

## Structural Dynamics, Marketing Pathways and Economic Performance of Nepalese Tea: Comparative Analysis of CTC and Orthodox Segments

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### Abstract

Tea is one of the horticultural cash crops which considerably contributes to export revenues and rural livelihoods in Nepal. It can be broadly divided into two categories: Crush, Tear & Curl (CTC) and Orthodox, each of which has its own production system and market structures. This study presents an in-depth analysis of the structural dynamics, marketing pathways, and economic performance of both segments. Using the primary data collected from 106 tea industries operating in Jhapa and Ilam, the study explores ownership patterns, green leaf sourcing strategies, processing capacity, market orientation, and economic performance. The results reveal that CTC industries are largely estate-based and chiefly cater the domestic demand, while Orthodox industries depend more on smallholder farmers and are export-oriented. Despite such structural and marketing divergences, both types of industries experience underutilized processing capacity. To examine economic performance and comparative advantage, the analysis estimated the cost of production (CoP) and Domestic Resource Cost (DRC) ratios for both tea types. The evidence reveals that Orthodox tea is costlier to produce, but offers a greater comparative advantage in foreign markets, as reflected by a lower DRC ratio. This situation suggests that while cost competitiveness remains a challenge, Orthodox tea has great potential in the global market from a resource efficiency point of view. Conversely, CTC tea is comparatively cheap and shows weak export competitiveness. To sum up, the research highlights the dual nature of Nepal's tea economy, characterized by diverging pathways and market positioning, with implications for targeted policy support and strategic alignment based on comparative advantage.

**Keywords:** Comparative advantage, CTC tea, Domestic Resource Cost, Orthodox tea, and Trade competitiveness

### Introduction:

Recognized as a priority horticultural commodity, tea is one of the most important agricultural industries that generates employment, supports smallholders and earns foreign currency in Nepal. Nepalese tea industries primarily produce two types of tea-Crush, Tear & Curl (CTC) and Orthodox-for two different types of markets and follow distinct value chain paths (ITC, 2017). While

CTC tea produced in the eastern Terai region of Nepal caters chiefly to domestic demand, Orthodox tea grown in high hills is mostly destined for export, primarily to India and third-country markets (Kalauni et al., 2020). These divergent market trends create a need to explore how the two segments are positioned strategically in Nepal's tea economy.

In recent years, the tea industry in Nepal has been under increasing pressure to boost its competitiveness. This is largely due to shifting consumer preferences from traditional black tea towards healthier and specialty tea, which has resulted in a gradual rise in tea imports and growth in global competitiveness (Jaiswal et al., 2022; Wasti, et al., 2020). To ensure sustainability, it becomes essential to focus on market access, value addition, and strategic positioning of products in both local and international markets. In this scenario, the choice of marketing pathways and sales destinations is critical to determine how profitable and successful tea producers can be (Parmar et al., 2023).

Although these factors are becoming more important, there aren't sufficient empirical studies that investigate the marketing dynamics and economic performance of Nepalese tea. The majority of research works are concentrated on value chain analysis and marketing perspective of Orthodox tea (Mishra et al., 2020), ignoring the domestic dominance and untapped potentials of CTC, which contributes to over 71.16% of the total tea production in Nepal (NTCDB, 2025). This oversight is particularly significant while considering the different paths that CTC and Orthodox tea have taken on market development and policy support gaps.

This study aims to fill the gap by offering a comparative analysis of CTC and Orthodox tea, drawing on primary data gathered from tea processing units. The study specifically looks at structural dynamics, marketing pathways, sales destinations, and economic performance of both tea industries. By exploring these elements, the study aims to provide insights that can guide policies and development initiatives taken to enhance the market orientation and export promotion of the Nepalese tea industry.

## Materials and Methods:

### *Study area and coverage*

The research was carried out in two principal tea-producing districts of Nepal—Ilam and Jhapa, which produce 99.49% of the total tea produced in Nepal (NTCDB, 2025). While Jhapa is the major CTC tea-producing district, Ilam specializes in producing high-quality Orthodox tea. The study covered all 106 tea industries operating in the study area, comprising 37 CTC and 69 Orthodox, ensuring complete representation and avoiding sampling bias.

### *Data collection*

Primary data were collected using a pre-tested semi-structured questionnaire during June-September 2024. The questionnaire was designed to get quantitative and qualitative information on production, green leaves sourcing, sales, price, market destinations, channels, and cost structures. The reference values on production, sales, and price were collected for the Fiscal Year (FY) 2023/24. The survey team was trained to ensure consistency and minimize interviewer bias. Data were validated using cross-checks and follow-up interviews where necessary.

### *Data analysis*

Descriptive statistics, such as frequencies, percentages and cross-tabulations were used to investigate and compare the structural dynamics, marketing pathways, and competitive performance of CTC and Orthodox tea. Graphical representations and tables were created to summarize and present the data in a readily comprehensible form using Microsoft Excel 16 and SPSS (Version 26).

### *Classification of tea processing units based on the scale of production*

In order to classify tea processing units by their production scale, this study used quartile-based thresholds as adopted by Goswami and Chakrabarti (2012). We first looked at the annual production volumes for each tea type to see how they were distributed. Industries that produced below the first quartile (Q1) were labeled as small-scale, those between the second quartile (Q2) and the third quartile (Q3) as medium-scale, and those above Q3 were considered large-scale (Table 1).

### *Comparative analysis of economic performance*

The comparative analysis focused on key indicators that include Domestic Resource Cost (DRC) and Cost of Production (CoP) to compare the relative competitiveness and domestic resource use efficiency in the two tea segments.

The DRC coefficient is an analytical tool to measure the comparative advantage and trade competitiveness of commodities, especially in the agricultural sector. The coefficient determines the opportunity cost of domestic (non-tradeable) resources—land, labor, and capital—utilized in the production of a commodity in terms of net foreign exchange earned or saved (Gorton and Davidova, 2001). It indicates the efficiency with which

**Table 1.** Criteria for the classification of tea processing units based on production scale

Scale	CTC	Orthodox	Statistical Basis
Small	< 500,000 kg/year	< 20,000 kg/year	Below Q1
Medium	500,001–1,000,000 kg/year	20,001–100,000kg/year	Between Q1 and Q3
Large	>1,000,000 kg/year	>100,000 kg/year	Above Q3

domestic resources are used in generating value added at border prices. FAO (2009) estimated DRC as the ratio of the price of domestic factors of production to the value-added in international prices using the following equation:

$$DRC_{ij} = \frac{C_{ij}^d}{(P_{ij} - C_{ij}^f)}$$

Where,  $C_{ij}^d$  and  $C_{ij}^f$  measures the cost of domestic and foreign inputs respectively, for the country  $i$  producing product  $j$ ;  $P_{ij}$  represents price of the product. Here,  $P_{ij} - C_{ij}^f$  indicates the domestic value addition created by the production process. While analyzing the results, a DRC ratio less than 1 would indicate that country  $i$  has a comparative advantage in manufacturing product  $j$ . A lower DRC value indicates a stronger competitive advantage. Yercan and Isikli (2018) also adopted a similar approach while comparing the global competitiveness of horticultural products in Turkey.

