RESEARCH ARTICLE

An economic analysis of production and marketing of cashew nuts in Kallakurichi district

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Abstract

India is the second-largest producer of cashew nuts in the world and Tamil Nadu is one of the major producers and exporters of cashew nuts in India. Kallakurichi is one of the districts in Tamil Nadu, where cashew is being cultivated and processed. This study focuses on the production and marketing of cashews in the Kallakurichi district, where no studies have been conducted. For this study, 30 farmers, 5 local traders, 5 processors, 5 wholesalers, 5 retailers and 5 consumers were interviewed. This study involves the estimation of economic aspects of raw cashew nut production by studying the cost and returns from the crop per unit of land. Percentage analysis was carried out to examine the cost that contributes more to the total cost and, therefore, to make suggestions to reduce the cost. Market study involved tracing the marketing channels of cashew nut in the district and estimating the marketing aspects, such as marketing cost, market margin, price spread and marketing costs were computed for each channel to ascertain the channel that involves the least cost in comparison with others. VRI 3 variety is extensively cultivated in the area. The study shows that the annual variable cost is ₹47105.5 per acre in the study area, while net returns over variable costs are ₹15830.58 per acre. Analysis of profitability showed that NPV, BCR and IRR are ₹3542.89, 1.07 and 12.80 % respectively. Sensitivity analysis revealed that cashew cultivation is highly sensitive to fluctuations in costs. There are five marketing channels for marketing raw cashew nuts. Among the channels, Channel III (Farmer-Processor-Consumer) involves minimum cost and maximum efficiency in comparison with other channels. Constraints in production and marketing were also studied. Among the variable costs, the cost of harvesting was higher, which was because harvesting was the most labour-intensive process. The major constraint in production was uncertain weather, which led to fluctuations in yield and price.

Introduction

Cashew Nut (*Anacardium occidentale*) is a significant cash crop in India with significant export potential. This Brazilian-origin crop was introduced to India during the 16th Century AD by Portuguese travellers in Western Goa (1). Its ability to grow in marginal lands made it spread to other states in India. The export of cashew nuts from India started during the 18th century AD. It can be grown in areas where the dry season is distinct and receives rainfall as low as 50 cm per annum. It can also be grown in areas as high as 350 cm annually, given the soil is well-drained (2). The demand for cashew nuts in international markets is mainly for cashew nut kernels and cashew nut shell liquid (CSNL). India is the second-largest producer of cashew nuts in the world, next to the Ivory Coast. Cashew production in India was about 794.91 thousand MT under an area of 1199.08 000 ha during the year 2023 - 2024 (3). India is one of the major exporting as well as importing countries in the world. The major export destinations of Indian cashew nut kernels are the UAE, the Netherlands, Japan, Spain and Saudi Arabia, whereas the major export destinations of cashew nut shell liquid are China, Vietnam, Mexico, Korea Republic and Japan (4). In India, the major producers of cashew nuts are Maharashtra, Andhra Pradesh, Odisha, Karnataka and Tamil Nadu. In Tamil Nadu, cashew is being cultivated in districts such as Ariyalur, Cuddalore, Pudukottai, Theni, Sivagangai, Villupuram and Thanjavur. In Tamil Nadu, production of cashew nuts is about 87.07 thousand MT under an area of 176.01 thousand ha and the price of cashew nut is in increasing trend in the state (Fig. 1) (5). Kallakurichi was bifurcated from Villupuram in the year 2019 and it is a district where cashew nut is being cultivated and forms the livelihood of farmers in the area. In this district, the production is about 454 MT under an area of 941 ha (5). Being close to Panruti, the district plays an important role in the production and marketing of the cashew nuts.
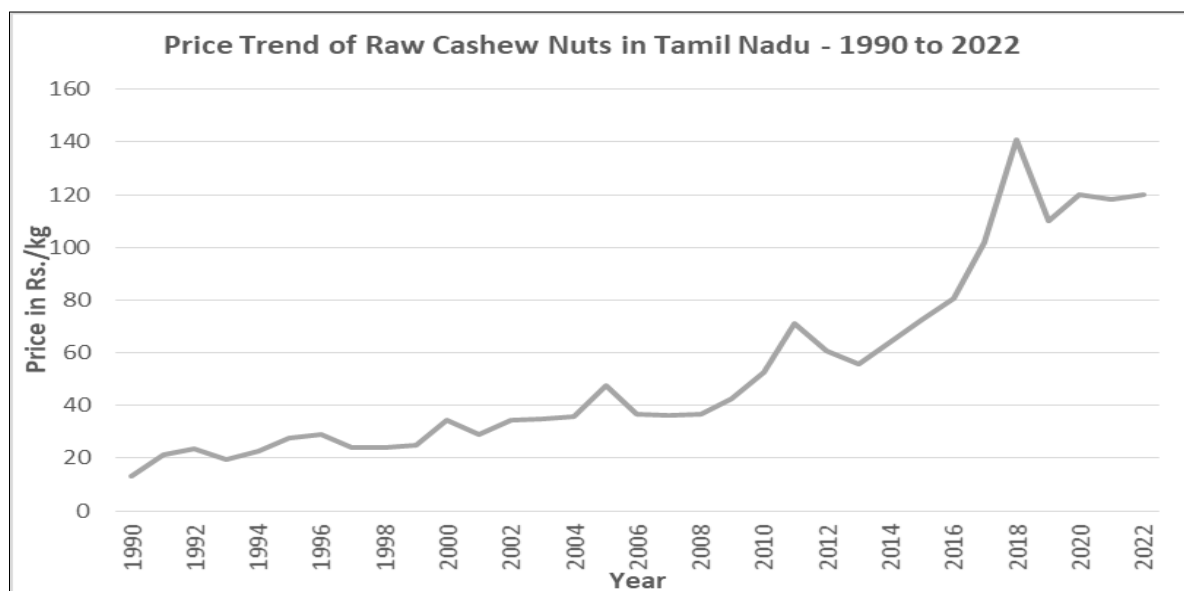
Fig. 1. Price trend of cashew nuts in Tamil Nadu during the period 1990-2022 (Prepared by the author based on secondary data from Directorate of Cashew Nut and Cocoa Development).

