*J Bangladesh Agril Univ 23(1): **59-70, 2025*** https://doi.org/10.3329/jbau.v23i1.80824

ISSN 1810-3030 (Print) 2408-8684 (Online)

Journal of Bangladesh Agricultural University

Journal home page: http://baures.bau.edu.bd/jbau

Research Article

Profitability and Value Chain Analysis of Cashew Nuts in Bandarban Hill District of Bangladesh

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ARTICLE INFO

Article history
Received: 18 February 2025
Accepted: 23 March 2025
Published: 31 March 2025

Keywords
Profitability,
Value Chain,
Cashew Nuts,
Bandarban
Bangladesh

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ABSTRACT

Cashew nut cultivation is emerging as a promising agricultural activity in the Bandarban hill district of Bangladesh, offering significant economic potential in domestic and international markets for small-scale farmers and agribusiness enterprises. The present study analyses the profitability, value chain and the existing challenges of cashew nut production. In the Bandarban hill district, 90 cashew nut growers and 23 market intermediaries were purposively selected from the Rowangchari, Ruma, and Thanchi upazilas through face-to-face interviews. Descriptive analysis including Net Return, Gross Margin, Benefit Cost Ratio (BCR), Net Present Value (NPV), Internal Rate of Return (IRR) and Value Chain Analysis were used to analyze the data. On average, per hectare yield of cashew nuts was zero in the first year and 1,610 kg per hectare in 5-25 years. The total costs were Tk. 68,781 per hectare per year and Tk. 128 per tree per year. Though the gross return was zero in the first four years, the estimated gross and net returns per hectare per year for the next five to twenty-five years were Tk. 1,77,100 and Tk. 1,08,319 respectively. The NPV, BCR, and IRR were found as Tk. 7,75,050, 1.76 and 34%, respectively, in the study area. In the cashew nut value chain, the Faria (who collects the nuts from the farmers and transports them to the market) added the lowest value of Tk. 3 per kg (2.73%), whereas the processor added the highest value of Tk. 37 per kg (26.81%) in the cashew nut value chain. The study identified that irrigation was the major problem, followed by labor scarcity, and high transportation costs. The findings of this study might be helpful for policy-making as well as the development of cashew nut production and marketing systems in Bangladesh.

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Introduction

The majority of people in Bangladesh are dependent on the agricultural sector for their livelihood, income, and employment (Islam *et al,* 2020; Mitra & Yunus, 2018; Rayhan *et al.,* 2021). The country is renowned for growing a wide range of tropical plants (Rahman *et al.,* 2020). Cashew nut (*Anacardium occidentale*) is a tropical plant (shrub) and one of the high-value crops. Cashew kernels are a good source of nutrients, lipids, protein, and carbohydrates (Nandi, 1998). The by-product of cashew nuts, cashew nut shell liquid (CSNL), is also valued as a raw material for the paint and varnish industries (Sethi *et al.,* 2015).

The average lifespan of cashew was found to be 25 to 30 years (Sekar and Karunakaran, 1994). Although it may thrive in dry, sandy areas and low soils, the cashew tree is a sprawling, broad-leafed evergreen (Chipojola *et al.,* 2009). There are 12 ethnic communities and Bengali live in the Chattogram Hill tracts in Bangladesh. Each of the hill tribes calls the cashew by a different name in their names, like, the Chakma people call it "Tang Gulo", Marma "Badangsi", Tanchangya "kasana Gula", Tripura "Badam Bathai" Bam "Kashnak" and in the local Cottogram people, it says "Taam" (Uddin, 2022).

The global market for cashew nuts is worth $9.8 billion and growing at a rate of 4.5 percent per year worldwide (Ali, 2021). In the farming years 2020-2021 global cashew production was 837,790 metric tonnes, or over 3.8 million metric tonnes of raw cashew nuts. The country produced 1,462 tonnes of cashew nuts in FY 2020-21, which was 1,323 tonnes in FY 2019-20 (Sohel, 2021). Cashew nut cultivation in the past was limited to the Chattogram Hill Tracts; now cultivation has spread to 16 other districts (Sohel, 2021). Currently, the annual local consumption of cashew nuts is over 1,300 tonnes, whereas local farmers can supply about 300 tonnes, and the rest is imported (Sohel, 2021). Bangladesh has a good chance to participate and take a share in the global nut export. This nut is not perishable, and it can keep in store for many years, and it's easy to handle.

Cite This Article
Tanchangya, D., Salam, S. and Deb, M. 2025. Profitability and Value Chain Analysis of Cashew Nuts in Bandarban Hill District of Bangladesh. *Journal of Bangladesh Agricultural University,* 23(1):59-70. https://doi.org/10.3329/jbau.v23i1.80824

The government of Bangladesh and many industrialists are investing in this sector and establishing processing plants. The climate of the country is good for cashew nut production. The Ministry of Agriculture reported that at least 5 lakh hectares of land in the three hilly districts – Rangamati, Khagrachhari, and Bandarban – are lying uncultivated. If at least 2 lakh hectares of land were covered with cashew nut trees, it may be possible to earn more than $1 billion (around Tk. 9,000 crore) a year (Ali, 2021). Based on this context, this study is an attempt to reveal the present condition of cashew nut production, its profitability, and value chain analysis. Furthermore, it presents production and marketing-related problems faced by cashew nut farmers.

