1 INTRODUCTION

1.1 Supply Chain Management

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. Supply chains exist in both service and manufacturing organizations, although the complexity of the chain may vary greatly from industry to industry and firm to firm.

Supply chain management (SCM) is the oversight of materials, information, and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer. Supply chain management involves coordinating and integrating these flows both within and among companies. SCM is typically viewed to lie between fully vertically integrated firms, where the entire material flow is owned by a single firm and those where each channel member operates independently. Therefore coordination between the various players in the chain is key in its effective management. It is said that the ultimate goal of any effective supply chain management system is to reduce inventory (with the assumption that products are available when needed).

SCM flows can be divided into three main components (Infoscaler, 2001).

- The product flow
- The information flow
- The finances flow

Product flow: It includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs. The global supply chain only works smoothly, if the internal product flow is organized perfectly. Product flow management, when properly employed, blends a variety of tasks to bring the supply chain into harmony.
**Information flow:** It involves transmitting orders and updating the status of delivery. Timely supply chain information can pay off handsomely in lower costs, less inventory, improved throughput, shorter cycle times, and the highest levels of customer service. The very essence of supply chain management is effective information and material flow throughout a network of customers and suppliers. By using the Internet, companies simply have better and more far-reaching ways to speed up the information flow process and make it more effective.

**Financial flow:** It consists of credit terms, payment schedules, and consignment and title ownership arrangements. A central issue for all supply chain partners, however, is the financial flows that distribute the financial resources common to virtually all traded economic activities. Without such financial flows, individual supply chain partners cease to function, and the collaboration among such partners common in contemporary supply chains becomes impossible. Alternatives to financial flows such as bartering do not provide the flexibility necessary for the coordination and operation of the complex, geographically dispersed systems that are contemporary supply chains. From the operations perspective traditionally adopted by supply chain management researchers, financial flows are seen as a routine, almost automatic corollary of product and service transmission within and across organizations. Their most important feature is the fact that they enable transmission of material, products, services, personnel, or information. The cost associated with them is also relevant, although it is not explicitly recognized in any of the main supply chain management models. Dealing with the specifics of financial flows, and with their cost implications, is left to specialist functions such as financial managers and management accountants.

**1.2 International Supply Chain**

According to Mr. Remy Moreau (2008), “Extending a supply chain beyond borders obviously lengthens the chain and results in exposure to greater variables. These variables can include border crossings, multiple modes of transportation and multiple hands-offs, different government systems, technology issues and security concerns. Every one of these variables presents opportunities for errors that can stall the entire supply chain. Companies that operate globally are under greater pressure
than their domestic counterparts to actively manage their supply chain. The risks inherent in managing a global supply chain mean that companies need to be constantly conducting cost-benefit analyses. Sourcing overseas may be less costly, but the risks could outweigh the benefits in the long run.”

International supply chain entails additional considerations (MacDonald, 2006):

1. **Security**: When the supply extends beyond domestic borders, a whole new level of security comes into play.

2. **Port Issues**: If a company is shipping by ocean, they absolutely need to consider capacity issues and route their goods accordingly.

3. **Tax and Tariff issues**: Make sure that manufacturing or sourcing overseas is as low cost as they think it is. Tax and tariff regulations differ according to country. Something as basic as the way a product is packaged can change its entire tariff structure.

4. **Partnerships with local experts**: Extending the supply chain into another country requires in-depth knowledge of how that country operates. Partners, either through third party logistic provider (3PLs) or directly, are often critical to success.

5. **Cultural differences**: Misunderstanding the culture can wreak havoc on the planning.

6. **Technological abilities and capabilities**: A global supply chain often requires an even greater investment in technology to improve visibility.

7. **Risk Management**: With a global supply chain, the possibility of things going wrong is greater and often more costly to fix. Knowing what the risks are and planning for them in advance is critical.

### 1.3 Domestic Supply Chain

There are certain elements that are required to manage any supply chain regardless of whether it's domestic or global. Things like visibility, technology and flexibility are basic ingredients that need to be incorporated seamlessly in order for a supply chain to function efficiently regardless of the length of the chain. Technology speeds the supply chain and creates visibility. Visibility is another key element. This is particularly critical in order to allow companies to manage their supply chain.
strategically, identifying various points throughout the supply chain where goods can be held to reduce the risk of delays. Achieving visibility is far easier domestically than globally. Flexibility is also critical to the success of the supply chain. Companies need to ensure that both their supply chain and their partners can readily integrate alternate locations should circumstances dictate quick response.