Marketing efficiency studies can reveal how effectively a marketing system performs in bringing agricultural products from producers to consumers, at the same time ensuring fair returns to farmers. The theoretical framework of marketing efficiency rests on two aspects, namely pricing efficiency and operational efficiency (6). Pricing efficiency refers to the ability of the marketing system to transmit accurate price signals and ensure price stability through fair competition and transparency. Operational efficiency is concerned with the physical movement and handling of produce with the aim of minimising wastage, reducing marketing costs and maximising value addition across the supply chain. In the context of marketing cashew nuts in Kallakurichi district, where marketing infrastructure is relatively underdeveloped, studying marketing efficiency can provide insights into how effectively various marketing channels function. Evaluating the distribution of consumer prices among different channels can reveal the profitability and fairness of each channel from the perspective of the producer. The higher the efficiency, the better the realisation of price by the farmers. Marketing studies may also underscore the inefficiencies in the channels and help address the constraints through policy interventions.

However, no previous studies delved into the production and marketing of this crop in Kallakurichi District. Therefore, this study aimed to examine the production and marketing scenario in this district. The study had the following objectives: to analyse the cost and return in raw cashew nut production within the study. Another objective is to trace marketing channels and to measure marketing cost, marketing margin and price spread among the channels and to study constraints in the production and marketing of cashew nuts in the study area.

Review of Literature

Cashew production forms the livelihood of its producers by contributing more to their income (7). Being confined to marginal lands and the recommended package of practices not being followed, the production of cashew nuts was low (8). Cashew plantation as an agroforestry enterprise was profitable even under rainfed conditions (9). The cost of cultivation of cashew nut was directly related to the size of the farm, based on

the study of socio-economic conditions of the farmers (10). Studying the production and marketing aspects of cashew nuts in the Ugwolawo District of Nigeria revealed that production of cashew nuts was moderate in the area due to non-utilisation of yield-improving technologies and lack of access to viable markets (11). A study regarding monoculture cultivar cashew revealed that they were preferred by the farmers despite heavy requirement of agrochemicals and susceptibility to pests and wildlife attack (12). Farmers who adopted perennial crops, such as cashew, gained more income than farmers who adopted annual crops in their field (13). A study on small-holder farmers in South India also revealed that cashew farming increased the farmers' income, improving their food security, education, social status and living standard (14).

Economic viability of the SRI system of paddy was analysed by assuming the data on cost and returns for a time frame of 30 years (15). Economic analysis of vegetable seed production showed that it was profitable. When cost increased and revenue decreased simultaneously, the enterprise was viable (16). The impact of mangroves in traditional shrimp farming in the Mahakam Delta of Indonesia was assessed with profitability measures, viz. NPV, IRR, BCR and PP and it indicated that polyculture ponds with mangroves would perform better than other pond systems (17). Profitability analysis of investment on drip irrigation in banana cultivation in South Gujarat region was done, calculating NPV, BCR and IRR, which showed that the technology was financially more feasible and economically more viable than a conventional irrigation system (18). Profitability analysis was done to evaluate the climate-smart agriculture in the Gandaki River Basin of Nepal and it helped suggest the most effective practices to the study area (19). Cost-benefit study and sensitivity analysis of irrigation systems in Kurdistan, Iraq, showed that the irrigation systems were sustainable and IRR was more sensitive to crop prices than to indirect benefits (20). Similarly, profitability and sensitivity analysis of the International Potato Centre-led seed system interventions in Malawi showed that the investment was viable but sensitive to adoption rates, yield, cost of production and research and extension costs (21). Similarly, a cashew plantation is also a long-term investment for which the same profitability analysis can be done.