In this study, the cost of domestic inputs included those resources that are produced or sourced within the country, such as green leaf, labor, bricket, electricity, transportation, maintenance cost, staff salary, communication, rent, and other expenses associated with insurance, audit, and banks. Similarly, the cost of

foreign inputs included those resources that are imported or sourced from other countries, such as coal, petroleum, lubricants, packaging material, and certification costs. Depreciation of machinery was also treated as foreign inputs, as the machines used for tea processing in Nepal are mainly imported either from India or China.

Similarly, CoP was computed by aggregating the total Variable Cost (VC) and total Fixed Cost (FC) incurred in made tea production. The VCs included expenses that varied with production volumes, such as the cost of green leaf procurement, labor wages (both permanent and seasonal), fuel and power, packaging, and transport while the FCs included expenditures that remained constant regardless of production levels, such as salaries of permanent staff, depreciation of machinery and buildings, interest on capital, and administrative overheads. Both costs were calculated on an annual basis and then standardized on a per kilogram of made tea to allow an easy comparison between the two segments.

## Results:

### *Structural and operational characteristics of tea industries*

Nepal's tea production revolves around two main types of plantation systems: large tea estates and smallholder farms, each playing a unique role in the CTC and Orthodox

**Table 2:** Structural and operational characteristics of CTC and Orthodox tea industries

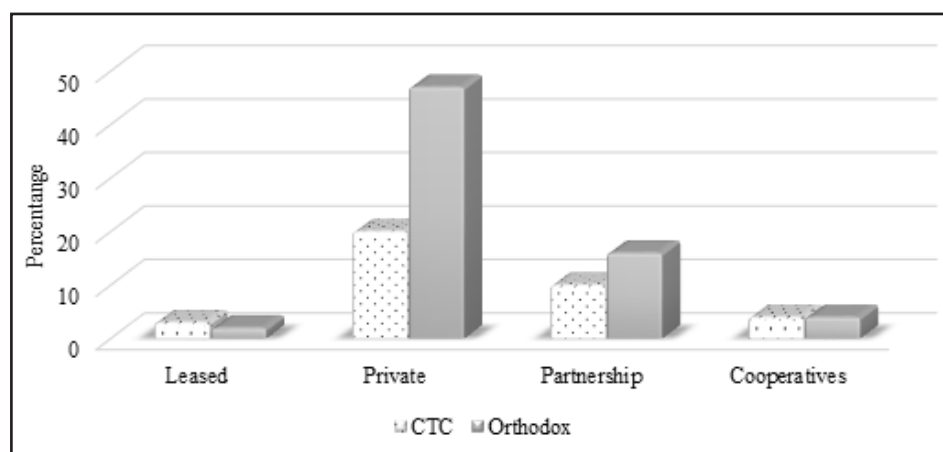
Characteristics	CTC	Orthodox	Combined
<b>Plantation area</b>			
No. of large tea estates	86 (70.49)	36 (29.51)	122
No. of small farmers	3,012 (28.25)	7,650 (71.75)	10,662
Large estates (ha)	5,700 (64.77)	3,100 (35.23)	8,800
Small farmers (ha)	4,680 (54.07)	3,975 (45.93)	8,655
Average land holding of small farmers (ha/farmer)	1.55	0.52	0.81
Average size of tea estate (ha/tea estate)	66.28	86.11	72.13
<b>District-wise frequency of tea industries</b>			
Ilam	1 (1.45)	68 (98.55)	69 (65.09)
Jhapa	36 (97.30)	1 (2.70)	37 (34.91)
Total	37 (34.91)	69 (65.09)	106 (100)
<b>Frequency of tea industries based on ownership type</b>			
Leased	3 (2.83)	2 (1.89)	5 (4.72)
Private	20 (18.87)	47 (44.34)	67 (63.21)
Partnership	10 (9.43)	16 (15.09)	26 (24.53)
Cooperatives	4 (3.77)	4 (3.77)	8 (7.55)
<b>Annual turnover</b>			
Total annual turnover (billion NRs)	3.86	3.19	7.05
Avg. turnover (NRs/tea factory)	104,261,081	46,268,696	66,511,321

Source: Field Survey, 2024

Note: Figures in parentheses represent percentages.

segments of the industry. Large tea estates are usually corporate-owned or managed plantations that operate on a commercial scale, often having a processing facility of their own. In contrast, smallholder farms are owned by individual farmers or a group, typically working with smaller plots of land and supplying green leaves to nearby industries. The survey results as illustrated in Table 2, show that the average size of landholding of the smallholder farmers was 1.55 ha for CTC and only 0.52 ha for Orthodox. In contrast, the average size of large estates was 66.28 ha for CTC and 86.11 ha for Orthodox.

Moreover, the large tea estates involved in the value chain amounted to 122, with 86 (70.49%) affiliated with CTC tea and 36 (29.51%) with Orthodox. On the other hand, smallholder farmers had a much higher involvement in Orthodox tea than in CTC. Out of 10,662 farmers; 7,650 (71.75%) were involved in Orthodox and the remaining 3,012 (28.25%) were involved in CTC. The total plantation area of large estates was 8,800 ha, with a larger segment under CTC (5,700 ha or 64.77%) compared to Orthodox (3,100 ha or 35.23%). Similarly, smallholders had plantation areas of 4,680 ha (54.07%) and 3,975 ha (45.93%) under CTC and Orthodox, respectively.



**Figure 1.** CTC and Orthodox tea industries categorized on the basis of ownership

With regards to processing facilities, the CTC tea industries are concentrated in Jhapa district (36 out of 37 units), while those of Orthodox are almost entirely in Ilam (68 out of 69 units). Interestingly, only one factory under the management of Nepal Tea Development

Corporation produces CTC tea at the foothills of Soktim, Ilam, making an exception for the Orthodox-dominated region. Similarly, another factory at Jhapa, which is conventionally known as the CTC tea-producing district, switched to Orthodox, targeting European markets.

Furthermore, there were variations in the ownership patterns across the two segments as illustrated in Figure 1. Private ownership is most prevalent for both CTC (18.87%) and Orthodox (44.34%). Partnerships, on the other hand, are a bit more common in Orthodox tea industries, with 15.09% compared to 9.43% in CTC. Interestingly, there were 3.77% cooperative-operated tea industries in each segment. Leased operations seem to be relatively uncommon in tea, with just 2.83% and 1.89% instances in CTC and Orthodox, respectively.

In terms of business transactions, the total turnover of all tea industries combined for the annual turnover of NRs 7.05 billion in the FY 2023/24. In this, CTC received a slightly higher share (3.86 billion rupees) compared to Orthodox (3.19 billion rupees). However, when we look at the average turnover per unit, CTC significantly surpasses Orthodox, with an impressive NRs 104.26 million compared to NRs 46.27 million for the Orthodox tea industries. This clearly shows that CTC production

has a scale advantage and a broader market reach. CTC industries usually run on a larger industrial scale and focus on high-volume sales, allowing them to take advantage of economies of scale, even at lower unit prices. On the other hand, Orthodox, which often commands higher prices for its specialty tea, typically operates on a smaller scale, leading to lower average turnover.

