



# ANALYSIS OF THE LOGISTICS COST OF CEYLON TEA SUPPLY CHAIN: A STUDY ON SMALL SCALE TEA FACTORIES IN YATINUWARA

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## ABSTRACT

The tea supply chain is one of the oldest supply chains in Sri Lanka. It provides a significant contribution to balance tea demand and supply. However, Sri Lanka's share of world tea production and world export is gradually decreasing. The twin goals of cost reduction and service enhancement can be achieved through effective management of logistics activities. Therefore, the study carries out to calculate the logistics cost in the tea supply chain based on five small scale tea factories in Yatinuwara. The logistics cost in the tea supply chain was analyzed by transport cost, warehouse cost, and package cost. The study found that transport cost has occupied half of the total logistics cost in the tea supply chain in Sri Lanka. Warehouse cost was the lowest cost component of the total logistics cost. The portion of the labour cost is very high for all the logistics activities in the tea supply chain. The contribution of the logistics cost to the overall tea production cost remains at one-digit percent among the small-scale tea factories in Sri Lanka.

**Keywords:** Logistics cost, Tea supply chain, Ceylon tea, Supply chain management, Logistics management, Sri Lanka

## INTRODUCTION

Cultivation of tea under the brand name of *Ceylon tea* began in the decade of 1870 by the British and now it has become the largest export earner and employer for Sri Lanka. The tea industry in Sri Lanka brings over one billion dollars as the foreign exchange to the country and provides direct and indirect employment opportunities to around 1.5 million people. Tea has remained the most important crops in the country's agricultural landscape. Sri Lanka is the world's fourth-largest producer of tea. Presently, the total area of tea production is around 222,000 hectares with the classification of three elevation categories namely high grown, medium grown, and low grown. Sri Lanka currently produces mainly black tea, green tea, instant tea, bio tea, and flavored tea. Sri Lanka is the world's largest producer of orthodox tea. In the highly competitive global marketplace, the pressure on organizations to find new ways to create and deliver value to customers grows ever stronger. There is a growing recognition that through effective management of logistics, the twin goals of cost reduction and service enhancement can be achieved. The tea supply chain is one of the oldest supply chains in Sri Lanka. It provides a significant contribution to balance tea demand and supply. However, Sri Lanka's share of world tea production and world export is gradually decreasing.

These are the signs of losing competitiveness in the global tea market. Tea production in Sri Lanka reached its peak in cost of production in recent years due to wage hikes and other essential overheads in plantations.

At present, the tea production cost is at the highest among the main tea producing countries at Rs. 575 per kilogram and the cost was Rs. 450 per kilogram in 2015. Therefore, planters are experiencing a loss of Rs.80 to Rs.100 per kilo (Perera, 2015). The rising cost of production on the plantations and smallholder tea factories could hinder the growth of the tea production sector. According to figure 1, the total cost per kilo had continuously increased. In 2014/15 cost per kilogram was identified as 478.23 but in 2015/16, 2016/17, and 2017/18 cost per kilogram was constantly increased.

