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An explanatory study on the prospectus and constraints faced by fruit processing industries in Punjab

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Abstract

The food processing sector has emerged as a high-growth area in terms of value-added products in India. The present study was conducted with the objectives of studying the capacity utilization, various sources of procurement of raw materials, the existing pattern of disposal of processed fruit products, identifying major constraints facing fruit processing units in Punjab, and suggesting appropriate policy measures to overcome these constraints. The study has been based on personal interviews with 60 sample farmers and 6 fruit processing units in Hoshiarpur, Fazilka and Ludhiana districts of Punjab. Descriptive tools, marketed surplus analysis and five-point Likert scale-based Mean Relevancy Score have been used for analysis of data collected from respondents. The results of the study indicate that there is a concentration of fruit processing units in Ludhiana, the industrial hub of the State, whereas major fruit producing areas of Hoshiarpur and Fazilka have been left out. The installed processing capacity of fruit processing units in the State is being utilized to the extent of only 10.47 percent on average. The utilization is decreasing as the size of the unit is increasing. Local and distant markets are supplying raw materials to fruit processing units. However, only about 16 percent raw material is being procured directly from farmers. The major constraints identified in the study were poor and inadequate supply of fruits, weak market demand for processed products, lack of cold chain, and inefficient utilization of processing waste. The study suggested technological up gradation and suitable policy intervention is necessary to remove these specific constraints to strengthen fruit processing sector and to bring about agricultural diversification in Punjab.

Keywords: Markets, fruits, processing, capacity, utilization, procurement, constraints

1. Introduction

In India, the food sector has become a highly profitable sector because of its vast scope for value addition, particularly in the food processing industry. There are enormous efforts by the Government of India under the Ministry of Food Processing Industries (MoFPI) to enhance investment in this particular sector every year. India stand sixth largest food and grocery market in the global ranking, as its retail segment accounts for 70 percent of total sales (Shaw and Jha, 2025) ^[17]. The Food processing sector contributes 32 percent of India's food industry and makes the country stand fifth globally in production, consumption, and exports (USDA, 2025; IBEF, 2025) ^[18, 8]. Within the country, the food-processing sector shares 8.39 percent of agricultural gross value added (GVA) and 8.80 percent of manufacturing GVA. As per the Ministry of Food Processing Industries report 2024, the food processing sector contributes nearly 13 percent of exports and 6 percent of industrial investment. Although India has abundant raw materials and a large domestic market, it imports only 1.7 percent of all processed food from abroad (MoFPI, 2024) ^[12]. Recent estimates indicate continued underutilization of horticultural production processing in India, as only around 4.5 percent of fruit and 2.7 percent of vegetables of total production in the country are processed (USDA-FAS, 2026) ^[19]. This level of processing is much lower than in most of the other major markets, including Malaysia (83%), the Philippines (78%), the U.S. (65%), and China (23%) (FAO, 2024) ^[4]. This demonstrates that India has a lot to add value, reduce post-harvest losses, and be competitive in global processed food markets. The poor processing of horticultural crops is alarming, as India has a large and growing production base. The country's horticulture production is estimated at approximately 370.74 million tonnes in

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2024–25 and a record 377.78 million tonnes in 2025–26 (NHB, 2026) ^[14]. The severe dissimilarity between high production and low processing suggests that investments are required in cold chain storage and transportation, and the creation and utilization of processing infrastructure in the country.

Fruits and vegetables, often called protective foods for their high nutritional value, undergo several post-harvest operations after production, resulting in losses of about 6.02 to 15.05 percent for fruits and from 4.87 to 11.61 percent for vegetables (Jha *et al.*, 2015) ^[9]. The study further estimated annual quantitative losses of approximately 7.36 million tonnes of fruits and 11.97 million tonnes of vegetables (NABCONS, 2022) ^[13], while per-capita fruit availability remains below the recommended 150 grams per day (ICMR, 2024) ^[7]. Processing helps check this spoilage and enhances the shelf life and utility of fruits, besides creating employment and foreign-exchange opportunities that can drive rural economic growth. Fruit cultivation has gained considerable momentum in Punjab, where about 103,287 hectares are now under fruit crops (GOP, 2024) ^[5]; yet the processing industry continues to suffer from fluctuating market prices, variable quality, uncertain raw-material availability, high energy costs, underutilised capacity, and irrational location choices that neglect the state's major fruit-producing districts. Against this backdrop, the present study was undertaken to examine the prospects and constraints of the fruit processing sector in Punjab.