The specific objectives of this study are to know the profitability of cashew nut production, the value chain and the existing challenges in cashew nut production in Bangladesh. To achieve the objectives of this study, the following research questions are explored: (1) what are the total cost of production, gross return, net return, gross margin as well as NPV, BCR and IRR? (2) Who are the main stakeholders involved in production, processing, distribution, and marketing, their functions and value addition? (3) What challenges do cashew farmers and other value chain actors face?

A variety of literatures found that cashew nuts have been extensively studied in South and East Asian as well as African countries, where they have been grown for a very long period (Mgonja and Shausi, 2022; Agbongiarhuoyi *et al.,* 2020; Miassi *et al.,* 2019; Oladejo, 2015). As only a little research and study were done on cashew nuts in Bangladesh, there is scope for future research and study. However, as global and domestic demand for cashew nuts continues to rise, understanding the profitability and value chain of cashew production is crucial. This paper makes three contributions to the existing literature through the exploration of profitability and value chain of cashew nuts. First, understanding the profitability of cashew nut farming in Bandarban can help farmers and policymakers make informed decisions about investment and expansion. Second, the study will examine the different actors in the cashew value chain to identify inefficiencies, value additions, and potential areas for intervention. Third, this study will identify key challenges in cashew nut production. Addressing these challenges can improve Bangladesh's position in the global cashew market and attract investments in the sector. However, this study is crucial for farmers, agribusiness investors, policymakers, and development agencies as it provides empirical insights into the profitability, value chain efficiency, and challenges of cashew nut production in Bandarban. These information help them in making informed decisions to promote cashew cultivation and agribusiness development in the region. The findings will support strategic planning and interventions to enhance cashew cultivation and market competitiveness in Bangladesh. Overall, this study will contribute to the sustainable growth of the cashew nut industry, benefiting farmers, traders, and the overall economy.

Materials and Methods

Study Area

For considering the objectives of the present study, Rowangchhari, Ruma, and Thanchi Upazilas under the Bandarban Hill District were selected purposively. Bandarban hill district is located between 21º11' north latitude and 22º22' north latitude and 92º40' east longitude and 92º41' east longitude. The district has seven sub-districts or upazilas Bandarban Sdar Upazila, Lama Upazila, Alikadam Upazila, Naikhongchhari Upazila, Ruma Upazila, Rowangchhari Upazila, Thanchi Upazila, and two municipalities (Figure 1). These areas were selected due to characteristics such as uniform soil types and topographical and climatic conditions for growing cashew nuts.

Figure 1. Map of Bandarban District
Source: Wikipedia (2016)

Sampling and Data Collection

A purposive sampling technique was adopted to collect the data of nut farmers and different market participants. So, ninety cashew nut farmers were selected and interviewed from Rowangchhari, Ruma, and Thanchi Upazilas, of which thirty farmers were from each Upazila. Besides, a total of 23 samples comprising 9 Faria, 6 Beperi, 3 Aratdhar, 3 wholesalers, and two local nut processors, were taken from the respective markets. For practical observation, the researcher visited a farmer's cashew nut garden personally. The data were gathered in local units to reduce mistakes.

The collected data from respondents had been processed, tabulated, and analyzed logically.

Data Analysis

Descriptive analysis and value chain analysis were used to analyze the data and extract meaningful conclusions. The profitability of cashew nut production was measured based on gross return, gross margin, and net return. In this study, capital budgeting was done by calculating the Net Present Value (NPV), Benefit Cost Ratio (BCR), and Internal Rate of Return (IRR) of the cashew nut orchard. Here, a 10% opportunity cost of capital was used to determine the discount rate. Interest on operating capital was computed by all variable costs for various operations in cashew nut production. Interest on operating capital was computed at the rate of 10% for a year. It was assumed that if the producer borrowed money from the micro-credit institutions, he would have to pay interest at the above-mentioned rate. Gross return was calculated by multiplying the quantity of the cashew nuts (kg/ha) with the average price of the product (Tk./kg). Net return (NR) was the difference between gross return (GR) and total cost in production (TC). Gross margin calculation was done to have an estimate of the difference between total return and variable cost. The difference between the present value of cash inflows and outflows is known as NPV. NPV was estimated by using the formula:

$$NPV = \sum_{t=1}^{t=n} \frac{(B_t - C_t)}{(1+i)^t}$$

Where, B_t = benefit in each year, C_t = cost in each year, t = number of years, and i = interest rate (discount rate). If NPV>0, the investment is accepted; NPV<0, the investment is rejected; and if NPV=0, the investment is indifferent.

When comparing the discounted value of all cash inflows and outflows throughout the lifespan of a project, the benefit-cost ratio (BCR) is calculated. In the present study, BCR was calculated as,

$$BCR = \sum_{t=1}^{t=n} \frac{B_t}{(1+i)^t} \Big/ \sum_{t=1}^{t=n} \frac{C_t}{(1+i)^t}$$

Where, B_t= benefit in each year, C_t= cost in each year, t= numbers of years, i= interest (discount rate). If BCR>1, the investment is accepted, BCR<1, the investment is rejected and BCR=1, the investment is indifferent.

