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# Sustainable Supply and Supply Chain Mapping - Sri Lankan Tea Supply Chain

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**Description**

Sustainable supply chain management has gained great attention during last few decades. Companies not only need to deliver quality products, but also have to comply with environmental, economical, ethical and social aspects. This has created more challenges for managing the supply chain. Increased customer awareness in sustainability concepts has further increased the challenges. In supply chain management sustainable supply is an important part of any business and it is critical for the success of the whole supply chain. With identifying the importance in these concepts; this paper tries to define the sustainable supply and supply chain mapping using a theoretical framework. It further describes the research methodology that is used to identify the influencing factors on sustainable tea supply in Sri Lanka tea supply chain.

**Location**

iC - SBS Teaching Facility

# **Sustainable Supply and Supply Chain Mapping- Sri Lankan Tea Supply Chain**

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## **Abstract**

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## **1 Sustainable Supply in Tea Industry: Sri Lanka**

### **1.1 Sri Lankan Tea Industry**

The tea industry is an important agricultural industry that plays an important role in many developing countries around world (Gesimba et al. 2005; CBSL 2009; FAOSTAT 2010). Around 15% of the direct employment opportunities are created from the tea industry in Sri Lanka (Herath & Weersink 2006; CBSL 2009). Sri Lankan tea production is divided into the estate sector and the smallholding sector depending on the extent under cultivation (Table 1 and Map 1 in the Appendix) (CBSL 2003; SLTB 2010). Map 2 shows a generic flow of tea leaves (Kasturiratne 2008), where tea leaves are sent to the processing centre either directly from plantations or through bought leaf suppliers. The processed tea will be sent to brokers, located in Colombo. The tea is sold at the Colombo tea auction which is held weekly and it handles around 3 – 7 million kilograms of tea per week. The Colombo tea auction is the main channel to sell tea in Sri Lanka. Only around 5% of tea is sold using other channels such as direct selling (CBSL 2008). Being a major industry in the country, sustainable tea supply is vital to the Sri Lankan economy. However, the Sri Lankan tea industry has been facing major issues such as increasing global competition and production cost, reducing tea export earnings and falling export share in the world market (CBSL 2009). This indicates that there is a huge opportunity to improve the performance of the tea industry.

### **1.2 Tea Supply Chain**

Even though Tea is considered as an agricultural product, supply chain management plays an important role. Until recently, the agricultural sector has focused mainly on growing and harvesting. However, the agriculture sector is increasingly following the manufacturing industries by forming more tightly aligned value chains (Boehlje, Hofing & Schroeder 1999). Therefore, the applications of supply chain management concepts are prominent in the agricultural sector also (Hill 2000). Especially agriculture with being a part of natural resources, it has a strong connectivity with

quality of life of both current and future generations. Furthermore, manmade activities in food production and consumption have a great impact on sustainability (Husti 2006). Therefore, sustainability in agriculture is vital to achieve as farmers can get more profits and benefits with applying sustainable practices (Reganold, Papendick & Parr 1990). Today tea being considered as a tradable product, it needs to focus on a wider area including not only growing but also managing other activities such as obtaining farming inputs/supplies, value added activities, packaging and distribution which normally occur after harvesting the crops and activities such as research & development (France 2009). This indicates a great emphasis on supply chain management concepts in the agriculture sector too, however, consideration of sustainability concepts in the food supply chain is limited (Husti 2006).

Therefore, this research tries to study the sustainable supply chain management concept in tea industry not only because it is a major tradable agricultural product but also since there is a huge gap in research in tea supply chain not only in Sri Lanka, but also in other countries. Most of the research done to date in the tea industry in Sri Lanka has been focused on social issues (Herath 2002; Herath & Weersink 2003; Herath & Weersink 2006; Herath & Weersink 2007; Herath & Weersink 2009) such as labour (Wickramasinghe & Cameron 2005), health; soil degradation (Wickramasinghe n.d.), sales and marketing (Ganewatta et al. 2005; Kasturiratne et al. 2006; Kasturiratne 2008). These studies have not considered the integration of triple-bottom-line concept.