2. Research Methodology

A multistage random sampling design was used to select the farmers. In the first stage, Hoshiarpur and Fazilka districts were selected on the basis of the highest area under fruits in the state. From each district, one block with the highest fruit area - Bhunga (Hoshiarpur) and Abohar (Fazilka) - was chosen, and two villages were selected from each block. All fruit-growing farmers in each village were listed along with their area under fruits, and fifteen farmers were drawn from each village. Applying the cumulative cube-root frequency method, farmers were grouped into small (up to 4.14 acres), medium (4.14–7.47 acres) and large (above 7.47 acres) categories, yielding a final sample of 60 farmers (n = 60). A list of licensed fruit processing units in the production centres

(Hoshiarpur and Fazilka) and the consumption centre (Ludhiana) was obtained from the respective District Industries Centres and classified by investment into micro (up to Rs 25 lakh), small (Rs 25 lakh–5 crore) and medium (above Rs 5 crore) categories; six processing units were selected across the three districts for detailed study. Data on socio-economic profile, marketed surplus, total production, and total home consumption were collected from farmers, while data on capacity utilisation, sourcing of raw material, procurement and disposal of products were collected from the processing units through a personal interview schedule.

2.1 Marketed Surplus

The marketed surplus is the quantity made available by farmers for the non-farming community after meeting all their own requirements (home consumption, gifts to neighbours, and other disposals):

Marketed surplus = Total production - Total requirements

2.2 Mean Relevancy Score (MRS)

To assess the constraints faced by processing units, a structured interview schedule was developed using a five-point Likert scale ranging from 1 (No Problem) to 5 (Very Severe Problem). The Mean Relevancy Score for each statement was computed as:

$$MRS = \frac{(VSP \times 5 + SP \times 4 + MP \times 3 + LP \times 2 + NP \times 1)}{n}$$

Where: VSP, SP, MP, LP and NP denote the number of respondents rating a statement as a Very Severe, Severe, Moderate, Low or No problem respectively, and n is the total number of respondents. MRS values range from 1 to 5, a higher score indicating a more severe constraint.

3. Results and Discussion

3.1 Socio-economic Profile of Respondent Farmers

The socio-economic characteristics of the sample fruit growers are presented in Table 1.

Table 1: Distribution of sample farmers w.r.t. age, education level, family size and occupation

S. No.	Characteristics	Category	Frequency	Percentage
1.	Age (years)	Young (25–40)	19	31.67
		Middle (41–55)	27	45
		Old (>55)	14	23.33
2.	Education level	Illiterate	1	1.67
		Primary	2	3.33
		Middle	2	3.33
		Matric	15	25
		Higher Secondary	16	26.67
		Graduate	19	31.67
		Post graduate	5	8.33
3.	Family size (No.)	Up to 5	40	66.67
		More than 5	20	33.33
4.	Occupation	Farming only	52	86.67
		Farming + other occupation	8	13.33

The age of the farmers ranged from 25 to 55 years, with the largest share (45%) in the middle age group of 41–55 years. Education levels varied from illiterate to post-graduate, with graduates forming the single largest group (31.67%), followed by those with higher secondary (26.67%) and matric-level (25%) education. About two-thirds of the farmers (66.67%) had a family size of up to five members, and the vast majority (86.67%) depended on

farming alone as their principal occupation, with the rest combining farming with a secondary occupation such as government service, teaching or driving.