### ***Operational typology based on green leaf sourcing***

Since green leaf is the principal raw material in the tea industry, it plays a decisive role not only in the operational structure but also in the production cost, quality, reliability of supply, and ultimately competitiveness. On the basis of green leaf sourcing model, the tea processors

**Table 3.** CTC and Orthodox tea industries based on green leaf sourcing

Categories	CTC	Orthodox	Combined
Estate-based	7 (6.60%)	5 (4.72%)	12 (11.32%)
Bought-Leaf Factories (BLF)	13 (12.26%)	20 (18.87%)	33 (31.13%)
Mixed-model factories	17 (16.04%)	44 (41.51%)	61 (57.55%)
<b>Total</b>	<b>37 (34.91%)</b>	<b>69 (65.09%)</b>	<b>106 (100.00%)</b>

Source: Field Survey, 2024

Note: Figures in parentheses represent percentages.



**Table 4.** Production capacity, actual made tea production and capacity utilization

Category	CTC	Orthodox	Combined
No. of tea processing units			
Small	10 (34.48)	19 (65.52)	29
Medium	18 (50.00)	18 (50.00)	36
Large	9 (21.95)	32 (78.05)	41
Total	37 (34.91)	69 (65.09)	106
Annual processing capacity (kg/year)			
Small	4,450,000	251,500	4,701,500
Medium	15,600,000	1,065,000	16,665,000
Large	16,800,000	11,650,000	28,450,000
Total	36,850,000	12,966,500	49,816,500
Actual made tea production in FY 2022/23 (kg)			
Small	2,516,000	190,860	2,706,860
Medium	8,411,095	500,650	8,911,745
Large	8,299,696	7,060,420	15,360,116
Total	19,226,791	7,751,930	26,978,721
Capacity utilization (%)			
Small	56.54%	75.89%	57.57%
Medium	53.92%	47.01%	53.48%
Large	49.40%	60.60%	53.99%
Total	52.18%	59.78%	54.16%

Source: Field Survey, 2024

Note: Figures in parentheses represent percentages.

operating in Nepal can be classified broadly into three categories: i) Estate-based factories, ii) Bought-Leaf Factories (BLFs), and iii) Mixed model factories. The estate-based tea factories rely solely on green leaves produced at their own tea estates, while BLFs buy green leaves from tea growers, usually smallholder farmers. The mixed-model factories purchase the green leaves from both sources. While BLFs support rural livelihoods and incorporate farmers, they are likely to be affected by issues such as variations in the quality of green leaves, limited control over the inputs, and traceability challenges for quality control.

A review of green leaf sourcing models, as presented in Table 3, reveals that the majority of Nepalese tea industries follow the mixed model. This model constitutes more than half of the total production (57.55%), with Orthodox tea exhibiting a significantly higher adherence to this model (41.51%) than that of CTC (16.04%). The BLF is the second most prevalent sourcing pattern, where processing units procure green leaves exclusively from smallholder growers. The pattern is slightly more prevalent in the Orthodox segment (18.87%) than in the CTC (12.26%), reflecting the central contribution of small growers in the Orthodox tea value chain.

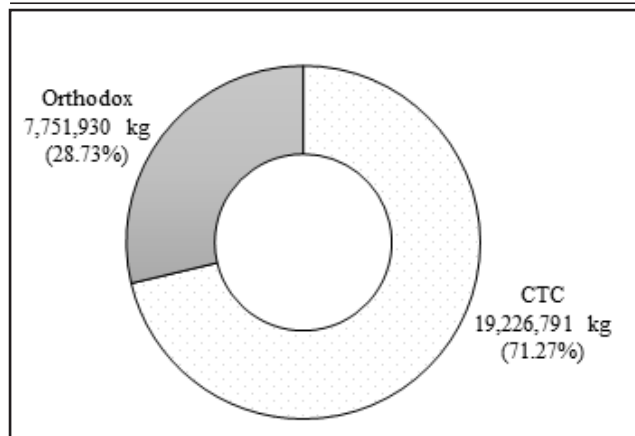
#### ***Production capacity, actual production and capacity utilization***

Nepalese tea processing units are highly heterogeneous

with regard to their size of operation, and this significantly affects their processing capacity as well as their efficiency. According to the quartile-based classification, the industry has 29 small-scale, 36 medium-scale, and 41 large-scale processing units. From the distribution point of view, Orthodox units dominate the large-scale sector (78.05%), CTC and Orthodox units are equal in the medium-scale sector (50%). It is important to note that the classification into small, medium and large scales was based on different production thresholds, varying significantly among CTC and Orthodox industries, as already explained in Table 1.

In terms of processing capacity, CTC categorically dominates Nepal's tea industry in processing infrastructure. The annual processing capacity of the CTC totals 36.85 million kg, which is nearly three times greater than that of Orthodox (12.97 million kg). Although there is a higher number of Orthodox industries (69 compared to 37 in CTC), the CTC industry commands more than 74% of the country's total tea processing capacity.

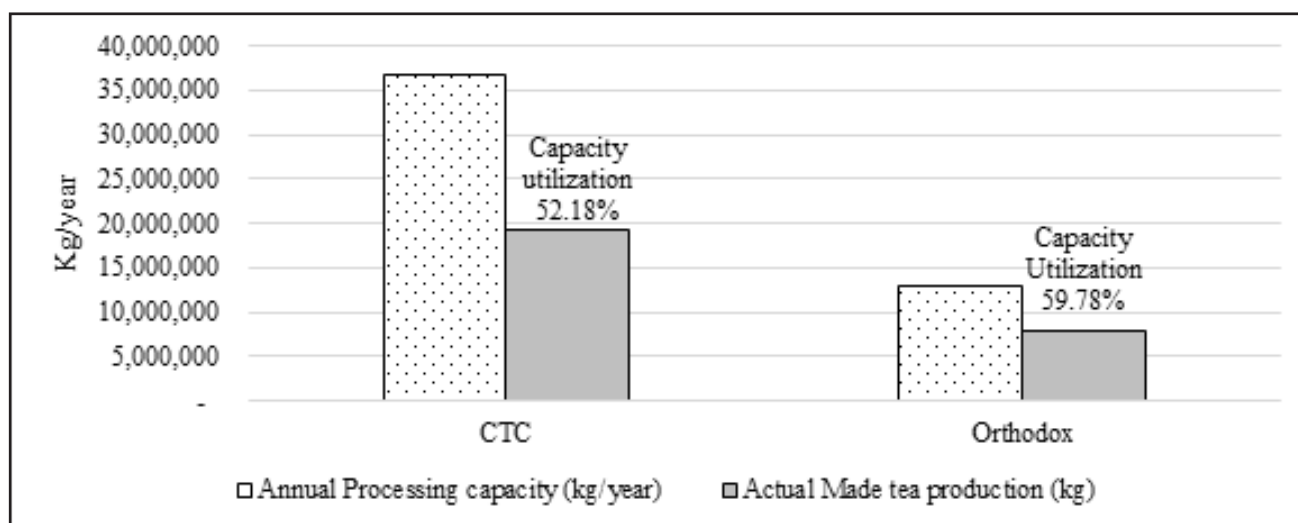
This size difference directly correlates to the actual made tea production. In FY 2023/24, CTC tea industries produced 19.23 million kg of made tea, accounting for approximately 71% of the national production, while those of Orthodox produced only 7.75 million kg, contributing 28.73% only (Figure 2). This division reflects the different structures of the two segments:



**Figure 2.** Production of CTC and Orthodox tea in FY 2023/24

operating to their full potential. The reason for this underutilization seems to be the lack of green leaf supply, which limits production despite a higher capacity of the industries.