## **2 Literature Review**

### **2.1 The Starting Point: Supply Chain Management**

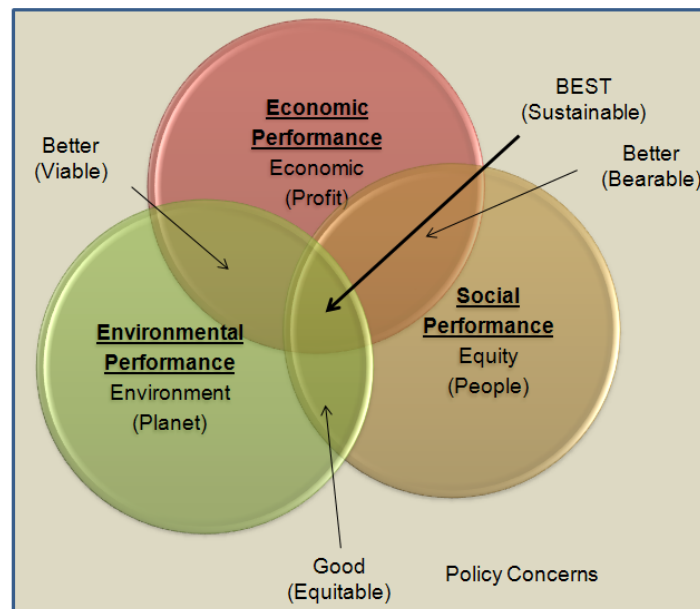
Supply Chain Management can be defined as a combination of integrated planning, coordination and control of all processes and activities along the supply chain to provide a value added service while reducing the total cost of all stakeholders in the supply chain (Van der Vorst, Beulens & Van Beek 2000). In a globalised environment, supply chain management has become important due to the increase focus on overall revenue growth and performance in the supply chain (Chandra & Kumar 2000). Furthermore, globalization has increased the risk in supply chain (Kleindorfer, Singhal & Van Wassenhove 2005). In recent times sustainable supply chain management has become important and has gained more attention from academics and practitioners not only in manufacturing sector but also in service industry and agricultural sector (Lin ; Van der Vorst et al. 1998).

In order to achieve a sustainable supply chain, it is crucial to understand the sustainable supply concept and supply chain design. However, there is a lack of research on the sustainable supply concept and supply chain mapping. Therefore, this paper tries to define the sustainable supply and how it impact on sustainable supply chain management as well as the importance of supply chain mapping.

### **2.2 Sustainability**

Sustainability or sustainable development became prominent around the world after the publication of “Our Common Future” report by the World Commission on

Environment and Development in 1987 (Mebratu 1998). It defines sustainable development as “a development that meets the needs of the present without compromising the ability of future generations to meet their need” (Brundtland 1987, p 8). This report has increased the awareness of sustainable development in both developing and industrialised nations (Carter & Rogers 2008). The triple-bottom-line: natural environment, economic and social equity have been identified as the major pillars in sustainability (Vachon & Mao 2008). Sustainability is a broader concept where it considers the overall performance and benefits in the triple-bottom-line (Carter & Rogers 2008; McCue 2010) when it includes the dependency between social, economy and environmental aspects (Elkington 1998). When operating a business, there are various issues that emerge in these areas. Sustainability can be achieved only if they are addressed in an integrated manner as shown in Figure 1. An organization can be placed in the happiest or best position with achieving a win-win solution for economic, environmental and social conditions (Carter & Rogers 2008).



**Figure 1: Organizational Sustainability and the Triple Bottom Line  
Modified from (Carter & Rogers 2008)**

Linton et al. (2007) added that the political influence also plays a central role in sustainability where there is a strong influence on integrating the three pillars. The discussion of policies related to sustainability has increased not only locally but also regionally, nationally and internationally (Glavic & Lukman 2007; Linton, Klassen & Jayaraman 2007).

### 2.3 Sustainable Supply Chain Management

Sustainability has become a major concern not only in earth science but also in other fields such as engineering, health science, management, social science and operations management (Linton, Klassen & Jayaraman 2007). Linton et al. (2007) pointed out that the sustainability consideration in management (including economics, business & management) literature has increased considerably since 1990s. The sustainable concept has captured a greater attention in supply chain

management as the impact of sustainability goes beyond the individual territories with the increase in globalisation (Foran et al. 2005). The sustainable supply chain management requires not only to consider the firm's own operations but also needs to consider operations of the entire supply chain starting from input suppliers to the consumer including reverse logistics for obsolete products (Fiksel 2010). Glavic and Lukman (2007) highlights those terms such as minimising waste, pollution control and prevention, global warming, depleting natural resources and minimising natural resources utilization have been some terms that indicate the emphasis on the sustainable supply chain management.