3.2 Marketed Surplus

The marketed surplus of kinnow and malta across farm-size categories is presented in Table 2. Marketed surplus for both

crops increased with farm size in absolute terms, but as a proportion of production it remained uniformly high (over 95%) across all categories, reflecting the predominantly commercial, low-home-consumption nature of fruit cultivation in the sample

area. On average, farmers marketed 98.20 per cent of kinnow and 96.06 per cent of malta production, retaining only a small share for home consumption and gifts.

Table 2: Marketed surplus of kinnow and malta on different category of sample farmers (Qtl/ farm)

S. No.	Farm size classification	Kinnow			Malta		
		Production	Home consumption	Marketed surplus	Production	Home consumption	Marketed surplus
1.	Small	273.00 (100)	7.52 (2.75)	265.49 (97.25)	62.11 (100)	2.65 (4.26)	59.45 (95.74)
2.	Medium	615.45 (100)	12.75 (2.07)	602.71 (97.93)	103.25 (100)	3.77 (3.63)	99.49 (96.37)
3.	Large	1422.40 (100)	21.28 (1.50)	1401.13 (98.50)	178.60 (100)	7.12 (3.51)	171.48 (96.49)
	Average	770.28 (100)	13.85 (1.80)	756.44 (98.20)	114.65 (100)	4.51 (3.94)	110.14 (96.06)

Note: Figures in parentheses are percentage of total production.

Home consumption includes at home, given free as gifts and other consumption.

3.3 Processing Capacity and its Utilisation

A total of 170 processing units were located across the three sample districts, of which the majority (85.88%) were micro-scale, followed by small (9.42%) and medium (4.70%) units. Although Hoshiarpur and Fazilka together account for 78 per cent of the state's fruit production, they hosted barely one-third (33.53%) of the total processing units, while Ludhiana - the state's

major industrial and consumption centre - accounted for 66.47 per cent. Table 3 presents the average processing capacity and its utilisation across the three size groups. Capacity utilisation was found to be inversely related to unit size: while micro units utilised 37.28 per cent of their (comparatively small) installed capacity, small units utilised only 19.67 per cent and medium units a mere 7.07 per cent, despite handling much larger volumes.

Table 3: Processing capacity and its utilization by various size group of processing units (Qtl. /unit)

Scale of unit	Fruits	Processing capacity	Utilization of fruits	% of processing capacity utilized
Micro scale	Kinnow	1902.30	670.45	35.24
	Guava	518.30	208.90	40.30
	Mango	673.60	364.48	54.10
	Apple	334.30	87.80	26.30
	Orange and malta	692	204.65	29.25
	Sub- total	4120.50	1536.28	37.28
Small scale	Kinnow	13210	1539.50	11.65
	Guava	2210	772.30	34.94
	Mango	2592	765.20	29.52
	Apple	1929.50	440.36	22.82
	Orange and malta	4345	1262.20	29.05
	Sub- total	24286.50	4779.56	19.67
Medium scale	Kinnow	54000	2086.50	3.86
	Guava	9000	1320	14.66
	Mango	10800	1325.60	12.27
	Apple	3600	448	12.44
	Amla	18000	1500.10	8.34
	Jamun	1170	110.66	9.8
	Watermelon	871.50	102.50	11.76
	Sub- total	97441.50	6893.42	7.07
Overall average		41949.50	4403.09	10.47

Overall capacity utilisation across the sample stood at only 10.47 per cent. Utilisation was lowest for kinnow in medium units (3.86%) and highest for mango in micro units (54.10%). Underutilisation of this magnitude reflects the location of units away from producing areas, the seasonal and perishable nature of fruits, poor processing-quality fruit availability, and underdeveloped infrastructure (Bhattacharyya, 2013) ^[2] - factors that force firms to source specific varieties from distant markets rather than operate at full scale year-round.