IRR refers to the income capacity of an investment. It is a discount rate that makes the NPV of a particular project equal to zero, i.e., in the case of IRR

$$IRR = \sum_{t=1}^{t=n} \frac{B_t - C_t}{(1+i)^t} = 0$$

Alternatively, IRR can be calculated as

$$IRR = LDR + \frac{NPV_{LDR}}{|\ NPV_{LDR} - NPV_{HDR}\ |} * (HDR - LDR)$$

Where, LDR= lower discount rate (%); HDR= higher discount rate (%) | | = absolute value.

The value addition of different value chain actors was estimated by the following formulas:

Value addition by the traders = Selling price-Purchase price

Value Addition (%) =

$$\frac{\text{Selling price} - \text{Purchase price}}{\text{Purchase price}} \times 100$$

The problems faced by farmers are accommodated on a 4-point Likert scale. In essence, it is a "forced" Likert scale. It gets its name from the fact that the user is compelled to make a decision. So, there is no safe 'neutral' option. In this four-point continuum, weights of 4, 3, 2, and 1 were assigned, with the direction of weighting being determined by the unimportance of the item. The weights were assigned as follows: Always a problem (4); sometimes a problem (3); a problem (2); not a problem (1).

Result and Discussion

Profitability Analysis

The cashew production period was divided into two categories 1-4 years, and 5-25 years. After planting the seed and sapling, it takes three years to reach maturity. In the 4th year, the plant produces nuts, but the plants are not fully mature, and produce only small-sized nuts in small quantities. Cost analysis is a must to analyze the profitability of cashew nut production. Two categories were established for human labor costs. The first was family labor, for which farmers did not pay in cash, and the second was hired labor, for which farmers were required to pay in cash. The opportunity cost concept was applied to calculate the costs of family labor. The market wage rate is the amount that farmers paid for the hired labor that was used as the opportunity cost of family labor in this study. A man-day was considered to be 8 hours of work for an adult male and female; it was 6 hours. The daily wage is Tk. 600 for males and Tk. 400 for the female labor. The first 1-4 years, and 5-25 years labor costs are found to be Tk. 13000 and Tk. 17600 per hectare per year, respectively. In the case of a per tree basis, labor costs are calculated as Tk. 24.25 and Tk. 32.82 for these two time periods, respectively (Annex1). Actually, for 5-25 years, farmers'

yearly labor inputs are required only for harvesting and garden cleaning (Anex 1). The seeds were collected from the other established garden, and saplings were supplied by the Department of Agricultural Extension (DAE). Table 1 presents the total cost of seed and sapling, which is Tk. 14,800 for one hectare of land. Seeds and saplings were planted in a square design, and the pant-to-plant distance followed a distance of 7×7 meters; approximately 200 plants can be planted in 1 hectare (Singh *et al.,* 2019). In addition, Maruthi *et al.* (2011) reported that presently the crop increases yield by 2-5 times in Karnataka, India. According to Kalaivanan and Rupa (2017), 1 meter of space is maintained between two rows of cashews when no intercrops are grown in cashew plantations. However, between two rows of cashews, the spacing maintained is 21m if guava, longan, rambutan, or breadfruits are planted between the rows under a mixed cropping system. Table 1 shows that 10 bamboos are needed for one hectare of cashew garden, and its cost is about Tk. 800 per hectare, and Tk.1.49 per tree.

It is observed that 124 kg of urea was used for one hectare of cashew garden, and the cost of the fertilizer was Tk. 2,232 per hectare, and Tk. 4.16 per tree (Table 1). It is also observed that in the study area, farmers only applied urea at the growth stage in small quantities to the orchard. Due to hill area and irrigation problems, farmers were less interested in using other garden fertilizers. Interest on operating capital was computed by all variable costs for various operations in cashew nut production, such as labor, seed, fertilizer, etc. The interest on operating capital estimated for cashew nut production in 5-25 years is Tk. 1,760 per hectare/year and Tk.3 per tree/year, respectively (Table 2).

Table 1. Materials cost

Sl No	Particulars	1-4 years			
		Quantity	Price	Cost per hectare (Tk.)	Cost per tree (Tk.)
1	Seed and sapling				
	Seed	35 (kg/ha)	80 (tk/kg)	2800	
	Sapling	80 (pieces/ha)	150 (tk/piece)	12000	150
2	Bamboo for staking	10 (pieces/ha)	80 (tk/piece)	800	1.49
3	Fertilizer				
	Urea fertilizer	124 (kg/ha)	18 (tk/kg)	2232	4.16
	Total			17832	155.66

Source: Field Survey, 2022

Table 2. Cost of cashew nut cultivation period (5-25 years)

Particulars	Cost per hectare (Tk.)	Cost per tree (Tk.)	Percentage
I. Variable cost			
Labor cost			
Garden cleaning	1,600	2.99	2.23
Harvesting	16,000	30	23.26
Interest on operating capital	1,760	3	2.56
Total variable cost	19,360	36	28.15
II. Fixed cost			
Land use cost	49,421	92	71.85
Total fixed cost	49,421	92	71.85
Total cost	68,781	128	100