Organic Cardamom, a perennial crop, was analysed economically in Sikkim with economic parameters and its marketing channels were identified. This showed that the longer the marketing channel, the higher the marketing cost and marketing margin (22). The presence of more intermediaries in the cashew supply chain makes a significant contribution to its price spread (23). The study of the marketing pattern of cashew nuts in Bastar District of Chhattisgarh showed that most of the cashew nuts were disposed of through itinerary traders, which was then followed by village merchants. This study also indicated that co-operative societies need to be formed to get remunerative prices for cashew nuts (24). There was an inverse relationship between marketing costs and marketing margins with marketing efficiency in the case of cashew nut in the South Goa District of Goa (25). Production of cashew nuts can be boosted by efficient use of resources and to enhance knowledge of farmers on fertilisers, manures and pest control, extension services need to be provided to farmers (26). Lack of a proper channel of marketing and price policy for cashew nuts was perceived as a problem by farmers in marketing cashew nuts (27). Price fluctuations were the major constraint in cashew nut marketing (28). More economic profitability had been realised by wholesalers and retailers in cashew nut marketing, in the case of North-Eastern Benin (29). Lack of knowledge of farmers on standards and grading should be addressed by continuous capacity building on quality cashew nut production and quality assessment to improve marketing, as per the study in the Bono Region of Ghana (21). Seasonal production of cashew nuts and lack of storage and processing facilities result in instability in price, affecting its marketing (30). In addressing the specific welfare needs of cashew growers, co-operative membership should be promoted for collective action (31). Lack of infrastructure, connectivity and institutions in rural areas remained barriers in gaining knowledge on modern farming technologies (32). The cashew nut market in India, which is dominated by a few traders, should be set right by introducing farmer collectives like FPOs (33). If not coupled with adequate support and complementary resources, any innovation like climate information services would lead to reduction in yield and so affecting farm income and food security of cashew farmers, as indicated by a study in Ghana (34). As cashew nut production is primarily determined by area expansion, investment in research and genetic improvement of the crop remains important intervention (33). Analysis of value chain of small holder ginger underscored that accessing new markets an organizing co-operatives could develop the value chain sustainably (35). Analysing the economics of rice marketing in Adamawa State of Nigeria also suggested that agricultural training workshops should be provided to producers and marketers regarding storage and distribution (36).

The past studies provide useful insights into cashew production and marketing. Cashew nut, owing to its tendency to grow on marginal lands, increases the farmers' income considerably. However, its profitability varies widely with the socio-economic conditions prevailing in the region. Marketing of cashew nuts is a challenging aspect, as the price keeps on fluctuating with demand and depends greatly on intermediaries. By reviewing the literature as a base, this study was aimed at analysing the production and marketing of cashew nuts in the study area and it tried to suggest policies similar to the past studies, by analysing the current scenario.

Materials and Methods

Data and data sources

To conduct the study, primary data were collected from cashew nut farmers from Thoppaiyankulam village of Thirunavalur Block, Kallakurichi District. A simple random sampling method was used in this study. Semi-structured interview schedule was used to collect data engaging the samples in personal interviews. Data on costs involved in and returns from cashew nut cultivation for the year 2024 were collected from 30 farmers in the study area. Data on marketing aspects were collected from five local traders, fifteen processors, five wholesalers, five retailers and five consumers.

Costs and returns

The Cost of and returns from cashew nut cultivation were calculated by estimating net returns over variable costs.

Net returns over variable cost = Gross returns – Total variable cost   (Eqn. 1)

Profitability analysis

Profitability of cashew plantation in the study area was evaluated by estimating net present value, benefit-cost ratio and internal rate of return by the following relations.

$$Net\ Present\ Value = \sum_{t=1}^{n} \frac{R_t - C_t}{(1+r)^t}$$

(Eqn. 2)

Where,

R_t - Returns from the investment at time t

C_t - Cost at time t

r - Discount rate

$$Benefit - Cost\ Ratio = \frac{\sum_{t=1}^{n} \frac{R_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}$$

(Eqn. 3)

Where,

R_t - Returns from the investment at time t

C_t - Cost at time t

r - Discount rate

$Internal\ Rate\ of\ Return$

$$= LDR + \left[\frac{NPV\ at\ LDR}{(NPV\ at\ LDR - NPV\ at\ HDR)} (Difference\ between\ HDR\ and\ LDR) \right]$$

(Eqn. 4)

Where,

LDR - Lower discount rate

HDR - Higher discount rate

NPV - Net present value

Percentage analysis

Percentage analysis was carried out in estimating the contribution of various cost components and in studying the constraints faced by the farmers.