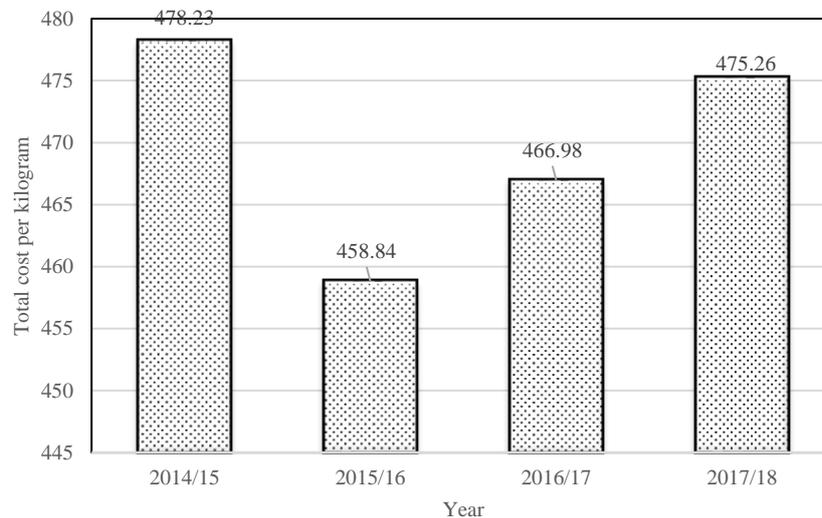


Figure 1: Tea production cost per kilogram  
Source: Department of Census and Statistics (2018)

As a result of inflation, the cost of production of tea has continued to rise during the last few years. This is mainly due to the rising prices of all inputs such as labor, power, fertilizers, and pesticides. The average cost of production of tea during the period 2010-2014 has risen from Rs.390 /kg in 2010 to Rs.434 in 2014. (Perera, 2014). Today Ceylon tea has faced different kinds of challenges because Sri Lanka is losing tea market power amongst the main tea importing countries. Therefore, Ceylon tea production must move to a new path and achieve cost-effectiveness as well as sustainability.

Involvement of logistics management is of paramount importance for achieving sustainability. Logistics refers to the overall process of managing and how the resources are acquired, stored, and transported to their destination (Kenton, 2019). Involvement of logistics cost must be minimized because the logistics cost is directly linked with the cost of production and final tea price as well. The tea supply chain has several nodes: growing, picking, withering, rolling, fermenting, drying, blending, packing, and storing. The tea supply chain is then developed further by distributing this essential product worldwide (Cooke, 2017). There are different kinds of costs within the tea supply chain and those costs affect the Ceylon tea price as well as global competitiveness. Supply chain network design with a powerful modeling approach can deliver a significant reduction in supply chain cost and improvements in service levels (Balaji & Kumar, 2013). The main logistics costs in the tea supply chain can be identified as warehousing cost, transport cost, and packaging cost. An effective supply chain management minimizes cost, waste, and time in the production cycle.

## LITERATURE REVIEW

### *Cost of Transport*

Transport cost is usually the largest single cost expenditure in most logistics operations (Bowersox, 2008). Transportation is the operation area of logistics that geographically moves and positions inventory (Bowersox, 2008). Transportation requirements can be satisfied in three basic ways: cost, speed, and consistency (Bowersox, 2008). In the 18th century, the British cultivated tea and coffee in Kandy area but there were issues regarding transport facilities. Therefore, they built roads and railways to transport their production to Colombo more conveniently. The expenses a company incurs when it transports its inventory or other assets to another location may pass to the customer, spread across all products, or may simply absorb by the producer (Financial Dictionary, 2012). Most of the time, transport cost is passed on to the customer and the price of goods continues to rise (Murray, 2015).

Transport cost is a function of the type of goods that need to be transported. The mode of transportation for a perishable good will be different from an imperishable good. Tea transportation is one of the essential logistics operations in the tea supply chain and the transportation should be completed within regular time because tea quality can damage. The quality of tea would decide the final tea price. Therefore, tea factories must choose the most suitable transport mode. Use of the railway system as a mode of transportation aimed at reducing congestion on the roads and cutting down on the travel time. Around 1200 truckloads per week come to Colombo for tea auctions from the plantations (Wettasinghe, 2015). During the last four years, transport cost had increased in a noticeable amount. That was the main reason for the total cost of production per tea kilogram to be increased.

### *Cost of Warehouse*

A warehouse has traditionally been viewed as a place to hold or store inventory. However, in contemporary logistics systems, warehouse functionality is more properly viewed as mixing inventory assortments to meet customer requirements. Adding a warehouse in a logistics system reduces overall transport cost by an amount greater than the required investment and operation cost. Four basic economic benefits of a warehouse are consolidation and break-bulk, sorting, seasonal storage, and reverse logistics (Bowersox, 2008). An important goal in warehousing is to maximize flexibility. Flexibility is facilitated by information technology. Technology has influenced almost every aspect of warehouse operation by creating new and better ways to perform storage and handling (Chandrasekera, 2019).