The low supply of green leaves is largely due to seasonality in tea production and scattered smallholder farming. The majority of smallholders cultivate on under one hectare of land and depend mostly on rain-fed conditions, leading to enormous seasonal fluctuations in leaf supply. During the winter season, the plucking of green leaves stops, resulting in underutilization of factory capacity. Additionally, pest infestations periodically reduce the productivity of tea plants. Mismatch between



**Figure 3.** Production efficiency of CTC and Orthodox tea

**Table 5.** Production, sales values and average price of CTC and Orthodox tea

Particulars	CTC	Orthodox	Combined
Total production (kg)	19,226,791 (71.27)	7,751,930 (28.73)	26,978,721 (100)
Total Sales (NRs)	3,698,850,053	3,689,681,312	7,388,531,365
Average price (NRs/kg)	192.38	475.97	273.87

Source: Field survey, 2024

Note: Figures in parentheses represent percentages.

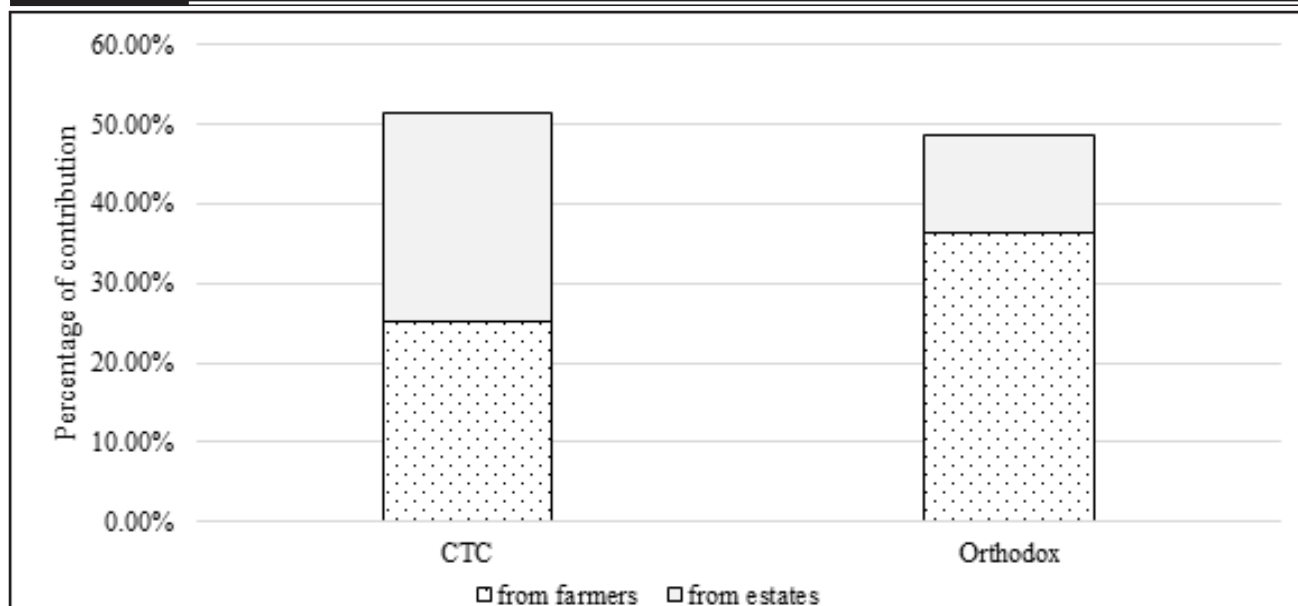
CTC tea industries are typically larger and industrial-scale operations, whereas Orthodox are smaller in scale, reflecting their focus on specialized and value-added markets.

Interestingly, when we look at the capacity utilization—measured as the ratio of actual production to that of processing capacity—we can see that Orthodox units are performing better at 59.78% compared to CTC units, which sit at 52.18% (Figure 3). When combined, the overall capacity utilization for all tea industries stood at 54.16%. This figure indicates that, on average, nearly half of the installed processing capacity in the Nepalese tea industry remains underutilized. Comparatively, Orthodox processors are making the most out of their installed capacity, as many CTC factories are not

rising processing capacity and decline in plantation area in recent years, especially in the CTC-based plains, is another cause. Smallholders also sell green leaves to competing industries, offering slightly higher prices, leading to irregular supply to individual processors. Collectively, these inefficiencies at the market and production levels constrain the normal supply of green leaves and thereby reduce the capacity utilization of Nepalese tea industries every year.

### *Sourcing of green leaf*

There is a significant contribution of smallholder farmers in green leaf supply (61.37% of the total) for processing. As illustrated in Figure 4, the Orthodox tea industries get 36.26% of the green leaf from farmers and only 12.39% from tea estates. However, the proportion of green leaf



**Figure 4.** Contribution of farmers and estates in supplying green leaves for made tea production

supply to CTC factories is relatively balanced, 25.12% by farmers and 26.24% by tea estates. These statistics confirm the under-utilization of production capacity, which is closely tied to the fluctuations in green leaf supply, specifically from the large networks of small growers.

#### ***Sales values and average prices***

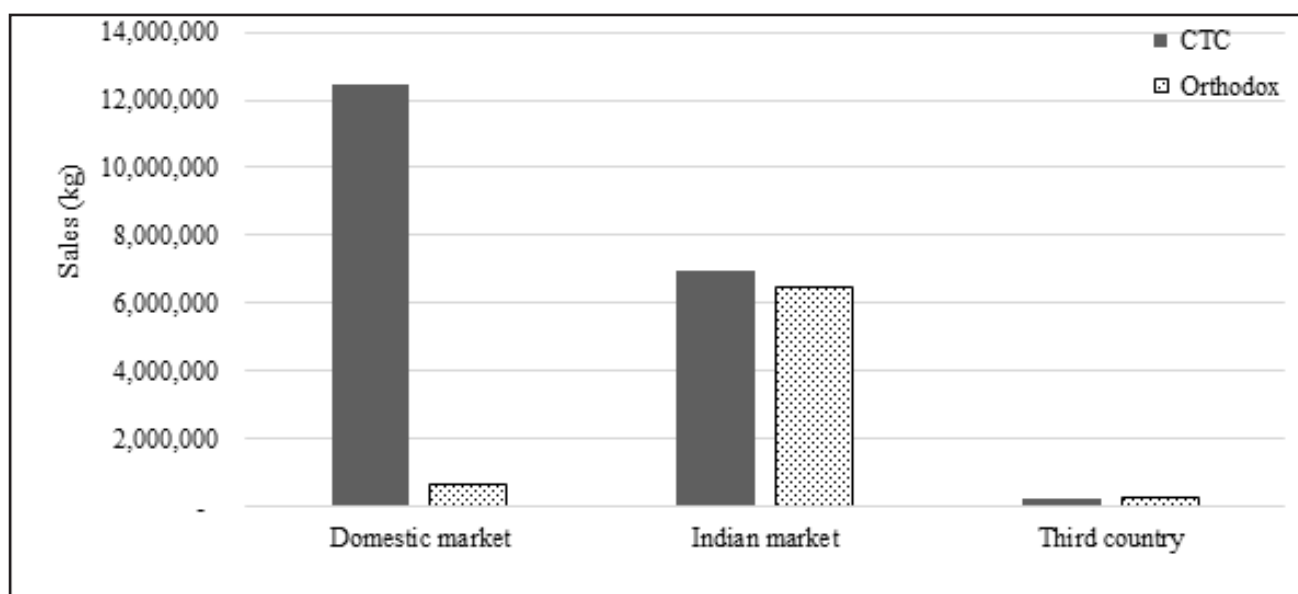
Even though Orthodox tea constitutes a smaller percentage of the total production (i.e., 28.73%), its contribution to the total sales value is higher than that of CTC tea (Table 5). In FY 2023/24, CTC tea generated sales revenue of NRs 3.65 billion, while Orthodox tea generated as high as NRs 3.69 billion. This difference is mostly driven by the variation in average sales price. While CTC tea was sold at an average price of NRs 189.91 per kg, Orthodox tea commanded an average rate of NRs 475.97 per kg. These figures indicate the