Marketing cost

Marketing cost was estimated by the following relation

Marketing Cost = $C_f + C_{m1} + C_{m2} + \ldots + C_{mi}$ (Eqn. 5)

C_f - Cost paid by the producer/farmer

C_{mi} - Cost paid by i^{th} middleman in the market

Market margin

Market Margin was calculated by the formula.

Market Margin = Selling Price - (Purchase price + Total marketing cost)   (Eqn. 6)

Marketing efficiency

For studying the marketing aspects in the study area, data on costs involved in marketing per unit kg of raw cashew nuts were collected. As the available data were on costs and prices, marketing efficiency was estimated by calculating Modified marketing efficiency (6).

$$MME = \frac{FP}{MC + MM}$$ (Eqn. 7)

Where,

MME - Modified Marketing Efficiency

FP - Net price received by the producer

MC - Total Marketing Cost

MM - Total Marketing Margin

Results and Discussion

Socio-economic conditions of sample farmers

Among the sample farmers, most were male. Most of the farmers were educated to a secondary level. Most of the farm holdings were of small size and most of the farm families were of size 2-4 members (Table 1).

Varietal spread

Data collected from the farmers regarding the cost of cultivation showed that the varieties being cultivated in the study area are traditional varieties, VRI 2, VRI 3 and VRI 4. Among the farmers, 54 % of the farmers are cultivating VRI 3 and 40 % of the farmers are cultivating traditional varieties. VRI 2 and VRI 4 are being cultivated by 3 % of the farmers each.

Table 1. Socio-economic conditions of sample farmers in the study area

Particulars	Percentage
Gender	
Male	93.33
Female	6.66
Education	
Primary	10
Secondary	63.33
Higher Secondary	3.33
Graduate	23.33
Family Size	
2 – 4 members	73.33
5 – 7 members	26.67
8 and above	0
Size of Land Holding	
Marginal	36.67
Medium	53.33
Semi-medium	6.67
Large	3.33

Source: Prepared by the author based on the primary data

Annual variable costs and returns for the year 2024

Variable cost components that contribute to the cost of cultivation were estimated. Among the variable cost components, manures and fertilisers contribute about 25 % of the total cost, while it is 18 %, 7 %, 16 % and 34 %, respectively, for intercultural operations, irrigation, plant protection and harvesting (Fig. 2). This indicates that the harvesting operation costs the most among the variable costs.

The annual variable cost of cashew cultivation for the year 2024 in the study area was ₹47107.5 (Table 2). The average yield of raw cashew nuts in the study area was 5.4 bags (1 bag = 80 kg), which is equal to 432 kg. The average price per kg of output was ₹145.69. The net return over variable cost per acre was ₹15830.58 in the study area (Table 3).

Profitability and sensitivity analysis of cashew plantations in the study area

To evaluate the profitability of cashew plantations in the study area, net present value (NPV), benefit-cost ratio (BCR) and internal rate of return (IRR) were calculated. To calculate these measures, data on cost and returns for 15 years were calculated

Table 2. Annual variable costs per acre in raw cashew nut production during the year 2024

| S.No	Particulars	No of units	Unit price	Total
I.	**Manures and fertilizers**			
	FYM (in tonnes)	4	1500	6000
	Application cost (man days)	4	400	1600
	Urea (kg)	180	6.67	1200
	DAP (kg)	75	12.5	937.5
	Complex (kg)	50	12.5	625
	MOP (kg)	25	25	625
	Application cost (man days)	2	400	800
II.	**Intercultural operations**			
	Ploughing (machine hours)	3.5	1200	4200
	Weeding (man days)	8	300	2400
	Trimming (man days)	4	450	1800
III.	**Irrigation charges**			
	Hours of irrigation	12	200	2400
	Labour (man days)	2	400	800
IV.	**Plant Protection**			
	Cost of Chemicals		2400	2400
	Cost of Spraying		5400	5400
V.	**Harvesting**			
	Labour (man days)	40	398	15920
	Total annual variable cost			47107.5