### *Cost of Package*

All materials used in tea packaging are certified to keep the product fresh and secure during transport and distribution (Jafferjee & Sons, 2019). Different tea grades are packed into different weight categories. The most popular bulk tea packaging types are 5ply lined corrugated cartons and large multi walled paper sacks. Quality is one of the most important factors to be maintained when packaging. Bulk tea bags are common package types. Tea sacks have 3 Ply, 4 Ply, are 5 Ply paper with an inner foil lining to maintain the freshness (Jafferjee & Sons, 2019). Each packaging type has its components that affect the overall cost of packaging. Some of these components are design and prototype work, materials, tooling, set up fees, testing, labor, volume, freight, and shipping (Velarga, 2017). Not all the costs in packaging operation are visible. As much as 90 percent of them are hidden. Storage costs, transport costs, damage, and returns, and administration costs are not visible (MacFarlane Packaging, 2017).

## METHODOLOGY

The study was conducted among five active small scale tea factories registered with the Sri Lanka Tea Board in Yatinuwara area. Both primary and secondary data were collected for the research study. Observation and interview methods were used for primary data collection. The research study utilized factory monthly account data. The main purpose of this research study was to estimate the logistics cost of the Ceylon tea supply chain up to the Colombo tea auction.

$$\text{Logistics cost} = \text{Cost of warehouse} + \text{Cost of package} + \text{Cost of transport}$$

### Transport cost

Many variables determine the final transport cost such as payment to drivers, cost per container, road taxes, tolls, fuel, and maintenance fees (Hooper & Murray, 2018). The authors calculated transport costs based on fuel, tires, maintenance, labor, and outsourcing cost.

$$\text{Transport cost} = \text{Fuel cost} + \text{Tire cost} + \text{Maintenance cost} + \text{Labor cost} + \text{Outsourcing cost}$$

$$\text{a) Fuel cost per kilo} = \left[ \frac{d}{k} \times i \times m \div h \right]$$

d = distance covered per day, k = kilometers per fuel liter, i = cost per liter, m = number of vehicles, h = number of kilograms per day

$$\text{b) Tire cost per kilo} = \frac{(e \times t)}{h}$$

e = cost of tire, t = number of tires, h = number of kilograms per month

$$\text{c) Maintenance cost per kilo} = \frac{q+w}{h}$$

q = service cost per month, w = repairs cost per month, h = number of kilograms per month

$$\text{d) Labor cost per kilo} = \frac{b \times u}{h}$$

b = salary per day, u = number of workers, h = number of kilograms per day

$$\text{e) Outsource cost per kilo} = \frac{(s \times j) + (y \times u)}{h}$$

s = number of kilogram supply per month, j = Rs 3 cost per kilogram, y = cost per hire from Kandy to Colombo, u = number of trips per month, h = number of kilograms per month

### Warehouse cost

Warehouse activities facilitate by tea brokering firms in the tea supply chain because tea factories are having small spaces to store their product. After the tea auction had marked the prices, the brokering firms recover handling, brokerage, and insurance costs from the tea factory. Therefore, the overall warehouse costs calculated using the following equation.

$$\text{Warehouse cost} = \text{Labor cost} + \text{Handling cost} + \text{Brokering cost} + \text{Insurance cost}$$

$$\text{a) Labor cost per kilo} = \frac{c \times d \times w}{o}$$

c = salary per day, d = number of working days per month, w = number of workers per month, o = number of kilograms per month

$$\text{b) Handling cost per kilo} = \frac{2.38 \times k}{o}$$

2.38 = handling cost per lot, k = number of lots per month, o = number of kilograms per lot

$$\text{c) Brokering cost per kilo} = 1\% \text{ from the value of one kilo (brokerage cost is calculated by brokering firm and recovered from the tea factory)}$$

$$\text{d) Insurance cost per kilo} = 6\% \text{ from the value of one kilo (insurance cost is calculated by the brokering firm and recovered from the tea factory)}$$