Carter and Rogers (2008) defines sustainable supply chain management as “the strategic, transparent integration and achievement of an organization's social, environmental and economic goals in the systematic coordination of key organizational business processes for improving the long-term economic performance of the individual and its supply chain”. This indicates that specific sustainable strategies should apply to all partners in the supply network. Sustainability cannot be achieved without integrating sustainable supply chain management practices in both upstream and downstream partners (Ageron, Gunasekaran & Spalanzani 2011).

On the other hand, increased customer awareness of sustainability has further increased the customer's expectations. It has added additional challenges for operators. Customers do not merely have a high demand for value change, but are also concerned with the ethical and social impact that resulted from operations. Customers need better quality products which are produced ethically exactly when they are needed (Hines 2004).

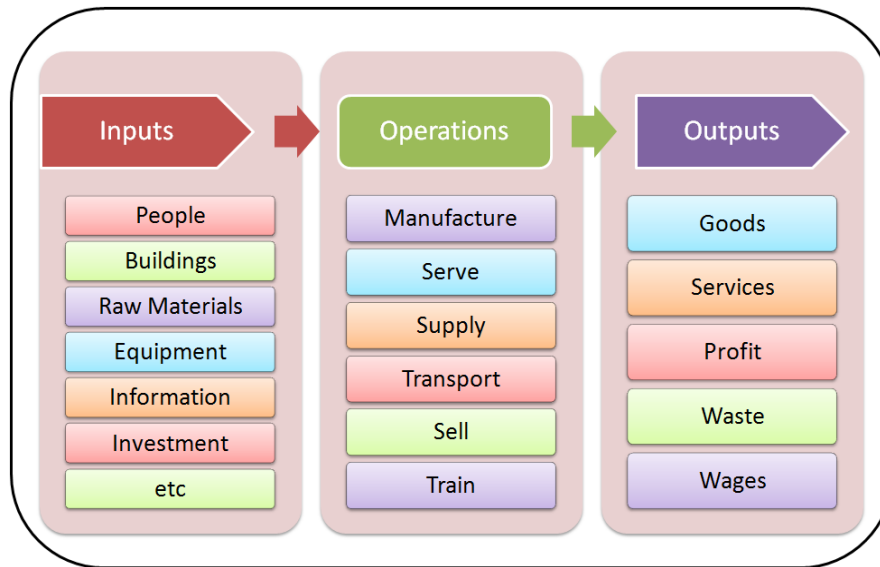
This leads companies to exploit all possible opportunities to optimize the business processes to increase thin profit margins while meeting the consumer expectations in a sustainable way (Sanayei, Farid Mousavi & Yazdankhah 2010). On the other hand, any company's main objective is to meet customer expectations and delivering a product better than its competitors (Ballou & Song 2008). In order to deliver a better service or a product, the inputs or supplies in manufacturing play an important role in the supply chain. Harland et.al (1999) mentioned that providing a clear vision of supply is a great challenge for any business as it is essential to have continuous inputs to achieve the desired needs of all stakeholders. To meet this challenge, it is essential to build a sustainable supply strategy. This includes the entire life cycle from cradle to grave. This is very complex as chains do not exist as isolated single entities; rather they are intertwined and include many company networks, consumers, professionals and other entities (Wolters, James & Bouman 1997).

## **2.4 Sustainable Supply**

Traditionally, supply chain managers mainly have been focused on purchasing function which acquires materials from external suppliers. Furthermore, more research has been undertaken on material management, purchasing and supplier management area (Baily & Farmer 1982). The physical movement of materials along the supply chain has been considered as the major issue for many firms (Ballou & Song 2008). In one way, it is acceptable that purchasing or material management gain more attention mainly because purchasing costs consists of more than a 50% of

the total cost of any business. An operation which is considered as the heart of the business needs raw materials (Monczka et al. 2010).