Source: Prepared by the author based on the primary data

Table 3. Net returns over variable cost per acre during the year 2024

S.No	Particulars	Quantity (in kg/ ac)	Unit Price (in ₹/ kg)	Total (in ₹ / ac)
1	Yield (kg/ac)	432	145.69	62938.08
	Net Returns over Variable Cost			15830.58

Source: Prepared by the author based on the primary data
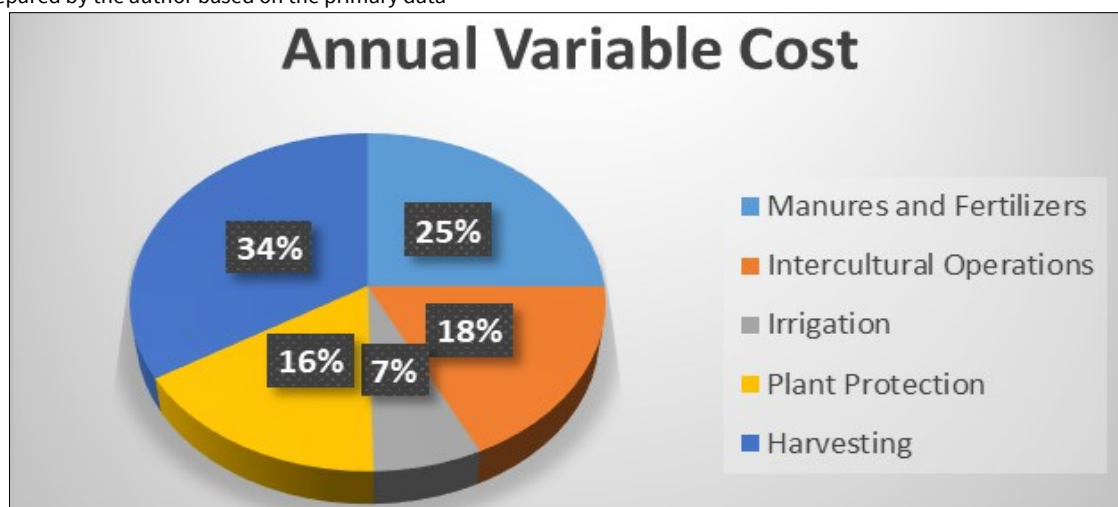
Fig. 2. Annual variable costs per acre in raw cashew nut production (Prepared by the author based on the primary data).

and discounting was done at 12 % and 18 %. It revealed that the NPV of cashew plantations in the study area was positive and was ₹3542.86 per acre. The benefit-cost ratio was found to be 1.07, which implies that for every rupee invested, the farmer gets ₹1.07 in return. The internal rate of return was also estimated to be 12.80 % (Table 4).

Sensitivity analysis was carried out by simultaneously varying costs, returns and discount rate by ±10 % to assess the effect of market fluctuations and financial conditions on the economic viability of cashew farming in the study area. In the base case, the project yielded a modest NPV of ₹3542.86, BCR of 1.07 and IRR of 12.80 % suggesting marginal feasibility. Under the +10 % scenario, where costs, returns and discount rate increased by 10 %, the investment turned unviable with negative NPV (₹3059.63) and IRR -12 %. Under the scenario -10 %, the investment became highly viable, with NPV rising to ₹10400.43 and IRR to 23.61 %, indicating that lower market costs and financial easing significantly improve profitability (Table 5).

Marketing channels identified in the study area

In the study area, five marketing channels were identified and are shown in Fig. 3. In Channel I, the farmer sells his produce to a processor; the processor processes the raw cashew nut and then sells cashew nut kernels to a wholesaler; from the wholesaler, the kernels are sold to a retailer and from the retailer, they reach the consumer. In Channel II, the farmer sells the raw cashew nuts to a local trader who assembles and sells them to processors; processors, in turn, sell the cashew nut kernels to wholesalers from whom they reach retailers and then consumers. In Channel III, farmers sell raw cashew nuts directly to processors and the processors, after processing, sell the cashew nut kernels directly to consumers. In Channel IV, farmers sell the raw cashew nuts to processors, from whom the processed kernels go to retailers and then consumers. In Channel V, farmers sell raw cashew nuts to processors; from processors, the cashew nut kernels are sold to wholesalers, which are in turn sold to consumers. A SWOT analysis of the marketing channels has been carried out, which is shown in Table 6.

Marketing cost, market margin, marketing efficiency, price spread and the producers' share in the consumer price for the identified channels

For the identified markets in the study area, marketing cost, market margin, marketing efficiency and the producer's share in the consumer price were estimated per unit of raw cashew nut, along with the finished product obtained by processing per unit which is depicted in Table 7. Among the channels, Channel II had the highest marketing cost while Channel III had the lowest cost. While estimating market margin, Channel IV had the highest, while Channel III had the lowest. Price spread was found to be the highest in Channel I and Channel IV, while it was the least in Channel III. Producer's share in consumer price was found to be the highest in Channel III, while it was the least in Channel I and Channel IV.