premium market positioning of Orthodox tea.

#### ***Destination-wise sales quantity***

The market of Nepalese tea can be divided into three categories: domestic, Indian, and third country (Table 6). As presented in Figure 5, a significant proportion of CTC tea (46.06% of total production) is consumed in the domestic market. On the contrary, only 2.35% of Orthodox tea is internally consumed, indicating its narrow domestic reach and concentration in the export market. India, being our major trading partner, consumed one-fourth of both types of tea. Third-country exports, i.e., beyond India, remain very low, i.e., less than 1% each of both types. The data suggest significantly untapped potential in high-value export markets, particularly for Orthodox tea, which is considered to be targeted for specialty and premium markets.

#### ***Domestic marketing channel***



**Figure 5.** Destination-wise sales (kg) of CTC and Orthodox tea in FY 2023/24

**Table 6.** Destination-wise sales (kg) of tea in FY 2023/24

Destination	CTC	Orthodox	Combined
Domestic market	12,425,986 (46.06)	633,631 (2.35)	13,059,616 (48.41)
Indian market	6,940,409 (25.73)	6,477,346 (24.01)	13,417,755 (49.73)
Third country	250,000 (0.93)	251,350 (0.93)	501,350 (1.86)
Total	19,616,395 (72.71)	7,362,326 (27.29)	26,978,721 (100.00)

Source: Field survey, 2024

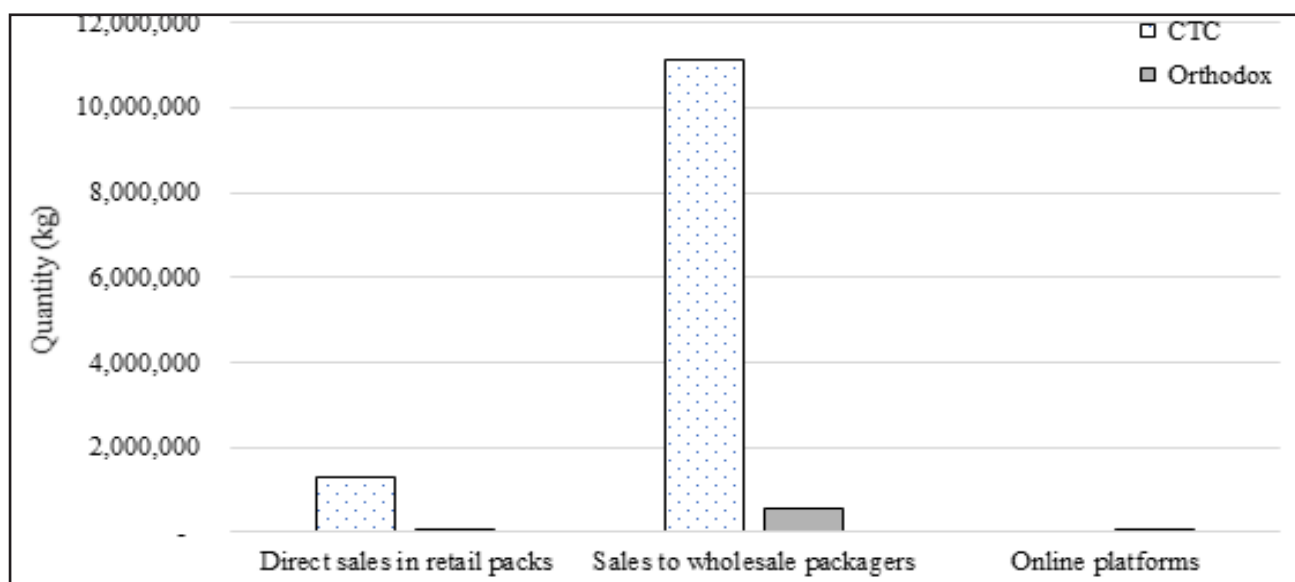
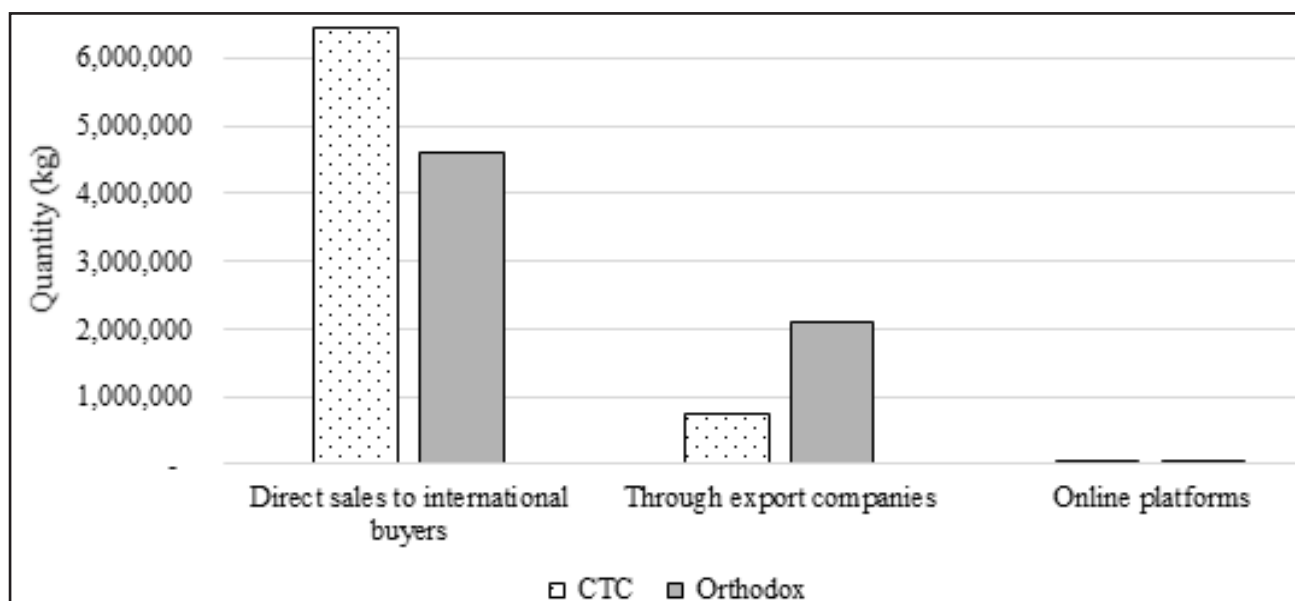
Note: Figures in parentheses represent percentages.