3.4 Sources of Procurement of Raw Material

Processing units sourced fresh fruit from three channels - directly from farmers, local (within-state) markets and distant (out-of-state) markets, generally through commission agents for the latter (Table 4). On average, a processing unit procured 4,407.68

quintals of fruit annually, of which 47.66 per cent came from markets within the state, 35.99 per cent from markets outside the state, and only 16.35 per cent directly from farmers. Direct farmer procurement was highest for micro units (24.54%) and lowest for small units (13.33%). Kinnow, being the dominant fruit crop of the state, was sourced entirely from within Punjab, whereas apple - not grown in the state - and a large share of guava, mango and amla had to be arranged from distant markets such as Delhi, Jaipur, Saharanpur, Sirsa, Ahmedabad, and Jammu & Kashmir/Himachal Pradesh. Medium units, which produce a wider range of jam, juice, pulp and concentrate, procured the largest overall quantity, consistent with their greater storage capacity, technical knowledge and financial strength (Singh, 1992) ^[16].

Table 4: Quantity of raw material (fresh fruits) procured from different sources by various size categories of sample processing units (Qtl. /unit)

Scale of unit	Fruits	Source of procurement and quantity procured			
		Farmer	Market within state	Market from other state	Total
Micro scale	Kinnow	244.65 (36.46)	425.80 (63.54)	-	670.45 (100)
	Guava	29.35 (14.05)	114.78 (54.94)	64.77 (31.01)	208.90 (100)
	Mango	70.60 (19.37)	175.38 (48.12)	118.50 (32.51)	364.48 (100)
	Apple	-	87.80 (100)	-	87.80 (100)
	Orange and malta	32.35 (15.81)	74.15 (36.23)	98.15 (48)	204.65 (100)
Total		376.95 (24.54)	877.91 (57.15)	281.42 (18.30)	1536.28 (100)
Small scale	Kinnow	323.60 (21.02)	1215.90 (78.98)	-	1539.50 (100)
	Guava	60.35 (7.81)	260.40 (33.72)	451.55 (58.47)	772.30 (100)
	Mango	75.40 (9.85)	222.45 (29.07)	467.35 (61.08)	765.20 (100)
	Apple	-	157.08 (35.51)	285.28 (64.49)	442.36 (100)
	Orange and malta	178.70 (14.12)	327.25 (25.85)	759.80 (60.03)	1265.75 (100)
Total		638.05 (13.33)	2183.08 (45.62)	1963.98 (41.04)	4785.11 (100)
Medium scale	Kinnow	640 (30.84)	1435 (69.16)	-	2075 (100)
	Guava	239 (18.18)	460 (34.99)	615.50 (46.82)	1314.50 (100)
	Mango	-	515 (38.79)	812.50 (61.21)	1327.50 (100)
	Apple	-	188 (41.96)	260 (58.04)	448 (100)
	Amla	268.70 (17.68)	425.80 (28.01)	825.50 (54.31)	1520 (100)
	Jamun	-	114.66 (100)	-	114.66 (100)
	Watermelon	-	102.50 (100)	-	102.50 (100)
Total		1147.70 (17.17)	3240.96 (45.23)	2513.50 (37.60)	6902.16 (100)
Average		720.73 (16.35)	2100.65 (47.66)	1586.30 (35.99)	4407.68 (100)

Note: Figures in parentheses are percentage of total quantity

3.5 Production and Disposal of Fruit Products

The quantity of fruit products produced and their market destination is presented in Table 5. Micro units produced comparatively small volumes with a magnitude of 324.35 tonnes per unit and disposed of most of it (69.77%) within Punjab. Small and medium units, by contrast, produced far larger volumes (943.19 and 1,284.30 tonnes/unit respectively) and sold 64.94 and

82.34 per cent of their output respectively in markets outside the state. Overall, an average unit produced 850.61 tonnes of fruit products annually, nearly 69 per cent of which was disposed of outside Punjab. This pattern reflects the better resource base and product diversification of small and medium units, which cater primarily to national markets, whereas micro units remain largely confined to local/state markets.