However, on the other hand, with increasing the knowledge in sustainable concept and increased competition with globalisation, focusing on other inputs such as infrastructure, information, innovation and knowledge, people, and relationship in the supply chain can be considered as important as raw materials because they play a major role in any business (Figure 2). For example, growing infrastructure has dramatically improved the performance and increased the accessibility to better quality materials and to scarce natural resources (Finch 2008; Swink et al. 2011).



**Figure 2 : Supplies for Operations (Adopted from (Waters 2009))**

The focus on the supply and flow of cash, investments, and monetary commitments on revenue generation from supply chain operations is essential in the value creation process along the supply chain (Barry 2006). Styger (2010) highlighted that in addition to facing the ongoing challenges in social and environmental areas in operations, companies have to face challenges on the fiscal side in order to achieve long term sustainability and to survive in the world economic crisis. The main challenges in these areas have been not only providing ethical services with minimal environmental damages, but also to achieve maximum returns from the business. Furthermore, in order to achieve efficiency with implementing various strategies, it requires more money, as implementation of any strategy will add more cost on your system. Styger (2010) highlighted that “to grow money, you need money”.

Supplying better technology would be a good enabler for the success of any business. It increases the connectivity not only within the company but also with the supply chain partners. Furthermore, technology increases the integration and innovation in the value chain and it would help to increase sustainability. It is emphasised that the integration of functions within the order-to-cash cycle aim on sustainably reducing the delays in financial flows along the chain (Bovet & Martha 2000; Barry 2006). Integration between channel members can be enhanced with the use of information technology and will result in improving performance measures (Hill 2000). Nidumolu et al. (2009) emphasises that innovation in technology,

production processes and raw materials provide more opportunities to increase the sustainability in the supply chain.

However, neither finance nor technology is the sole answer to maximise the return to stakeholders. Technology alone should not be viewed as a “silver bullet” to solve the issues in the supply chain. Implementing a technology on a wrong process would only increase the efficiency of doing the wrong process and will do it faster compared to a manual system. It does not add real value to the processes (Fawcett, Ellram & Ogden 2007).

Therefore, supplying other resources such as people, play an important role as talented human resource and the specialised capabilities are essential in order to re-align the supply chain and these resources will be the most premium assets for any business that assists to implement better strategies (John 2007). On the other hand, supplying innovative ideas and knowledge is also essential for any business to be sustainable in long term. Better relationships provide linkage between organization, supplier and customers to maximise benefits. However, any of these supplies would not provide positive results to the organization unless there is a supply of qualified, skilled human resources (Cavinato, Flynn & Kauffman 2006). Even if there is enough money and strategies or new ideas to increase the efficiency, a firm needs skilled people to implement those strategies. It is not just money or strategy that makes the difference. Strategies are just the tools where as properly trained and skilled human resources are the important assets that make the difference. Furthermore, the success of any business will depend on the leaders who have a strategic vision, spirit, willingness and broad knowledge and skills (Rainey 2010). Styger (2010) indicates that the lack of qualified and motivated leaders is a great challenge that restricts the companies from moving forward sustainably.

With globalisation, the complexity as well as the vulnerability to risk in supply chains has increased (Pai et al. 2003). Addressing the risks in environmental, social and economic context is a major challenge to obtain a sustainable supply. Proactive companies consider sustainability as a strategy rather than just complying to environmental laws or just being green (Darmanata et al. 2010). The managers and employers at all levels need to have a broader knowledge about every part of their business, market environment, social and natural environment. They should be able to craft the strategies, manage operations, leading changes and make effective decisions in order to achieve the competitive advantage (Bovet & Martha 2000; Barry 2006).

Additionally, sustainable performance of the supply chain will depend on the relationship between all partners in the supply chain (Van der Vorst, Beulens & Van Beek 2000). Technology can build the connectivity but it is the presence of a better understanding, trust and relationship between firms that enhances performance (Fawcett, Ellram & Ogden 2007). Furthermore, it has been highlighted that thinking of supply chain as a 50/50 mix of infrastructure and information is no longer valid in current business environment. It is time to consider the supply chain as a mix of 45/45/10 - people, technology and hard infrastructure because currently the competition will be mainly between supply chain alliances and supply chains (John 2007).