Source: Field Survey, 2022

Each year's total variable costs were different. During the fruit-bearing period (5th to 25th year), it was different from the establishment year or gestation period (2nd to 4th year). It shows in Table 5.3 that the per hectare total variable cost during the bearing period for cashew nuts was Tk. 19360 per ha/year, and Tk.36 per tree/year, which was 28.15 percent of the total cost. Labor cost was cashew orchards' highest variable cost item (Table 2). Land use cost was considered a fixed cost for cashew nut production. This cost was calculated based on the current rental value of the land. The average rental value was Tk. 49,421 per hectare per year, and Tk.92 per tree/year, which is 71.85 percent of the total cost (Table 2). From Table 2 it is also found that the total costs of cashew nut production were Tk. 68,781 per hectare/year, and Tk.128 per tree/year. During garden establishment, farmers require a major investment, which is very important for cashew nut

gardening. This cost is incurred at the beginning of the gardening process. Then, from the 2nd to the 5th year (during the gestation period), the cashew nut growers only incurred the maintenance cost. Garden establishment and maintenance costs per hectare are presented in Table 3. It shows that cashew nut growers required Tk. 74,853 per hectare, and Tk. 139.65 per tree as an establishment cost, where land rental value was the highest investment cost item in cashew orchards. Moreover, the operating and maintenance cost is Tk. 1,800 per hectare/year, and Tk.3.36 per tree/year for the gestation period (2nd to 5th year), (Table 3).

Table 3. Establishment cost

Sl. No.	Particulars	Cost per hectare (Tk.)	Cost per tree (Tk.)	Percentage
A.	Investment cost			
1	Rental value	49,421	92.20	61.58
2	Labor cost	7600	14.18	9.47
3	Materials cost	17832	33.27	22.22
	Sub Total	74,853	139.65	93.27
B.	Operating cost			
	Year-II	1,800	3.36	2.24
	Year-III	1,800	3.36	2.24
	Years-IV	1,800	3.36	2.24
	Sub Total (II+III+IV)	5,400	10.07	6.73
A+B	Total cost	80,253	150	100

Source: Field Survey, 2022

The first 3 years gross return is zero, because this time there was no production from the plant. From 4th-year plants, the first production was produced, but the produced nuts were not mature. Plants yield excellent quality, mature nuts beginning in their 5th year and continuing for at least 25 years. The average yearly production of nuts during 5-25 years is an average 1610 kg per hectare/year, and an average 4kg per tree/year. Cashew nut growers sell this nut at an average market price of Tk. 110 and earn a gross return of Tk. 177100 per hectare/year, and Tk. 428 per tree/year (Table 4). Similarly, Uddin (2022) reported that the average productivity (yield) of cashew per hectare is known to be 1.5-1.8 tons. However, it is possible to increase productivity through research. Correspondingly, Nayak *et al.* (2018) found that per ha, 1890 kg of raw cashew nuts were produced in Maharashtra, India, and their average price per kg was Rs. 153.20.

The average return of cashew nut farming during 5-25 years is found as to be Tk. 1,08,319 per hectare/year and Tk. 262 per tree/year (Table 4). The cashew nut gross margin per hectare was calculated by subtracting the total variable cost from the gross return. Per hectare gross margin of cashew nut was estimated at Tk. 157740 per hectare/year and Tk. 381 per tree/year (Table 4). Likewise, according to Farayola *et al*. (2013), gross margin analysis revealed that the cashew nut business is profitable in Nigeria. The NPV of the cashew nut orchard was positive and greater than zero (Table 5.6). Therefore, cashew nut production was an acceptable practice and feasible from a financial point of view. It also implies that the farmer becomes able to increase wealth by Tk. 7,75,050.61 per hectare of cashew production during 5-25 years of plant age. Similarly, Nayak *et al*. (2018) found per hectare NPV 9,72,207 and, 11,38,561 (Rs./ha) respectively from the 5th year onwards in Ratnagiri and Sindhudurga districts, Maharashtra, India. In this study, BCR emerged to be 1.76 percent (Table 5), showing that the cultivation of cashew nuts can be regarded as a significant and financially justified investment. Similarly, Wongnaa (2013) reported that 1.13 BCR was found in Ghana for cashew production. In the same way, Malave *et al.* (2013) also reported that the high-yielding variety of cashew nut BCR 1.95 and the local variety BCR 1.71 in the Konkan Region of Maharashtra, India. From the financial analysis of cashew nuts cultivation, it is revealed that cashew nuts are profitable from the 5th year onward, and afterward it is more or less beneficial up to a certain period of the crop's life span in this study. Correspondingly, BCR is greater than one from the fifth year (2.15) found in the West Garo Hills of Meghalaya, India (Hatai, 2018). So, it is found that the production and price of cashew nuts in Bangladesh is lower than the other countries. IRR value is found as 34% (Table 5), which indicates that the IRR of cashew nut production stood at 34%, which is sufficiently greater than an existing microfinance rate. Likewise, Malave *et al*. (2013) analyzed that IRR of HYVs was 24.67% and the local variety was 18.58% of cashew nuts in Maharashtra, India. So, it guarantees a reasonable return for investors and confirms that investing in cashew orchards was viable.