### Package cost

Tea packaging performs by the tea factories and the tea exporting companies in the tea supply chain. In the tea factory, tea puts into bulk packages, and then the bulk tea transport to tea exporting companies for the most appropriate packaging and other value-added services. In the tea factories, package cost can identify as follows.

$$\text{Packaging cost} = \text{Materials cost} + \text{Labor cost} + \text{Electricity cost}$$

- a) Material cost per kilo =  $\frac{s \times b}{o}$   
 s = cost per packet, b = number of packets per month, o = number of kilograms per month
- b) Labor cost per kilo =  $\frac{r}{o} \times w$   
 r = salary per day, o = number of kilograms per month, w = number of works per month
- c) Electricity cost per kilo =  $\frac{u \times l}{o}$   
 u = unit price, l = number of units, o = number of kilograms per month

### ANALYSES

The tea supply chain starts at the point of tea plucking. The harvest brings to the tea factory within 12 hours. Because the climate changes and various other facts affect the tea quality. The Sri Lanka Tea Board has enforced certain precautions and procedures to maintain the quality of tea despite some supply chain costs. Figure 2 depicts the monthly tea production in the selected five factories. Factory 4 and 5 have achieved the market power by producing 27 and 25 percent of the total production per month respectively. Factory 3 is the lowest producer, and the production is 13 percent per month. Nearly 250000kg per month produces by all five factories.

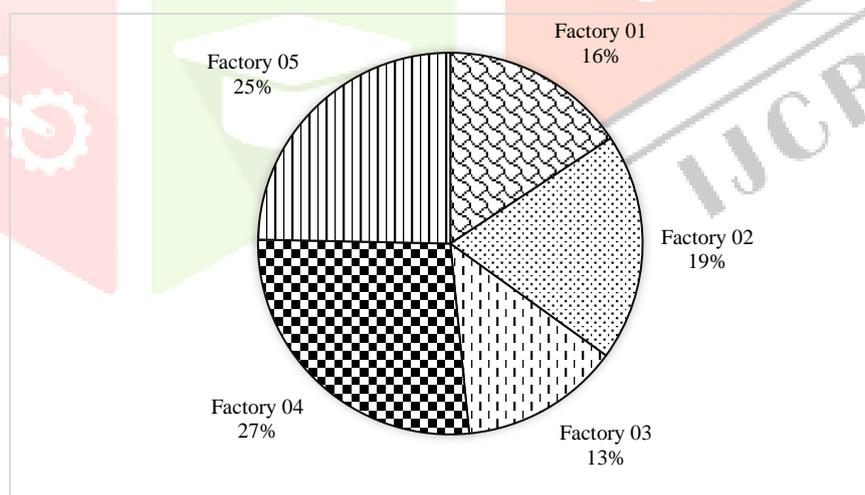


Figure 2: Monthly tea production  
 Source: Survey result

### Cost of Transport

Table 1 shows the transport cost per kilogram in rupees. Tea factories have outsourced some percentage of transport activities.

Table 1: Average transport cost

	Fuel cost	Tire cost	Maintenance cost	Labor cost	Outsource cost
1 Factory	3.54	1.27	0.98	9.76	1.93
2 Factory	6.35	1.95	0.84	11.67	2.16
3 Factory	2.95	1.58	0.9	5	1.35
4 Factory	7.86	2.07	1.02	6	1.3
5 Factory	1.02	1.02	0.47	2.01	2.36

Source: Survey result

According to figure 3, Factory 2 is having the highest transport cost. The transport cost of Factory 2 was 22.97 per kilogram and that for Factory 4 was 18.25. According to figure 3, all the tea factories have reached double digits percentages except Factory 5.