## **2.5 Supply Chain Mapping**

Recent research shows that to achieve an optimal supply chain performance, it is essential to map the supply chain to show the overall connectivity of each and every partner in the system. The resulting chain would not be a linear graphic but a very complex network intertwines with many players (Cavinato, Flynn & Kauffman 2006). This is becoming more important as the competition is now between supply chains rather than between firms. To improve the supply chain performance, managers should know exactly what is happening along their supply chain. If the supply chain design is similar to a “black-box” where nobody knows what is happening, it is impossible to implement any improvement strategy to achieve long term sustainability. Therefore, in recent times supply chain mapping has gained more attention in sustainable supply chain management.

Supply chain mapping can be defined as a map that shows the linkages between their suppliers and customers. It shows the reality of the supply chain (Yacher 2011). Supply chain mapping have many advantages for obtaining competitive advantage in any industry. Developing a supply chain map would be advisable for many reasons such as identifying the bottlenecks on the supply chain, to manage the supply chain risk (Mohd Nishat, Banwet & Ravi 2006), to measure performance at each supply chain nodes and would help to reduce the overall supply chain cost. Research shows that without knowing how your supply chain is designed and operated, it is difficult to measure the performance. Furthermore, mapping the supply chain would help to simplify the supply chain and it helps to minimize the complexity on the supply chain design. Complexity adds costs and burden on the supply chain rather than adding value. Furthermore, managers can make quick decisions to overcome the uncertainties that occur along the supply chain as well as the external environment when he has a clear image of his supply chain design (Fawcett, Ellram & Ogden 2007). Gardner and Cooper (2003) also pointed out that a strategic supply chain map will enhance the supply chain planning, helps to distribute key information efficiently, provide a base for supply chain redesign, help to understand the supply chain dynamics enhance monitoring and analysis. Supply chain map can be utilised as a bridge to connect the supply chain strategy and the corporate strategy. Therefore, in order to identify the performance measures and influencing factors in a sustainable supply, first it is essential to map the supply chain. However, there is a lack of research on sustainable supply and supply chain mapping concepts. Hence, this research tries to fill this gap and the following section describes the research methodology and concerns related this research.

## **3 Research Methodology**

### **3.1 Objective**

This research aim to map the tea supply chain, define sustainable supply and explore influencing factors on the sustainable tea supply chain in Sri Lanka. Furthermore, it will study how these factors affect sustainable supply, establish performance measures of the Sri Lankan tea supply chain and establish the factors that have an impact on the future sustainability of the Sri Lankan tea supply chain. It aims to develop new concepts and will provide insight and knowledge to the managers in the tea industry to achieve long term sustainability. The government

and operators will benefit as they can use the identified influencing factors to develop strategies and policies which leads to more profits and tangible benefits in the sector.

### **3.2 Research Design**

Figure 4 illustrates the research design in order to attempt to answer four main questions. The first three questions aim to explore influencing factors while the fourth question tries to find out the degree of influence these factors have and their performance in the sustainable tea supply. To answer the “what” questions, it is necessary to explore the operations in the tea supply chain in depth. Literature shows that a qualitative research approach is more suitable for such situations (Patton 1990; Ellram 1996; Denzin & Lincoln 2000; Cavana, Delahaye & Sekaran 2001; Flick 2002; Neuman 2003). To answer the fourth research question, it is necessary to conduct a survey to measure performance and hence a quantitative research approach is required. Therefore, this study will use a mixed research approach including an explorative and explanatory phases. The explorative phase I will be conducted to identify the important nodal points in the tea supply chains to map the supply chain and develop models for both internal and external tea supply chains. It also tries to find out the influencing factors on sustainable tea supply in each supply chain. The explanatory Phase II will be used to verify the supply chain models developed and verify the factors identified in the Phase I (Figure 3). Additionally, a survey will be conducted to measure the performance of the selected tea supply chains.

**Figure 3 : Detailed Research Design**

### **3.2.1 Phase I: Qualitative Research - Focus Group**

Group discussion and individual interviews are two major techniques used in qualitative research (Denzin & Lincoln 2000). Interviewing a group of people rather than individuals is popular in social and business research (Veal 2005). Focus group is a research technique that is used to collect data among a group of participants (Morgan 1996). The target groups of people from the main nodal points in tea supply chain will be invited to attend a workshop and the focus group discussions/interviews. The participants are allowed to interact with each other in the group rather than only interacting with the researcher (Calder 1977; Flynn et al. 1990; Morgan 1996). The researcher would select different views of the participants. The researcher can explore deeply by asking prompt questions and summarize the consensus based on the group participant's knowledge and their every day experience (Barbour 2007).