Table 4. Gross returns, net returns and gross margin of cashew nut production during fruit bearing period (5-25 years)

Particulars	Unit	Value per ha	Value per tree
Total yield	kg/ha or kg/tree	1,610	4
Average price	Tk./ kg	110	110
Gross returns	Tk.	1,77,100	428
Total variable cost	Tk.	19,360	47
Cost of cultivation	Tk.	68,781	166
Net returns	Tk.	1,08,319	262
Gross Margin	Tk.	1,57,740	381

Source: Field survey, 2022

Table 5. Value addition by different marketing actors of cashew nut

	Actors						
Items	Faria	Bepari	Aratdar-cum-wholesaler	Aratdar Chattrogram	Proce-ssor*	Whole-saler	Retailer
Purchasing price	110 (Tk./kg)	113 (Tk./kg)	118 (Tk./kg)	126 (Tk./kg)	138 (Tk./kg)	175 (Tk./0.17kg)	184 (Tk./0.17kg)
Selling price	113 (Tk./kg)	118 (Tk./kg)	126 (Tk./kg)	138 (Tk./kg)	175 (Tk./0.17kg)	184 (Tk./0.17kg)	192 (Tk./0.17kg)
Value addition (Tk./ kg)	3	5	8	12	37	9	8
Value addition (%)	2.73	4.42	6.78	9.52	26.81	5.14	4.35

Note: *Processors required 6 kg raw (shelled) nut to convert into 1 kg unshelled nut
Source: Field Survey, 2022

Value Chain Mapping of Cashew Nuts

Cashew nuts move from the producer to the ultimate consumer through some market actors such as Faria, Bepari, Aratdar, processors, wholesalers, and retailers. Therefore, all of these actors contributed to the marketing channel of cashew nuts. The value chain map and linkages between value chain actors at different stages of the cashew value chain are shown in Figure 2.

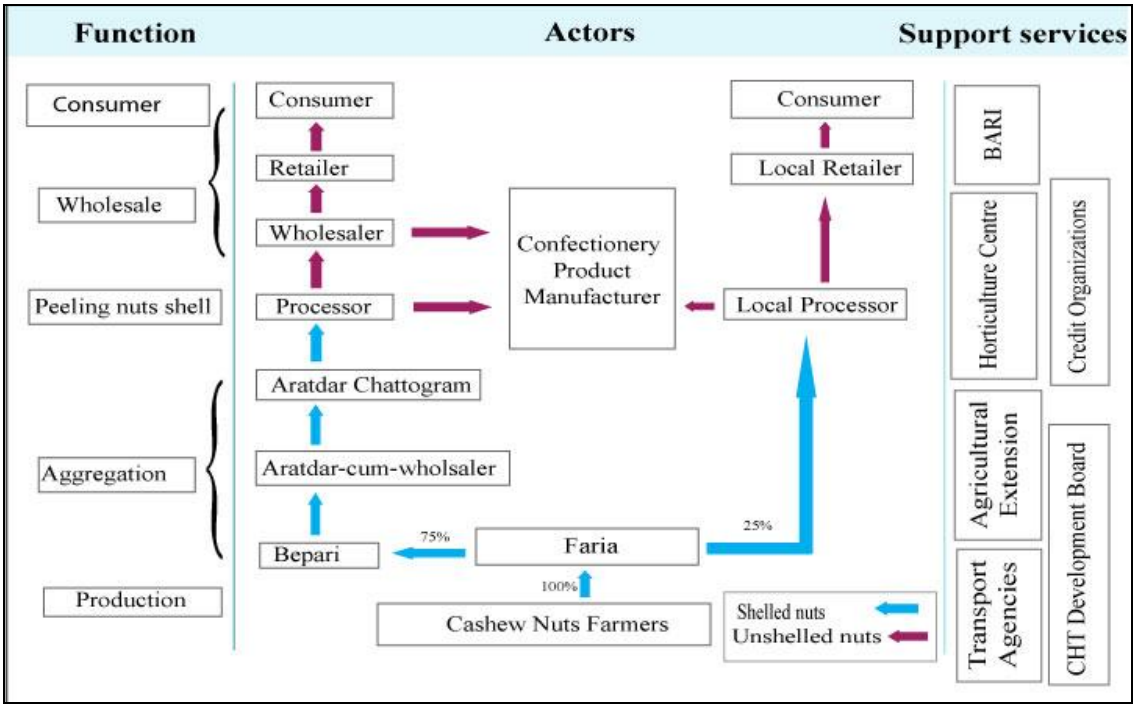

Figure 2. Value chain map of cashew nuts
Source: Field survey, 2022

Channel I: Farmer→ Faria→ Bepari→ Aratdar-cum-wholesaler→ Aratdar (Chattogram) → Processor → Wholesaler→ Retailer→ Consumer
Channel II: Farmer→ Faria→ Bepari→ Aratdar-cum-wholesaler→ Aratdar (Chattogram) → Processor→ Confectionery product manufacturer
Channel III: Farmer→ Faria→ Local processor→ Local retailer→ Consumer
Channel IV: Farmer→ Faria→ Local processor→ Confectionery product manufacturer

Faria collected cashew nuts from farmers and sold them to the Bapari and the local processors. Cashew nuts are transferred to processors through local and Aratdars at Chattrogram, where cashew nuts are unshelled and further transferred to confectionery product manufacturers, wholesalers, and retailers (Figure 2). Besides, local processors collected cashew nuts from Faria, unshelled the nuts, and transferred the nuts to local retailers and confectionery product manufacturers. Similarly, Balamurugan *et al*. (2011) showed marketing begins with the sale of raw cashew nuts by farmers and reaches the level of exporters/ retailers for selling processed and graded kernels to the ultimate consumers in India.