Constraints faced by farmers

Constraints faced in production

The constraints related to the production of cashew nuts faced by the farmers in the study area were listed in Table 8 and the percentage of farmers facing the constraints was estimated. The farmers in the study area have pests and diseases as the major problems, which caused significant loss in the quality and quantity of the cashew nuts. Major pests found in the study area were mealy bugs and apple and nut borer and the major disease was anthracnose, which explains the damage to the quantity and quality of nuts. Next to pest and disease problems, uncertain weather and uncertain yield remained the major problems. Erratic rainfall, particularly during flowering, affected the yield from cashew plantations. It was the major reason for the uncertain yield. Availability of labour, particularly during harvest, was a challenge in the study area. Factors such as pests and diseases, uncertain rainfall and dew deteriorated the nut quality. Cashew plantations require maintenance so as to keep weeds under control and to ease harvesting, which was again a labour-intensive process with heavy costs. Furthermore, cashew plantations yield after three or more years of planting, depending on the variety and so farmers perceived it as a

Table 4. Net Present Value, Benefit-Cost Ratio and Internal Rate of Returns of raw cashew production in the study area

Year	Establishment cost (in ₹)	Variable cost (in ₹)	Total cost (in ₹)	Total returns (in ₹)	Net returns (in ₹)	Discounted cost @ 12 %	Discounted returns @ 12 %	Discounted net returns @ 12 %	Discounted Cost @ 18 %	Discounted returns @ 18 %	Discounted net returns @ 18 %
1	16732.50	11000.00	27732.50	0.00	-27732.50	24761.16	0.00	-24761.16	23502.12	0	-23502.10
2	-	29387.50	29387.50	0.00	-29387.50	23427.54	0.00	-23427.54	21105.64	0	-21105.60
3	-	39147.50	39147.50	24886.35	-14261.20	27864.42	17713.61	-10150.80	23826.38	15146.60	-8679.78
4	-	43127.50	43127.50	47781.79	4654.29	27408.31	30366.19	2957.89	22244.68	24645.32	2400.63
5	-	43127.50	43127.50	51763.61	8636.11	24471.7	29372.06	4900.36	18851.43	22626.35	3774.92
6	-	47107.50	47107.50	53754.52	6647.00	23866.13	27233.71	3367.59	17450.10	19912.37	2462.26
7	-	47107.50	47107.50	59727.24	12619.74	21309.04	27017.57	5708.53	14788.22	18749.88	3961.65
8	-	47107.50	47107.50	64704.51	17597.01	19025.93	26133.07	7107.14	12532.39	17213.87	4681.48
9	-	47107.50	47107.50	64704.51	17597.01	16987.44	23333.09	6345.66	10620.67	14588.02	3967.35
10	-	47107.50	47107.50	79636.32	32528.82	15167.35	25640.76	10473.41	9000.57	15215.67	6215.10
11	-	47107.50	47107.50	79636.32	32528.82	13542.28	22893.54	9351.26	7627.60	12894.64	5267.04
12	-	47107.50	47107.50	79636.32	32528.82	12091.32	20440.66	8349.34	6464.07	10927.66	4463.59
13	-	47107.50	47107.50	79636.32	32528.82	10795.82	18250.59	7454.77	5478.02	9260.73	3782.70
14	-	47107.50	47107.50	79636.32	32528.82	9639.13	16295.17	6656.04	4642.39	7848.07	3205.68
15	-	47107.50	47107.50	79636.32	32528.82	8606.36	14549.26	5942.89	3934.23	6650.91	2716.68
Total	16732.50	636865.00	653597.50	845140.40	191542.90	278963.90	299239.30	20275.36	202068.50	195680.10	-6388.45
	NPV	3542.86		BCR	1.07	IRR	12.80				

Source: Prepared by the author based on the primary data

Table 5. Sensitivity analysis with 10 % higher and lower discount rates, costs and returns than the base

Particulars	Base	10 % higher	10 % lower
Lower discount rate %	12	13.2	10.8
Higher discount rate %	18	19.8	16.2
Discounted cost (in ₹)	278963.92	234279.98	269748.78
Discounted returns (in ₹)	299239.29	246279.60	295208.45
Discounted cashflow (in ₹)	20275.36	11999.62	25459.68
NPV (in ₹)	3542.86	-3059.63	10400.43
BCR	1.07	1.05	1.09
IRR %	12.80	-12.00	23.61