There are many advantages on using the focus group when collecting qualitative data (Denzin & Lincoln 2000). This will create a good environment for the participants who are reluctant or scared to give information on face-to-face interviews. This method stimulates the members to participate in group discussion in a group environment (Denzin & Lincoln 2000). In the first two focus groups discussions and semi-structured interviews will be conducted with the members from the senior government officers in the institutes related tea industry in Sri Lanka (Figure 4). This phase aims to explore the factors influence on the sustainable tea supply. This will give a comprehensive insight into the dynamics of tea industry and this knowledge would facilitate the researcher to conduct the discussion and interviews with industry participants.

To find out the influencing factors that affect the internal tea supply chain, two focus groups will be selected to represent the large scale companies where all main activities are undertaken in the tea supply chain such as growing, processing, brokering, value-added-tea producing and exporting. In order to identify the influencing factors and to map the external tea supply chain, two focus groups will be used which comprised of members from each nodal point such as; tea processors, tea brokers, value-added tea producers and tea exporters. In addition to that individual interviews are designed to collect information from small farmers.

Creswell (2003) pointed out that when selecting the participants, it is required to select the participants that would provide in depth and rich information. On selecting the participants care should be taken to select the companies that are involved in major nodal activities such as production, processing, distribution and export. They should be selected to represent both internal and external tea supply chain partners including the geographical dispersion. This will be done with the support of the Chamber of Commerce Sri Lanka.

### **3.2.2 Phase II: Quantitative Research**

The supply chain models developed and factors identified based on the first phase analysis, will be verified and refined using a larger sample to generalise the results. It is also expected to find how these factors influence on the sustainable tea supply

using a structured questionnaire. The factors identified in the phase I will be grouped into a smaller number of groups to reduce the number of variables. This will be done by aggregating the variables which have similar characteristics.

#### 4 Conclusion

This paper looks at the contextual references in supply chain management and the Sri Lankan tea sector. It recognises the importance of standard supply chain management techniques and preliminary connection to sustainable supply chain management. However, research to date suggest that there a huge gap in the understanding of supply chain resilience on sustainable supply chain management. Furthermore, there is a lack of research on Sri Lankan tea supply chain and understanding of the macro level supply in this area. On the other hand, in order to identify the influencing factors on sustainable tea supply in Sri Lanka, it is essential to map the Sri Lankan tea supply chain. However, it was found that supply chain mapping has not been research extensively. This is obvious not only for tea supply chain but also for supply chains in manufacturing sector. Therefore, this research would help to fill the knowledge gap in this area, while the overall results would help to improve the tea supply chain not only in Sri Lanka but also for other tea producing countries. Furthermore, the research findings would also assist other agricultural supply chains and manufacturing sector.