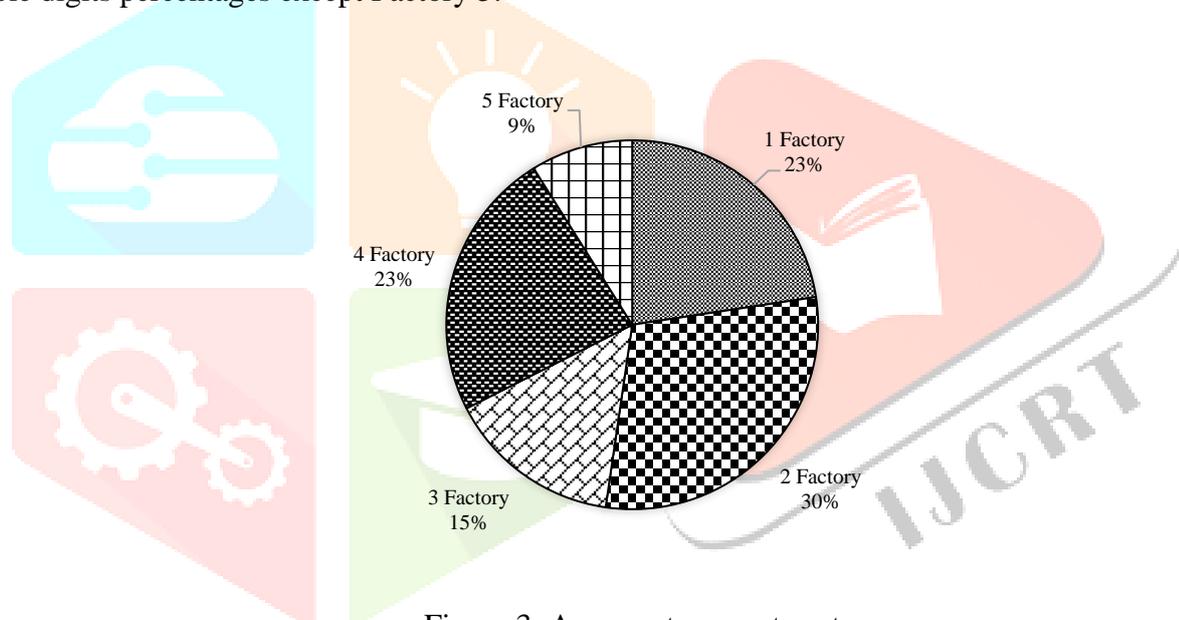


Figure 3: Average transport cost  
Source: Survey result

### Cost of Warehouse

Tea factories can only manage labor factor because other cost factors are belonging to tea brokerage warehouses. Insurance, handling, and brokerage cost are calculated by the brokerage firms and recovered from the tea factories. Factory based warehouses were small. Therefore, tea factories only store bulk tea until the tea transfers to Colombo brokerage warehouses.

Table 2: Average warehouse cost

	Labor cost	Insurance cost	Handling cost	Brokerage cost
Factory 01	2.28	0.06	0.82	0.01
Factory 02	2.56	0.06	0.93	0.01
Factory 03	2.45	0.06	0.64	0.01
Factory 04	1.74	0.06	1.09	0.01
Factory 05	1.81	0.06	1.11	0.01

Source: Survey result

According to figure 4, Factory 2, 1, and 3 have the highest warehouse cost of Rs. 3.56, 3.17 and 3.16 per kilo respectively. Factory 4 has the lowest warehouse cost of Rs. 2.9 per kilogram.