Source: Prepared by the author based on the primary data

Table 6. SWOT Analysis of marketing channels in the study area

Strengths	Weaknesses
• Multiple channels for marketing in the study area enable farmers to choose outlets among them	• Long marketing channels such as Channel I, II and V reduce producer's share in consumer price
• All the channels involve processors that ensure value addition	• There is no FPOs or co-operatives, which limits collective bargaining power and economies of scale
• Channel that offer direct linkage to consumers (Channel III) ensures high returns to farmers	• Reliance on local traders (Channel II) may lead to exploitation and poor realisation of price
• Market access is ensured by established flow in traditional channels	• There is a lack of real-time market information

Opportunities	Threats
• Shorter supply chains can be promoted to ensure efficient marketing	• Risk of price fluctuation due to demand driven pricing across all the channels
• Digital platforms can be introduced to promote direct sales FPOs and co-operatives can be established to improve market linkage	• Delay in payment may impact liquidity of farmers
	• Market power may concentrate with processors or wholesalers which limits fair competition

Source: Prepared by the author based on information collected through personal interviews

Table 7. Producer price, consumer price, marketing cost, market margin, marketing efficiency, price spread and producer's share in consumer price per kg of cashew nut in the study area

S.No	Particulars	Marketing channel				
		I	II	III	IV	V
1.	Producer price (₹)	144.61	150.00	144.61	144.61	144.61
2.	Consumer price (₹)	209.25	209.53	193.68	209.25	202.14
3.	Marketing cost (₹)	35.85	45.45	35.39	35.62	35.62
4.	Market margin (₹)	28.79	14.09	13.68	29.02	21.92
5.	Marketing efficiency	2.23	2.52	2.92	2.23	2.51
6.	Price spread (₹)	64.64	59.53	49.07	64.64	57.53
7.	Producer's share in Consumer price	69.11	71.59	74.66	69.11	71.54

Source: Prepared by the author based on the primary data

Table 8. Constraints faced by the farmers in the production and marketing of raw cashew nuts in the study area

S. No	Constraints	Percentage of respondents
	Production constraints	
1.	Pest and Disease Infestation	36.67
2.	Uncertain Weather	26.67
3.	Uncertain Yield	26.67
4.	Labour Availability	20.00
5.	Quality Deterioration	10.00
6.	Maintenance Cost	10.00
7.	Long Gestation Period	6.67
	Marketing constraints	
1.	Price fluctuation	43.33
2.	Delay in payment	10.00

Source: Prepared by the author based on the primary data
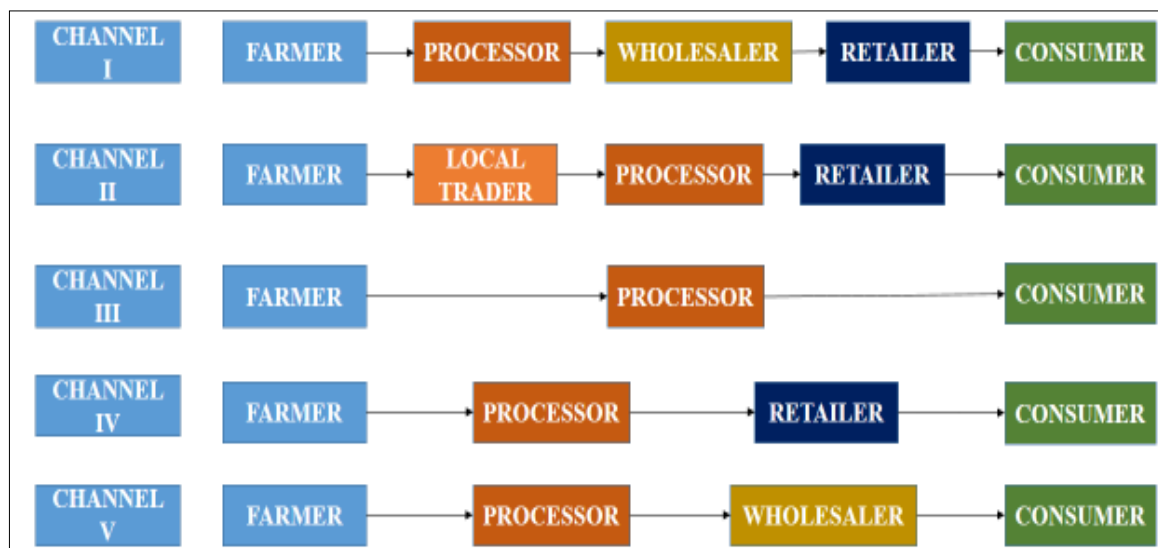
Fig. 3. Marketing Channels identified in the study area (Prepared by the author based on the primary data).

constraint. Therefore, following pest and disease infestation and uncertain weather, labour availability, quality deterioration, maintenance cost and long gestation period were quoted by the farmers as constraints.