**Table 7.** Quantity of tea (in kg) distributed through different domestic marketing channels

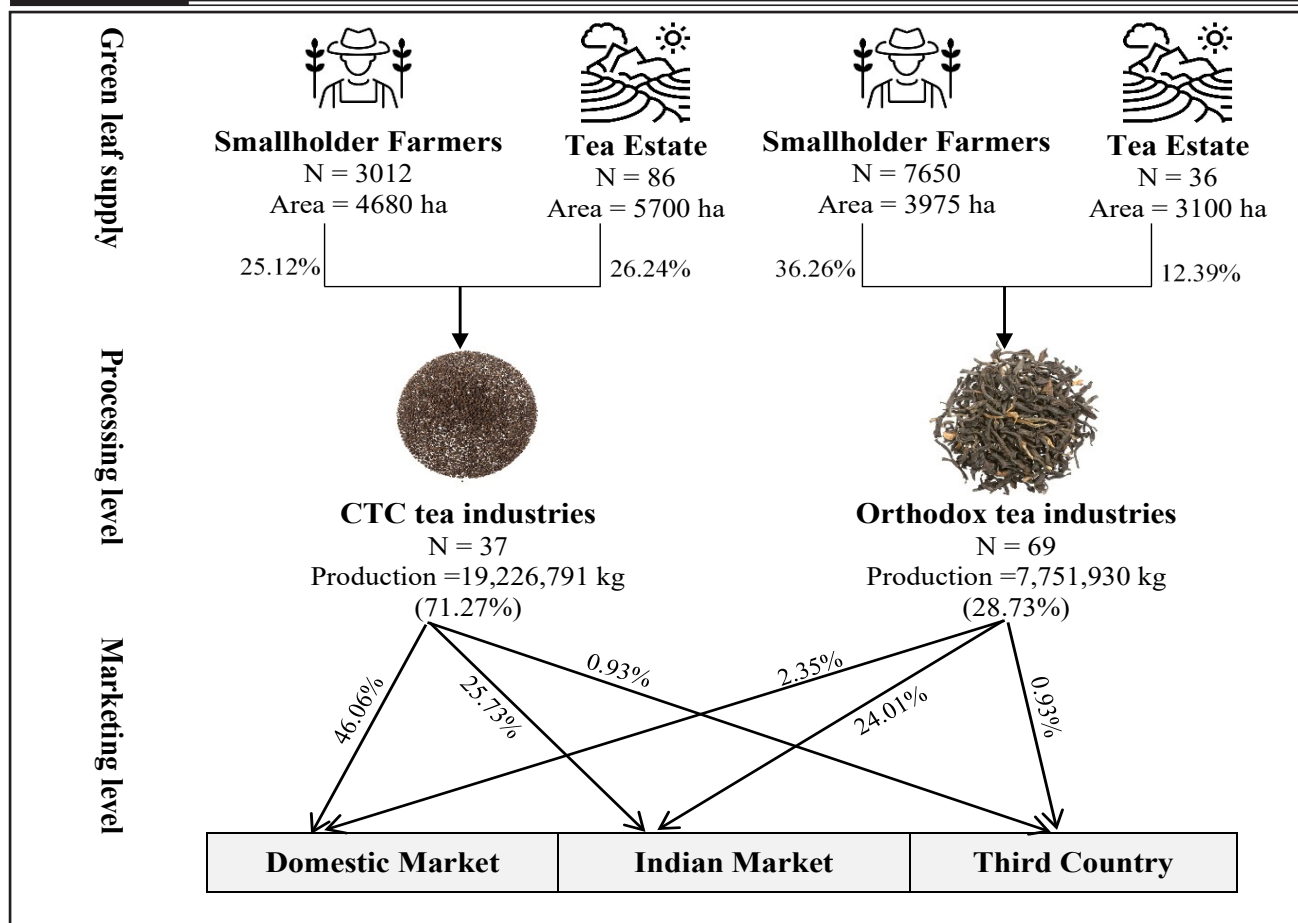
Marketing Channel (Domestic)	CTC	Orthodox	Combined
Direct sales in retail packs	1,279,850 (9.80)	85,893 (0.66)	1,365,743 (10.46)
Sales to wholesale packagers	11,146,136 (85.35)	543,538 (4.16)	11,689,674 (89.51)
Online platforms	-	4,200 (0.03)	4,200 (0.03)
Total	12,425,986 (95.15)	633,631 (4.85)	13,059,616 (100.00)

Source: Field survey, 2024

Note: Figures in parentheses represent percentages.

**Figure 6.** Distribution of tea through various channels in the domestic market**Figure 7.** Distribution of tea exports through various marketing channels





**Figure 8.** Marketing pathway of CTC and Orthodox tea: From leaves to the market

Source: Author's own illustration based on field survey (2024)

The domestic sales of Nepalese tea are dominated by the wholesale packagers (Table 7). As presented in Figure 6, 89.51% of domestic sales are done through wholesale packagers (85.35% CTC and 4.16% Orthodox), compared to 10.46% in retail packs (9.80% CTC and 0.66% Orthodox). Nominal quantity (0.03%) of Orthodox tea is also sold online. This reflects limited digital market penetration in the face of increasing e-commerce activities in Nepal. This implies that tea predominantly enters the domestic market as a bulk product, often blended and rebranded under various local brands.

### Export marketing channels

With regards to the export market, 79.30% of Nepalese tea (46.23% CTC and 33.07% Orthodox) is exported via direct sales to international buyers (Table 8). It indicates a high inclination and capacity of processors to find and maintain their own international buyers without relying excessively on exporting agents. However, Orthodox tea exporters appear to rely on export companies to some extent. In comparison to 5.30% of the CTC tea, they sell 15.11% of the Orthodox tea through these companies. This may be an indication of the need for facilitation by exporting agents in reaching niche markets, which require compliance with various quality standards and logistical support. While online channels seem to be

unexplored, representing only 0.28% of the total exports, there is a huge potential for expansion, especially for Orthodox tea, which can tap the specialty markets.

### Marketing pathways

The marketing pathway of Nepalese tea is summarized in Figure 8. It begins with the sourcing of green leaves, which are bought from the industry's own estates (26.24% for CTC and 12.39% for Orthodox) and smallholder farmers (25.12% for CTC and 36.26% for Orthodox). These green leaves are brought to the processing center and are then processed into made tea. The processed tea is supplied to various marketing channels. A significant proportion of CTC tea is sold in the domestic market (46.06%), while some find their way to India (25.73%) and third countries (0.93%). Orthodox tea, on the other hand, is predominantly exported: 24.01% to India and 0.93% to third countries.