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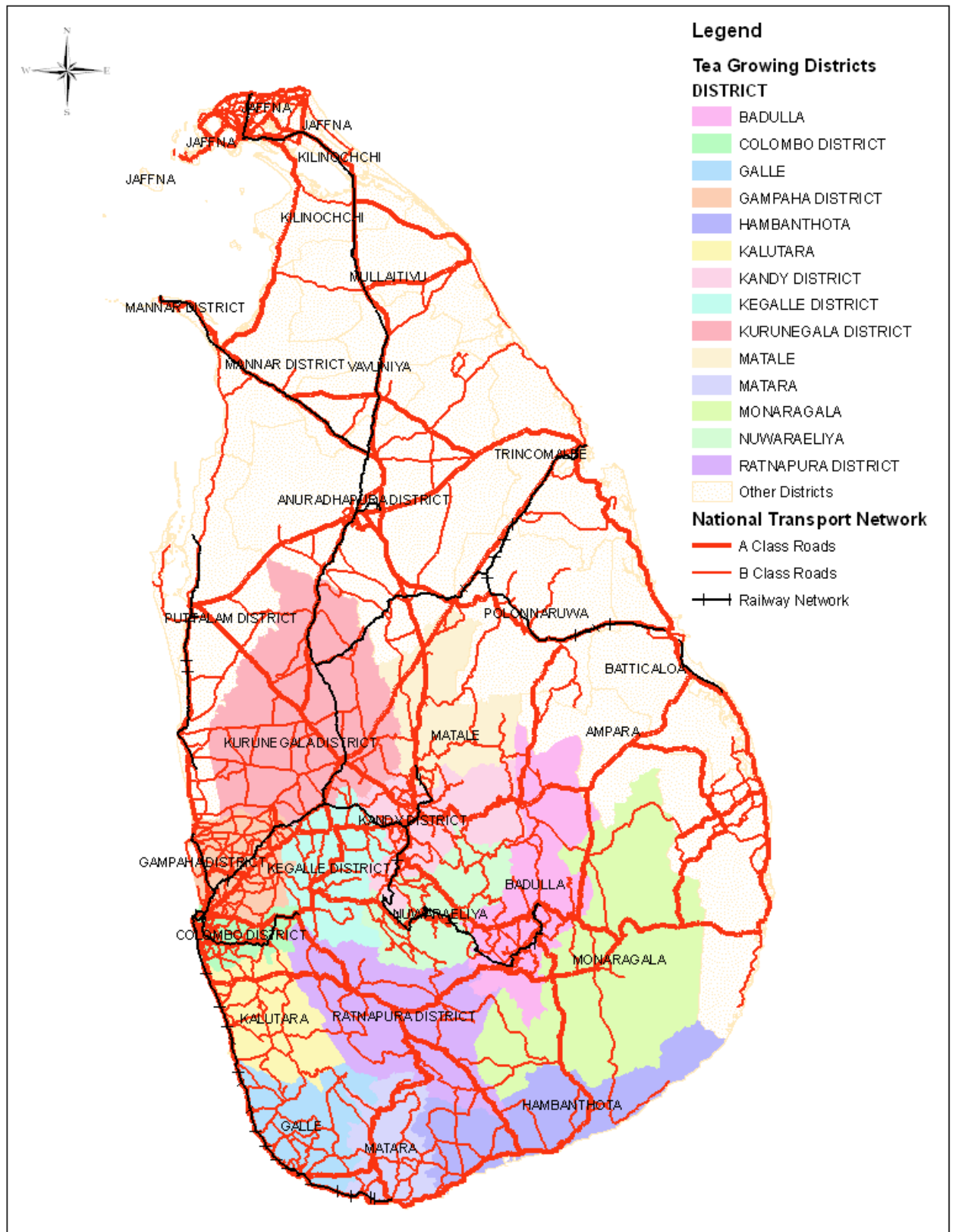
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## APENDIX