Table 5: Quantity of fruit products produced by processing units and its disposal (Tons/unit)

Scale of unit	Quantity produced	Market/ Destination within state	Market/ Destination out of state
Micro	324.35 (100)	226.30 (69.77)	98.05 (30.23)
Small	943.19 (100)	330.68 (35.06)	612.51 (64.94)
Medium	1284.30 (100)	226.81 (17.66)	1057.49 (82.34)
Average	850.61 (100)	261.26 (30.71)	572.89 (69.29)

Note: Figures in parentheses are percentage of total quantity produced

3.6 Constraints faced by processing units

The constraints reported by the sample processing units, along with their mean relevancy scores and ranks, are summarised in Table 6. Among raw-material and production-related problems, quality deficiencies in fruits available in the market emerged as the most severe constraint (MRS 4.50, Rank I), stated by all sample units, since taste, odour and product presentation depend directly on raw-material quality (Mehta, 2014) ^[11]. This was followed by the seasonal and inadequate supply of fresh fruit (MRS 4.33, Rank II), which forces micro and small units to limit themselves to a few products and leaves capacity underutilised (Bhattacharyya, 2013; Choudhary, 2019) ^[2, 3]; high marketing costs arising from an inefficient market system (MRS 4.17, Rank III), also reported by Reddy (2010) ^[15]; and inadequate cold-storage facilities (MRS 3.83, Rank IV), which force micro and small units to buy at high prices during lean-season arrivals.

Among constraints related to the marketing of processed products, weak consumer demand - particularly in rural areas, where high price, limited taste development and low awareness restrict uptake - was rated the single most severe problem overall (MRS 4.83), followed closely by the lack of cold-chain infrastructure for delivering perishable processed foods (MRS 4.67), which Kumar (2006) ^[10] and Choudhary (2019) ^[3] also identify as a major bottleneck for the high-value processing sector. High cost of packing material and poor utilisation of processing waste were both rated the most severe among the remaining product-marketing constraints (MRS 4.50 each), followed by paucity of funds/credit (MRS 4.17), inability to meet strict international quality standards for exports (Bhagyalaxmi, 2005) ^[1] and inadequate availability of skilled manpower trained in modern production and marketing techniques (MRS 3.83 each).

Table 6: Constraints faced by the fruit processing industries in Punjab

Problem	Low	Moderate	Severe	Very severe	Mean score	Rank
Fresh raw material and production related problems						
Seasonal and inadequate supply of fresh fruit	-	16.67	33.33	50.00	4.33	II
Quality problems of fruits	-	-	50.00	50.00	4.50	I
Lack of storage facilities	-	33.33	16.67	50.00	3.83	IV
High marketing costs	-	-	83.33	16.67	4.17	III
Marketing of fruit products related problems						
High cost of packing material	16.67	-	50.00	50.00	4.50	IV
Inadequate supply of skilled manpower	-	33.33	16.67	50.00	3.83	V
Paucity of funds	16.67	-	83.33	16.67	4.17	III
Lack of utilisation of waste	-	-	50.00	50.00	4.50	III
Strict quality standards for exports	-	16.67	83.33	-	3.83	VI
Lack of demand for processed product	-	-	16.67	83.33	4.83	I
Lack of cold chain for delivery	-	-	33.33	66.67	4.67	II

Note: '-' indicates zero observations for that response category. Ranks are assigned separately within each problem group.

4. Conclusion

The study finds that, despite an increase in the area under fruit cultivation in Punjab, the fruit processing sector is located irrationally, facing technological, financial, and economic constraints and underutilized in its capacity utilization. Processing units are situated in the industrial hub of Ludhiana and not in the major producing districts of Hoshiarpur and Fazilka. Installed processing capacity is used only to about one-tenth on average, with utilization decreasing as unit size increases. The raw material is procured mainly from within-state and distant markets and not directly from farmers. The poor quality, seasonality, and inadequate supply of fresh fruits were the major constraints faced by the processing units. On the marketing front, lack of demand for processed food products, lack of cold chain availability, and paucity of funds with industries were the major obstacles for fruit processing in the state. The study suggested that stronger links can be developed through contract farming and farmer producer organizations. There is an urge to develop cold storage infrastructure and transportation facilities to ensure consistent supply of raw material to the processing industries. In addition, better access to finance, skill training, plant varietal development that assists processing, and waste utilization technologies can enhance farmers' income, create more rural employment, and promote agricultural diversification in the state.

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