Functions performed by value chain actors

The functions performed by cashew nut actors have been broken down into various functions such as buying and selling, processing, pricing, transportation, sorting, grading, packaging, and market information. Acchukatla and Srinivasan (2019) discussed the various stages of cashew processing such as; procurement, boiling, de shelling, borma, peeling, grading and marketing in Tamil Nadu, India. It is required to collect fruits every day from the garden because cashew nuts do not ripen all at once. After collecting the fruits, the nuts are separated from the apples. After that, it requires 3–7 days for natural drying in sunlight. When the nuts are dried and the humidity becomes 9–10%, they are stored in a jute bag and kept in air circulated place. Farmers sold their nuts after they had dried. Due to the abundance of cashew nuts and their high price, some local cashew nut processors established some nut buying points for the farmers. Nut farmers can easily sell their produced nuts here which might reduce their marketing costs. The processors also collect nuts from the farmer's house and village. Mainly, the settlement Farias purchases produce from farmers and resells it to Bepari and nearby processors. There was a communication between the farmers and the Farias, Beparis, Aratdar in the study area. An effective transport system helps to expand the potential, rapid and dynamic market areas. Mahindra auto, mini truck and truck were the general modes of transportation used by the intermediaries, from the Faria, Bepari, Aratdar, processors, wholesalers and retailers. Grading refers to the sorting of products into various established or accepted standards quality of product. There was no prescribed grade standard for cashew nuts marketing in the study area. Grading was roughly done according to the size, color and nutshell of the nuts by the Paikers or Beparis, Aratdars, processors, and confectionery manufacturer. Large size, well dried and no spot on the shell nuts are good and worth price. Confectionery manufacturer and processors grade on size and texture of unshelled nuts. If 1 kg of cashew nuts contains 180 seeds, it's a good grade, and export quality nuts If 1 kg contains 181 to 210 nuts, is medium grade, and if there are more than 210 seeds in 1 kg, it is poor grade, which has a much lower value (Alam, 2022). In the study area, most of the traders' package shelled nuts in bags. The processors package unshelled nuts in a poly bag of different sizes like, 1kg, 500g, 250g and large-scale bags. This is convenient for wholesale and retail traders. In the value chain, prices started from farmers to Faria, Bepari, Aratdar-cum-wholesaler, Aratdar Chattrogram, processors, wholesalers, and retailers. From the farmer, Faria purchased per kg shelled nuts Tk. 110 and sold them to the Bepari at Tk. 113; the, Bepari sold them to the Aratdar-cum-wholesaler at Tk. 118, and the Aratdar-cum-wholesaler sold them to the Aratdar Chattrogram at Tk. 138 per kg shelled nuts (Table 6). Processors purchased shelled cashew nuts at Tk. 138 per kg and sold unshelled cashew nut at Tk. 1050 per kg to wholesalers. Finally, wholesalers sold this unshelled cashew nut to retailers at Tk. 1104 and further sold it at Tk. 1152 to the ultimate consumers. Alam (2022) reported that for 1kg unshelled nut required 3.5-4 kg shelled nuts. Shabuj (2021) also reported in processing level processors required 6 kg of raw shelled nuts for processing 1 kg of unshelled quality nut. To store the product, Aratdar maintains simply a shaded room, where enough air circulation is available. Marketing middlemen gathered information through direct observation, visits to the local market, and contact with other traders. They extensively used mobile phones to collect price information from fellow traders without visiting the market.

Table 6. Problems of cashew nut production

Problems	Weightage of challenges			
	Always a problem (4)	Sometimes a problem (3)	A problem (2)	Not a problem (1)
Irrigation problem	60* (66.67)	30 (33.33)	-	-
Problem of wild animal	49 (54.44)	35 (38.89)	6 (6.67)	-
Problem of workers	30 (33.33)	42 (46.67)	18 (20.00)	-
Environmental problem	23 (25.56)	16 (17.78)	33 (36.67)	18 (20.00)
Problem of harvesting and storage	24 (26.67)	21 (23.33)	34 (37.78)	11 (12.22)
Problem of drying	22 (24.44)	29 (32.22)	27 (30.00)	12 (13.33)
Problem of fertilizer	19 (21.11)	19 (21.11)	37 (41.11)	15 (16.67)
Problem of quality seed/sapling	-	22 (24.44)	38 (42.22)	30 (33.33)
Disease and pest	-	-	53 (58.89)	37 (41.11)
Transportation problem	-	10 (11.11)	47 (52.22)	33 (36.67)

Note:* indicates number of responses; Figures in the parentheses implies percentage of responses.
Source: Field survey, 2022

Value Addition of Cashew Nut

The value additions in per kg of raw cashew nuts by the different market actors are depicted in Table 5. According to the processor, they required 6 kg of raw (shelled) cashew nuts to produce 1 kg of unshelled nuts. So, the value addition calculation is based on 1 kg of raw cashew nuts, which are converted to 0.17 kg after processing under the processor. For wholesaling and retailing levels, a value addition of 0.17 kg (1:6) was calculated (Table 5).

All of the market actors add more or less value to the cashew nut value chain. Among them, the Faria added the lowest value of Tk. 3 per kg (2.73 percent) of raw cashew nuts (Table 5). Generally, Faria and Bepari added value by creating only place utility. Compared to the Faria and Bepari, Aratdars added more value as they stored the raw nuts for a few days. Local and Chattrogram-based Aratdars added 6.78% and 9.52% value to the raw cashew nut, respectively (Figure 3).