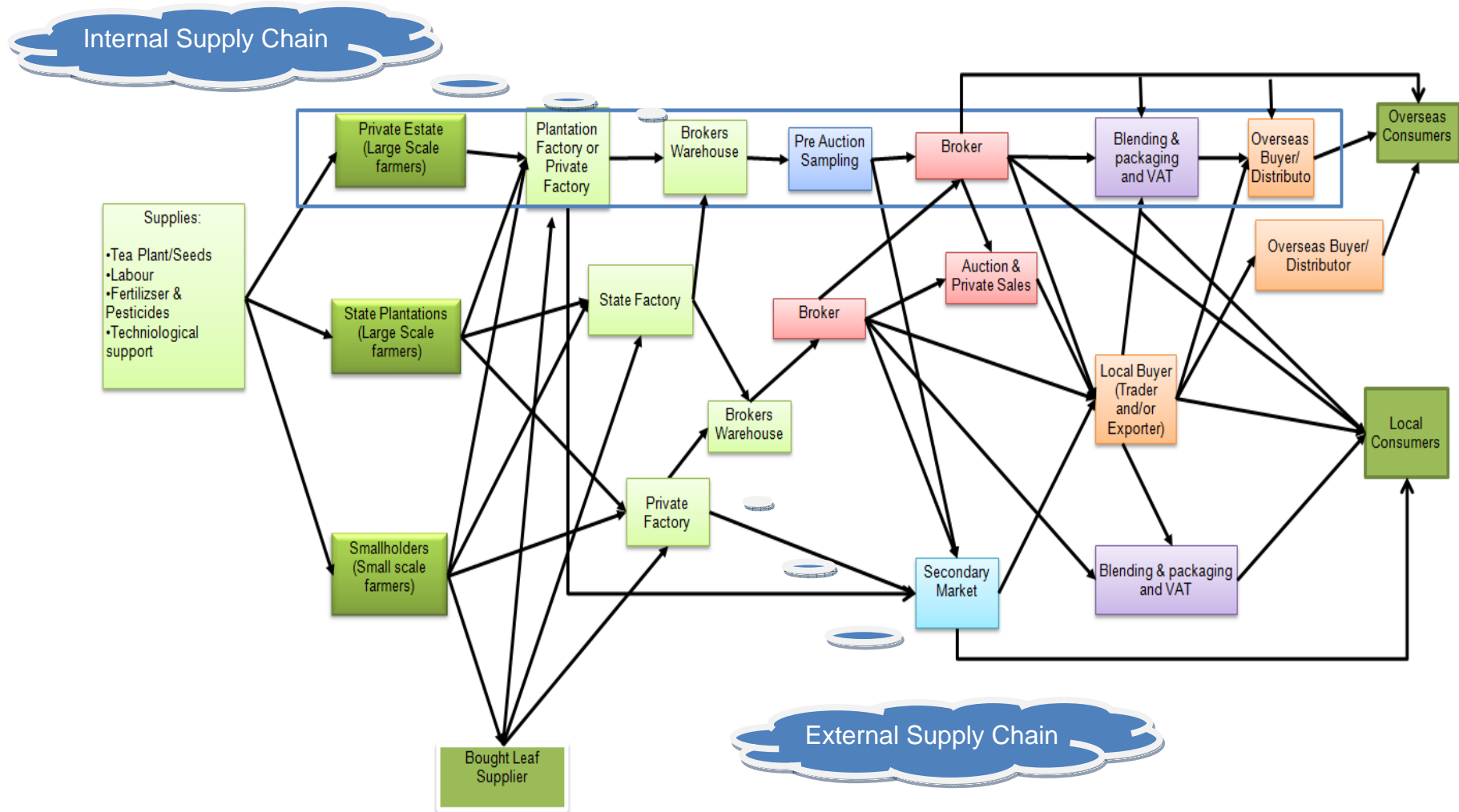
**Table 1 : Tea Cultivation Extent in Sri Lanka 1982 and 2002 (Hectares)**

District	Extent in 1982			Extent in 2002		
	Small Holding Sector	Estate Sector	Total	Small Holding Sector	Estate Sector	Total
<b>High Elevation Zone (above 1220 m of Mean Sea Level (MSL))</b>						
Badulla	3,196	31,545	<b>34,741</b>	5,616	25,024	<b>30,639</b>
Nuwara Eliya	3,112	59,710	<b>62,822</b>	4,045	46,222	<b>50,266</b>
<b>Middle Elevation Zone ( 610 m – 1220 m of MSL)</b>						
Matale	660	6,445	<b>7,105</b>	356	4,774	<b>5,130</b>
Kandy	7,947	27,135	<b>35,082</b>	7,609	14,990	<b>22,599</b>
<b>Low Elevation Zone (Lower than 610 m above MSL)</b>						
Colombo	89	161	<b>250</b>	93	60	<b>154</b>
Gampaha	-	-	-	12	-	<b>12</b>
Kalutara	539	3,047	<b>3,586</b>	6,117	1,054	<b>7,170</b>
Galle	8,213	6,396	<b>14,609</b>	22,062	3,568	<b>25,629</b>
Matara	8,025	7,515	<b>15,540</b>	17,326	6,378	<b>23,704</b>
Hambantota	142	-	<b>142</b>	440	-	<b>440</b>
Kurunegala	134	286	<b>420</b>	31	10	<b>41</b>
Moneragala	11	786	<b>797</b>	70	852	<b>922</b>
Ratnapura	4,881	19,183	<b>24,064</b>	25,433	12,918	<b>38,352</b>
Kegalle	1,570	6,417	<b>7,987</b>	4,551	3,107	<b>7,658</b>
<b>Sri Lanka</b>	<b>38,519</b>	<b>168,626</b>	<b>207,145</b>	<b>93,761</b>	<b>118,955</b>	<b>212,716</b>



Map 1: Map of Tea Growing Districts in Sri Lanka





**Map 2: Sri Lankan Extended Tea Supply Chain**  
Adapted from (Kasturiratne 2008)