To overcome the pest and disease incidence, tolerant varieties should be introduced in the study area, which should be coupled with sensitisation on integrated pest and disease management practices and timely sanitary measures. Uncertain weather can be overcome by introducing tolerant varieties, incorporating micro-irrigation systems and other moisture conservation practices such as mulching that can prevent flower and fruit drop. To reduce the drudgery in harvesting, technologies and practices shall be introduced. Farmers shall also be sensitised about weed management with cover crops. Intercropping can be done to overcome the poor cash flow in the initial years.

Constraints faced in marketing

The constraints faced in the marketing of cashew nuts by the farmers were also listed in Table 8 and the percentage of farmers facing those constraints was also listed. The major constraint faced by the farmers in marketing the study area was fluctuation in price, which significantly affects the gross income, as the price of the crop is highly determined by demand and varies throughout the year. Farmers were also found to be facing delays in payment from traders or processors who buy the raw cashew nuts from them. To tackle the problems in marketing, pooling of the produce can be a viable solution, which can improve the bargaining power of the farmers. Farmer-Producer organisations can be initiated in the study area. Further, infrastructures such as drying floors, storage godowns, etc. that can enable better marketing of the produce can be established.

Conclusion

The findings clearly show that cashew cultivation in the study area is dominated by smallholder farmers, with VRI 3 being the predominantly cultivated variety. The average variable cost of cultivation was ₹47105.5 per acre and net returns over variable cost stood at ₹15380.58 for the year 2024. The harvesting labour cost was the highest among all the cost components. This underscores that the level of mechanisation is low in the region and also that labour-saving technologies are absent. Profitability

analysis revealed that though the BCR is greater than one and the IRR is greater than the opportunity cost, they are just above one and the opportunity cost, respectively. This shows that there is still a need to improve the cultivation practices to reduce costs and to increase returns from the cashew plantations. Sensitivity analysis indicated that the investment is financially viable under base conditions but highly sensitive to changes in cost, returns and discount rate. Increasing the parameters by 10 % resulted in a negative NPV and reduced IRR. On the contrary, a 10 % decrease in the parameters improved both NPV and IRR significantly. This underscores the importance of stable market conditions and controlling production costs.

In terms of marketing, Channel III (Producer-Processor-Consumer) is found to be the most efficient channel among all five channels, with the highest producer's share in consumer price and the lowest consumer price. This shows that shorter and direct marketing channels can enhance farm income, benefitting both the producers and consumers.

Pest and disease attacks, in particular mealy bugs, apple and nut borer and anthracnose, were identified as the major production constraints deteriorating the quality of produce, potentially affecting the quantity. In marketing, price fluctuation due to demand-driven market conditions of the crop remained the most pressing constraint faced by farmers.

This study suggests the following recommendations based on its findings

- Research and extension efforts focusing on introducing mechanised harvesting tools and labour-reducing innovations should be taken, which can reduce the production costs, addressing the labour shortage

- Training and capacity-building programs focusing on Integrated Pest and Disease Management practices should be carried out through ATMA, KVKs and agricultural extension offices.

- Farmer-Producer Organizations (FPOs) should be formed and encouraged in the study area to aggregate the produce, negotiate better prices, invest in small processing units and initiate direct marketing.

- A real-time market information system should be established to provide farmers with updated information on prevailing prices, demand trends and projected fluctuations to help them make informed decisions, reducing price risks.

- Policy support with targeted subsidies on inputs, pest control measures and harvesting equipment, particularly for small and marginal farmers, can help improve economic viability.

Ultimately, the study highlights the need for technological interventions, reforms in marketing and institutional support to improve profitability and sustainability of cashew cultivation in the study area. Further, it underlines the importance of addressing the production and marketing constraints with targeted policy measures in enhancing farmers' income, reducing inefficiencies in marketing and ensuring long-term growth of cashew cultivation in the region.

Authors' contributions

MG designed the study framework and prepared the first draft of the manuscript. RP carried out the literature review and contributed to the analysis and interpretation of results. VS provided expertise on production aspects of cashew nuts and contributed to manuscript refinement. SML contributed insights on the marketing aspects of cashew nuts and supported manuscript editing. SA supervised the study and provided critical revisions to the manuscript. SG assisted with research coordination and offered guidance on both production and marketing perspectives. All authors discussed the findings, revised the manuscript critically and approved the final version .

Compliance with ethical standards

Conflict of interest: The authors do not have any conflict of interest to declare.

Ethical issues: None

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Additional information