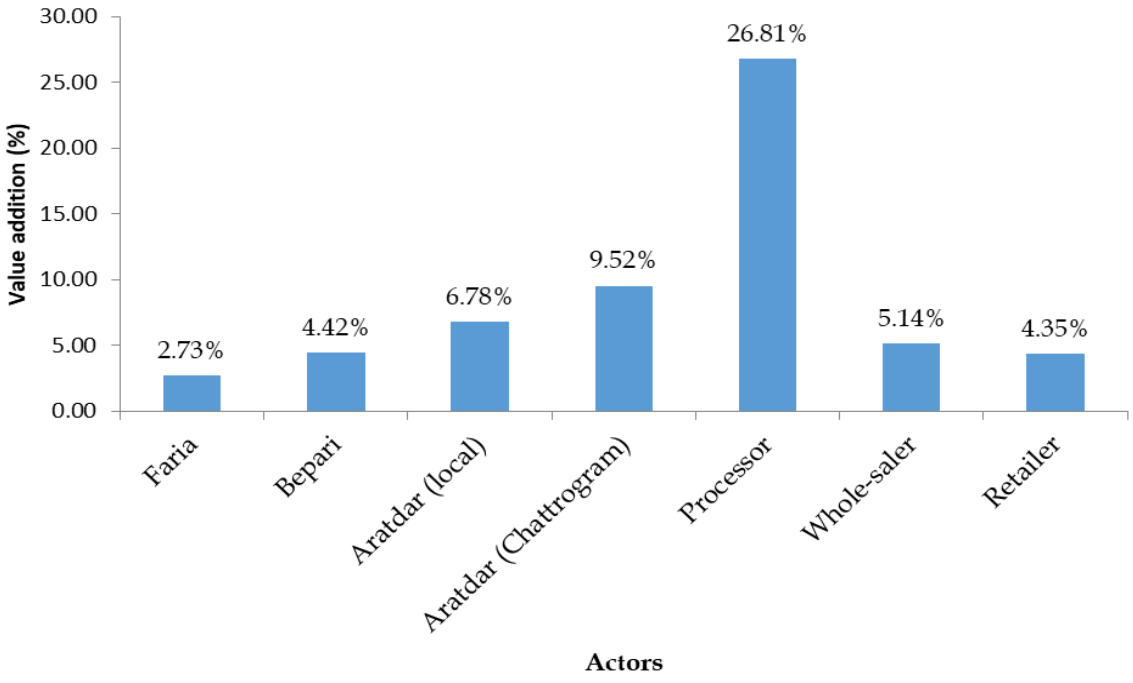

Figure 3. Percentages of total value addition by the actors
Source: Field Survey, 2022

The processor added the highest value of Tk. 37 per kg (26.81%) in the cashew nut value chain (Figure 3). As processors performed different activities related to processing, they added more value compared to other intermediaries. Finally, wholesalers and retailers added Tk. 9 and Tk. 8 per kg of raw cashew nuts, respectively (Figure 3). Similarly, Acchukatla and Srinivasan (2019) showed that various actors like farmer, processor, wholesaler, retailer, local trader, exporter and road side shop retailers, etc., affected overall industry performance and made it more competitive on the cashew nut value chain in Tamil Nadu, India.

Problems faced by the farmers and traders in cashew nut production

The cashew nut business in Bangladesh also participates in this sector, where the production and marketing systems are not free from problems. From production to consumption, all the channel members, including farmers, are facing different problems at different stages of marketing.

Lack of irrigation facilities makes farming difficult, though cashew nut is a tropical fruit (Uddin, 2022). Table 6 shows that the irrigation problem is highly rated by the respondents with 66.67% saying it's always a problem~~,~~ and 33.33% saying it is sometimes a problem. According to the majority of the respondents (54.44%) in this study, they always faced the problem of wild animals, followed by 38.9 percent as sometimes a problem (Table 6). Because it's normal in the study area, crops were damaged by the wild animals, like~~,~~ monkeys, elephants etc. During the study, it was found that "squirrels" damage a higher percentage of nuts than other~~s~~ animals. During the nut~~s~~ harvesting season, it required a large number of laborers. Every day, it is required to collect the nut, separate the nut from the apple, and dry the nut. Human labor becomes scarce at that time. The majority of the farmers (33.33% and 46.67%) reported that it ~~as~~ is always and sometimes a problem. High wind uproots the trees, and if there is low rain in the flowering season, it reduces the production. To maintain the quality of the nuts, it is necessary to collect fresh nuts and store ~~it~~ them. Otherwise, this damages the quality of nuts and makes the farmer's income difficult. In the study area, respondents reported it as a serious problem. Only 12.22% of respondents reported it as not a problem at all. It takes 3-5 days to dry nuts; at that time, farmers need to move out the nuts and again move them into the home. Around 24.44% reported that it ~~as~~ is a serious problem~~,~~ because sudden rain damages dry nuts. 12 respondents reported it as not a problem, as they are used to doing this kind of activity. The respondents said that fertilizers are found available in the market. Due to the hilly area, the fertilizer loss~~es~~ rate is high. Therefore, farmers were not interested in applying the fertilizer to the gardens. Among the respondents, 41.11% thought it was a minor problem, whereas 16.67% thought it was not a problem at all. In hilly areas, people carry their goods and products on their shoulders and backs. But it is very hard work, time-consuming, and only a small quantity of goods can be moved. The respondents reported that this is natural to them and is not a problem for them. If the transportation facility is developed in the rural area, it will help farmers with transportation, production, and information. About half of the respondents (52.22%) reported it as a minor problem. They thought that if there was good transportation from the garden to home, it could increase the production and collection of nuts.

