing system.

Future research should focus on quantitative assessment of marketing efficiency across alternative channels, examining how digital and cooperative marketing systems affect price realization and farmer income. There is also scope to explore the potential of value addition through processing, branding, and export diversification, particularly in light of changing consumer preferences and global demand for citrus fruits.

Further studies may assess the impact of climate variability, post-harvest technologies, and institutional interventions on the sustainability of Kinnow production and marketing. Longitudinal and comparative studies involving other

citrus-growing states could provide deeper insights into best practices and replicable models for Punjab's Kinnow sector.

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