### Comparative analysis of resource competitiveness

DRC results provide a quantitative estimate of the Nepalese tea industry's comparative advantage using the primary cost structures and average price realized. As presented in Table 9, the DRC coefficient for CTC tea is 0.87, while that for Orthodox is slightly lower at 0.84. Since both values are less than 1, it indicates that both

categories of tea possess a comparative advantage in international trade. This implies that Nepal uses domestic resources more efficiently than the foreign exchange saved or earned from tea exports after accounting for the cost of foreign inputs.

However, the lower value of DRC of Orthodox tea (0.84) suggests that it is relatively more competitive than CTC tea (0.87). This higher competitiveness of Orthodox tea can be attributed to its much higher market price (NRs 475.97/kg) compared to CTC (NRs 192.38/kg). Orthodox tea commands a premium price in specialty

Table 9. DRC analysis of CTC and Orthodox tea

	Particulars	CTC	Orthodox
<b>A</b>	<b>Cost of Domestic Resources (NRs/kg)</b>		
1	Green Leaf	95.35 (56.16)	247.04 (60.61)
2	Labor	19.73 (11.62)	44.23 (10.85)
3	Firewood	13.29 (7.83)	32.16 (7.89)
4	Bricket	1.71 (1.01)	0.42 (0.10)
5	Electricity	5.81 (3.42)	15.23 (3.74)
6	Transportation	1.81 (1.06)	5.97 (1.46)
7	Staff salary	2.14 (1.26)	2.97 (0.73)
8	Communication	0.11 (0.06)	2.14 (0.53)
9	Rent	0.42 (0.25)	0.41 (0.10)
10	Maintenance	1.27 (0.75)	5.61 (1.38)
11	Bank Interest	8.03 (4.73)	1.98 (0.48)
12	Bank Charges	0.06 (0.03)	0.15 (0.04)
13	Insurance	0.37 (0.22)	1.23 (0.30)
14	Audit	0.19 (0.11)	0.52 (0.13)
15	Other costs	2.11 (1.24)	2.55 (0.63)
	Subtotal (C <sup>d</sup> )	152.40 (89.75)	362.61 (88.97)
<b>B</b>	<b>Cost of Foreign Resources (NRs/kg)</b>		
1	Coal	3.78 (2.22)	3.22 (0.79)
2	Petroleum	5.26 (3.10)	19.29 (4.73)
3	Lubricants	2.42 (1.43)	2.44 (0.60)
4	Packaging material	3.02 (1.78)	6.95 (1.71)
5	Certification cost	0.00 (0.00)	9.97 (2.45)
6	Depreciation of machinery	2.92 (1.72)	3.06 (0.75)
	Subtotal (C <sup>f</sup> )	17.40 (10.25)	44.94 (11.03)
	<b>Total Cost of Production (NRs/kg)</b>	169.80 (100.00)	407.55 (100.00)
	Average price (P)	192.38	475.97
	<b>DRC = C<sup>d</sup> / (P - C<sup>f</sup>)</b>	0.87	0.84

Source: Field survey, 2024

Note: Figures in parentheses represent percentages.

and niche markets.

By cost structure, domestic resources account for 89.75% and 88.97% of the total production cost for CTC and Orthodox tea, respectively, reflecting the dominance of local inputs such as green leaves, labor, and firewood. Notably, green leaves, which are the major raw materials in the tea industry, alone account for 56.16% in CTC and 60.61% in Orthodox tea production cost. The share of foreign or tradable inputs like petroleum, coals, packing materials, certification, and depreciation of machinery is quite small but not negligible, especially in Orthodox tea, where the cost of certification (NRs 9.97/kg) significantly adds to the foreign cost component.

### Cost of production

Looking into the details of the CoP, the CTC and Orthodox tea segments exhibit a significant variation with respect to economic structures shaped by their respective inputs and market positioning. While the CoP for CTC was Rs169.97/kg, the Orthodox tea was produced at the cost of Rs 407.87/kg, which is more than double the cost of its CTC counterpart (Figure 9).

This variance in CoP is largely shaped by the differences in the variable cost (VC) and fixed costs (FC), as illustrated in Table 10. The total VC, which includes the cost of green leaves, labor, etc., dominates the entire cost structure in both segments and accounts for NRs 152.28/kg (89.60%) in CTC and NRs 377.29/kg (92.50%) in Orthodox tea. Green leaf accounts for over 56.10% of the total CoP in CTC and 60.57% in Orthodox. Moreover, the total FC, which includes salary and other administrative costs, is relatively lower but still considerable and accounts for NRs 17.68/kg for CTC and NRs 30.58/kg for Orthodox.

Table 10. Cost of production of CTC and Orthodox tea

	CTC	Orthodox
Total Variable Cost (VC)	152.28 (89.60)	377.29 (92.50)
Total Fixed Cost (FC)	17.68 (10.40)	30.58 (7.50)
Total CoP	169.97 (100)	407.87 (100)
Average price	192.38	475.97

Source: Field survey, 2024

Note: Figures in parentheses represent percentages.

Although the cost of production is higher, Orthodox tea commands a significantly superior average market price of NRs 475.97 per kg compared to NRs 192.38 per kg for CTC. This cost-price relationship shows that while Orthodox tea is more expensive to produce, it also fetches a higher value, mainly because of its positioning in high-end niche markets. The CTC tea is sold in the mass market and therefore must compete largely on cost management and efficiency.