Moving the in-shell cashew nuts from one place to another place, loading, and unloading trucks required human labor. In hilly areas, there was a lack of labor, and the cost of labor was also high. In addition, transportation costs constituted a large share of the marketing costs of shelled cashew nut~~s~~ traders. Vehicles for transporting raw cashew nuts are not always widely available. Generally, vehicles could only move during the daytime, not after evening. Market intermediaries reported that they had to pay high market tolls (at Paurasava and Zila Parishad) for trading cashew nuts. The municipality charged this toll for every single truck loaded. This high rate of toll increases their marketing costs and reduces their margin. Most of the Paikers, or Beparis and Aratdar, reported that at the time of transportation of cashew nuts from Bepari to local Aratdar to Chattogram, they had to pay tips and subscriptions to the different local political parties and institutions. These made the total marketing cost of Beparis very high. Similarly, Hatai (2018) found several problems faced by the farmers and traders of cashew nuts such as; recurrent price fluctuation, high input costs, marketing, storage and transportation cost, non-availability of adequate storage facilities, postharvest losses and lack of competitive marketing system in west garo hills of Meghalaya, India. Likewise, Srinivasan & Mehazabeen (2018) also showed that traditional technology, lack of investment funds, and acute shortage of labor force were major constraints faced by the cashew nut farmers and traders in Tamil Nadu, India. However, addressing these challenges through policy reforms, investment in modern processing technologies, farmer training programs, and improved market linkages is essential to enhance the sector's sustainability and competitiveness. A collaborative effort from farmers, policymakers, investors, and development agencies is necessary to overcome these barriers and unlock the full potential of cashew nut production in the country.

Conclusion

Cashew nut is a prominent agribusiness sector in Chattogram hill tracts. It can be concluded from the study's findings that cashew nut production is a profitable and potential venture, though this production practice faces many constraints for its rapid development and growth. The demand for cashew nuts is growing globally as well as in Bangladesh. As Bangladesh is a potentially fertile ground for cashew production, there is ample scope to increase the production of cashew nuts by providing the necessary environment and incentives to growers and traders. As human labor was the highest cost item of cashew nuts production, modern technology is essential to reduce this cost. It should be required to introduce the mechanical practice of different intercultural operations like weeding machines, artificial drying of nuts, etc. Insects and pests are the main threats to these agribusiness crops. It can damage the total crop, which may cause a serious financial loss. So, pest and disease-resistant cashew nut varieties should be introduced, and techniques to prevent wild animals in this area. In the case of cashew nuts marketing, different market tolls should be minimized and maintained at an equal level to other crops. The illegal charges at different levels of marketing should be removed by active regulation. The main income source for the people of the Chattogram hill tracts is agriculture. This agriculture could be converted into agribusiness. Commercially farm-produced cashew nuts are a strong step in this arena. Besides cashew nut production, there is scope to introduce juice made from cashew apple (by-product). Generally, farmers are just throwing it out due to inadequate production and marketing systems. So, the government should take the initiative to flourish this prominent agribusiness sector. Due to the shortage of raw cashew nuts, several processing factories have shut down. Importing shelled nuts from other countries' import duty is high. In other countries, like India and Vietnam, the governments provide cash incentives for importing shelled nuts. Processors reported that the higher import duty discouraged them from buying raw nuts from other countries. So, the government should provide effective incentives to them to run this business smoothly and for further development. Addressing these challenges through policy interventions, improved infrastructure, farmer support programs, and enhanced market linkages can significantly boost the cashew industry in Bandarban. Strengthening the value chain will not only improve profitability for farmers but also contribute to rural development, employment generation, and Bangladesh's position in the global cashew market. Overall, this study serves as a foundation for future research, policymaking, and investment in the cashew sector, aiming to transform it into a sustainable and competitive industry.

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Anex 1. Labor cost per hectare and per tree

Items	1-4 Years						5-25 Years					
	Family labor	Hired labor	Male (@Tk. 600/man day)	Female (@Tk. 400man day)	Total labor	Total cost (Tk.)	Family labor	Hired labor	Male (@ Tk 600/man day)	Female (@ Tk 400/man day)	Total labor	Total cost (Tk.)
Land preparation	2	4	-	-	6	3600	-	-	-	-	-	-
Seed and sapling collection	3	-	1	2	3	1400	-	-	-	-	-	-
Sapling and seed planting	4	-	2	2	4	2000	-	-	-	-	-	-
Fertilizer application	1	-	1	-	1	600	-	-	-	-	-	-
Maintenance labor cost	9	-	9	-	9	5400	-	-	-	-	-	-
Harvesting	-	-	-	-	-	-	30	-	20	10	30	16000
Yearly garden cleaning	-	-	-	-	-	-	3	-	2	1	3	1600
Total cost per hectare	13	4	13	4	17	13000	33	-	22	11	33	17600
Total cost per tree						24.25						32.82