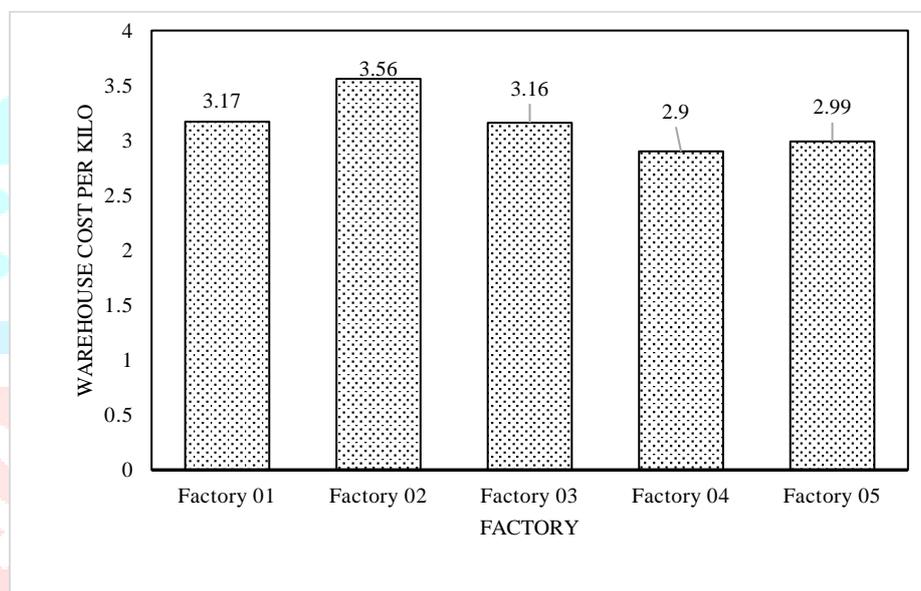


Figure 4: Average warehouse cost

Source: Survey result

### Cost of Package

According to table 3, the lowest cost contributor for packaging was electricity. The cost of electricity depends on the power capacity of the packaging machine.

Table 3: Average packaging cost

	Labor cost	Material cost	Electricity cost
Factory 1	2.35	4.9	1.21
Factory 2	3.16	5.16	1.35
Factory 3	2.56	5.54	0.98
Factory 4	2.26	4.95	1.95
Factory 5	2.89	4.81	1.27

Source: Survey result

According to figure 5, factory 1 and 5 have achieved the lowest costs as Rs. 8.46 and Rs. 8.97 per kilogram, respectively. Factory 2 faces the highest packaging cost.

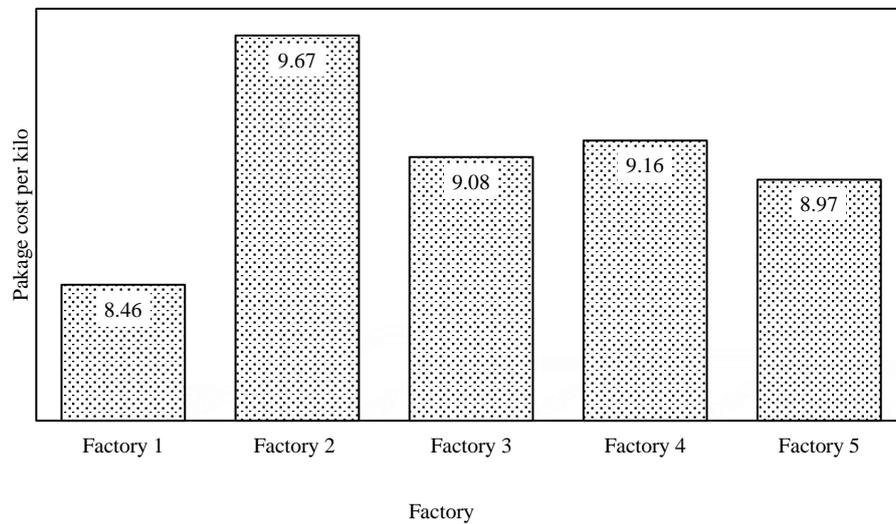


Figure 5: Average packaging cost  
Source: Survey result

### ***Total Logistics Cost***

Figure 6 shows the overall logistics cost involvement in the tea supply chain up to the tea auction in Colombo. Transport cost has occupied half of the total logistics cost (56%). Nearly, 33 percent of package cost has contributed to the total logistics cost and the average warehouse cost was 11 percent.