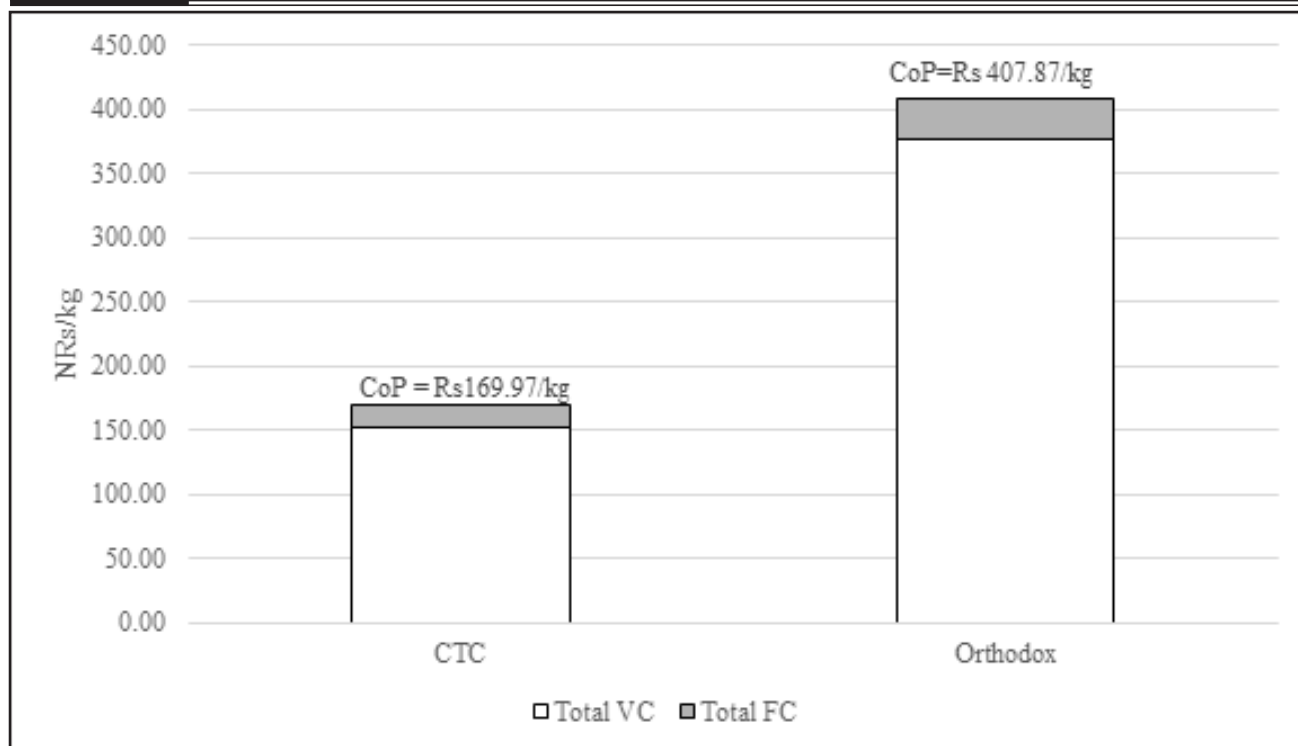


Figure 9. Cost of production of CTC and Orthodox tea

## Discussion:

### *Structural differences and implications for scale*

The analysis identified a clear structural variation between Orthodox and CTC tea segments in Nepal, with the CTC being predominantly estate-owned and operating on a larger scale and the Orthodox being more scattered and smallholder-based. This is consistent with tea-producing countries in South Asia, where large estates dominate high-capacity CTC, while Orthodox tea industries rely on decentralized small growers (Baruah, 2015; Zohora and Arefin, 2022). The advantage of scale, as observed in CTC, is reflected in higher turnover and scale economies, validating comparative advantage theories where capital-intensive production benefits from scale efficiency (Schumacher & Marsh, 2003).

### *Processing capacity, efficiency, and leaf supply*

Despite larger processing capacity, nearly half remains underutilized due to the shortages of green leaves, resembling other instances in India where the shortage of green leaves reduces the capacity utilization of tea industries (Rudra, 2018; Kumar, 2024). The estimated average production capacity of ~54% corresponds to studies on African smallholder tea estates that record potential production gains by improving technical efficiency (Katungwe et al., 2017). These trends indicate that enhancing the farmer–factory relationship and consistent leaf supply can substantially improve efficiency without major investment in capacity expansion.

### *Market orientation and value chain*

The research shows that CTC tea is marketed to internal and Indian markets, while Orthodox tea is targeted for foreign markets, though actual third-country exports remain low. This aligns with the findings that Orthodox tea is sold at premium prices, though the benefits are often tempered by certification costs, quality variation, and limited buyer access (Baruah, 2015; Zohora and Arefin, 2022). The cost-price premium points out that while Orthodox tea enjoys higher farm-gate prices, export logistics, and certification tend to reduce net gains (Qiao et al., 2015). Comparative value chain analysis of Nepalese tea demonstrates how quality parameters determine success in exports (Mohan, 2016).

### *Competitive advantage: cost structure and DRC*

Each of the two tea segments exhibited DRC values less than 1 (CTC = 0.87; Orthodox = 0.84), which indicates productive efficiency and comparative advantage in both types of tea. Orthodox tea's relatively lower DRC indicates a higher comparative advantage, due to its premium price, although produced at a higher cost. This aligns with comparative advantage theory where factors of production (land, labor and capital) and export orientation shape competitive positioning (Banerji and Donges, 1974; Yercan and Isikli, 2018).

### *Sourcing models: Equity and risk*

The mixed sourcing models for the green leaf are dominant, with notable dependence on smallholder farmers (60%). This dependence is not unusual in South Asia, as smallholders supply their harvest to the tea

industries but lack bargaining power and formal contracts (Uttiya and Kaushik, 2022). Evidence from Assam proves that inequality in buyer-seller relationships hurts the livelihoods of growers and has an impact on the consistency of green leaf quality. In Nepal, institutional studies also indicate that smallholders receive lower revenues due to differentiated quality, weak contracting, and limited market access (Mohan, 2016).

### **Policy and institutional preconditions for growth**

The analysis emphasizes the need for institutional interventions, such as stronger farmer organizations, cooperative structures, and market infrastructure, for improved production efficiency and equitable value distribution. Cooperative knowledge sharing in Sri Lanka practically showed that organized farmers had better bargaining power and better price realization (Winslow, 2002). In Nepal, limited quality awareness and challenges in maintaining traceability emphasize the need for quality standards and organic credibility for unlocking new markets (Mohan, 2016).

### **Conclusion:**

The study offers an in-depth analysis of the structural dynamics, marketing pathways, and economic performance of Nepal's two tea segments—CTC and Orthodox—based on empirical evidence from the primary data collected from 106 tea processing units. The findings highlight the distinct differences in operating structures, market dynamics, and economic performance of both segments, which reflect the dualistic nature of the Nepalese tea industry.

CTC tea industries are predominantly large-scale, estate-based, and domestic market-focused. Their marketing channels are relatively concentrated, with a common dependence on bulk sales through national traders. While CTC processors benefit from their larger economies of scale, their market extension is confined to lower-value segments with limited product differentiation. In contrast, Orthodox tea processors are more export-oriented, small-scale, and more closely linked to smallholder farmers. Their marketing pathways are relatively diversified, with a large proportion of sales to overseas markets.

Furthermore, the comparative analysis of the cost structures and economic performance revealed that both segments differed substantially. Although Orthodox tea featured a higher CoP, it exhibited a better DRC ratio compared to CTC tea, reflecting a stronger comparative advantage in the export markets. Conversely, while CTC tea has lower production costs due to economies of scale, it reflects a comparatively weaker DRC ratio, indicating poorer export competitiveness. These findings indicate that Orthodox tea might be more costly to produce, but it is more valuable in terms of resource utilization and

trade performance.

To sum up, the study emphasizes the heterogeneity of the Nepalese tea industry and the need for segment-specific policy support. For Orthodox tea, priority should be placed on maintaining quality and supporting certification schemes. For CTC, priority should be placed on building domestic value chains and targeting new export markets. These results provide a valuable empirical basis for stakeholders and policymakers looking to improve competitiveness and market performance in Nepal's evolving tea sector.

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### **Declaration of conflict of interest and ethical approval:**

Planning of studies, execution of studies, data collection, writing of the initial draft, and revision were done by G. Luitel. Similarly, H.K. Panta and K.C. Dahal were responsible for the conceptualization of the research and interpretation of results. T.P. Bhusal and K.P. Timsina were involved in statistical analysis. All the authors have read the manuscript before submitting it to the Nepalese Horticulture journal and declare that there is no competing interest regarding the manuscript. The research involves the participation of human respondents, mostly managers of the tea industries, who were informed that their responses would be kept confidential.

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