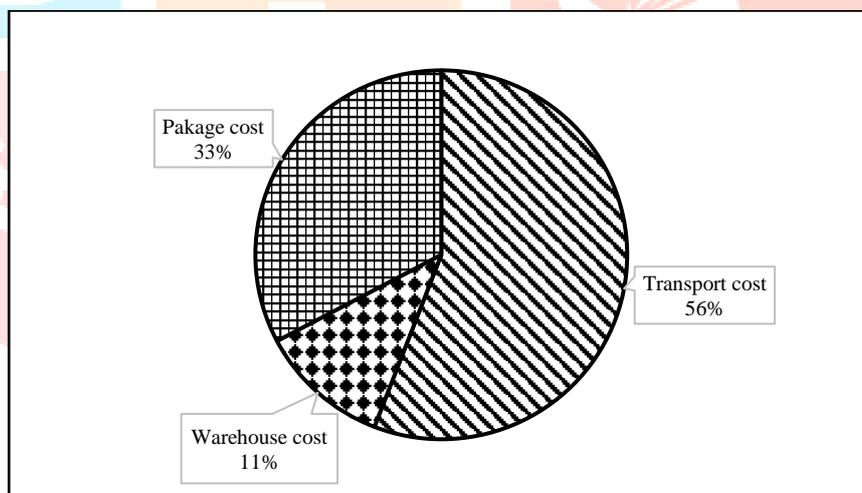


Figure 6: Logistics cost  
Source: Survey result

Figure 7 illustrates the contribution of logistics cost and the other costs related to tea production. It was examined that 6 percent of logistics cost has incurred from the overall tea production cost.

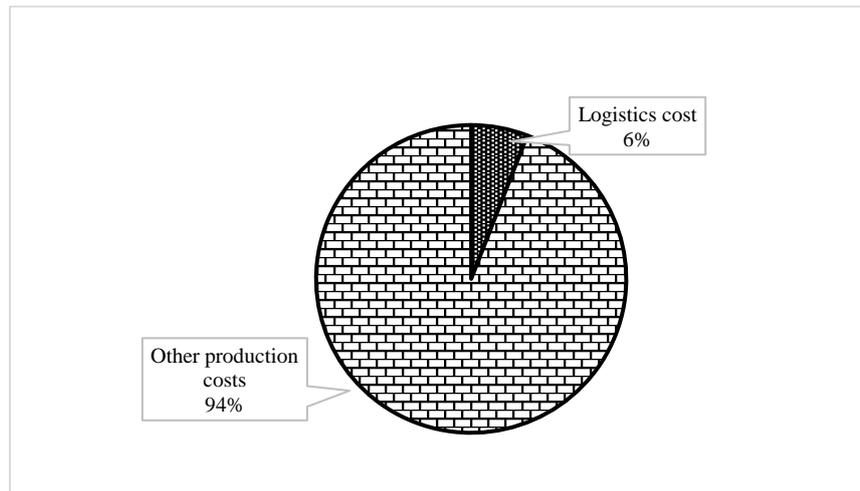


Figure 7: Involvement of logistics cost  
Source: Survey result

## CONCLUSION

The study found that transport cost is the major influence on the logistics cost in the tea supply chain in Sri Lanka. Transport cost has occupied half of the total logistics cost. Warehouse cost was the lowest cost component of the total logistics cost. The portion of the labour cost is very high for all the logistics activities in the tea supply chain. The contribution of the logistics cost to the overall tea production cost remains at one-digit percent in the small-scale tea factories in Sri Lanka.

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