1.3.1 Transportation

It is virtually inconceivable in today's economy for a firm to function without the aid of transportation. Transportation is an essential and a major sub-function of logistics that creates time and place utility in goods. In fact, the backbone of the entire supply chain is the transportation management that makes it possible to achieve the well known seven Rs: the right product in the right quantity and the right condition, at the right place, at the right time, for the right customer at the right cost (Transportation Infrastructure, 2009)

The importance of transportation should also be seen by looking at the impact of transportation on a country's economy. Studies reveal that in India the total logistics costs constitute nearly 13 percent (Manoj, 2008) of the gross domestic product (GDP) out of which nearly 40 percent is because of transportation alone (Kilgore, Joseph, Metersky, 2008). In the U.S, the estimates show that the cost is around 6 percent of the gross national product (GNP). The major infrastructure required for moving goods from one place to another in India involves the active roles of roads, road freight industry, railways, ports and shipping, and pipelines, all of which are either managed or regulated by the government (Vijayaraghavan, 2007).

1.3.1.A Road Network

India has one of the largest road networks in the world. The growth rate in road traffic has been 10 percent since 1951 (Vijayaraghavan, 2007) and would have gone higher had there been a larger and penetrative road network. Only 20 percent of the surfaced roads are estimated to be in good condition. This compares unfavorably with other countries (Indonesia and Brazil 30 percent, Korea 70 percent, Japan and U.S. more than 85 percent). National Highways (NHs) are the main arterial roads connecting ports, state capitals, industrial and tourist centers, and neighboring
countries. NHs constitutes less than 2 percent of the total road network, but carry nearly 40 percent of the total road traffic (Vijayaraghavan, 2001).

Deficiencies in the road network are causing huge economic losses because of slow transportation. The delay on the roads and ports also results in high inventory costs for the industry, thus affecting its competitiveness vis-a-vis international industry operating on JIT (just-in-time) inventory principles. The congestion at the ports and the insufficiently developed air services also affect foreign investment decisions, which often place a great premium on the infrastructure. International trends indicate that with the growth of the highway and aviation technologies, traffic tends to shift away from the Railways. However, in the continental economies like United States, China and Russia, the Railways have maintained their dominance. India's size, geography and resource endowments also mandate a dominant role for the Railways, not to mention the environmental considerations, which in recent years have caused a rethinking even in the developed world.

1.3.1.B Road Freight Industry in India.

Road freight industry plays a very important role in the logistics industry in India as it accounted for 4.6% of India’s GDP in FY08 (as per data released by Central Statistical Organisation). Road Freight industry in India is highly fragmented and unorganized. The unorganized sector occupies for nearly 80% of the market share. It accounts for over 60% of goods traffic and over 80% of passenger traffic (Outlookarena. 2009).

Road freight transport can be further classified into primary and secondary transportation. Primary transportation is one that covers distance not less than 50 km and over 1,000 km. Primary road freight accounts for over 70% of the Rs 1.42 trillion road freight industry. In the past ten years the road freight segment has reported a compounded annual growth rate of 8.9% and is expected to sustain this growth momentum in the coming years (Outlookarena. 2009). The same has been on account of earlier infrastructural investments. The capital expenditure was primarily focused on building network of roadways to enable transportation, which has resulted in a vast network of roads. It is also well connected in comparison to the
other modes of transport. Thus, road transport gains on account of route flexibility that enhances reach.

As mentioned above, the road freight industry stands out unique with the majority of the market share held by the unorganized sector. Out of the entire market size of approximately Rs. 38,000 crores, Rs 6000 crore are with the organized sector and the remaining with the unorganized sector (TCIL, 2008). The National Highways (NH) form only 2% of the entire road network in India, but handle over 40% of the national road freight traffic, putting enormous pressure on the highway infrastructure (TCIL, 2008). Also, on an average a commercial vehicle in India runs at a speed of 20 miles per hour (mph) compared to over 60 mph in the mature logistics markets of Western Europe and the USA (Ojha, 2007).

**Profile of the road freight industry:**

1. The industry continues to comprise small operators accounting for as much as 85 percent of the total fleet. The industry generates considerable local employment opportunities.

2. The total transport function is shared among several players. For example, operators perform only the haulage function, while the marketing, aggregating, storing and delivery functions are undertaken by agents and brokers.

3. The two principal manufacturers of trucks, TELCO & Ashok Leyland, account for more or less the entire fleet of heavy vehicles in the country (Vijayaraghavan, 2007). Owing to their monopoly, technology and price are dictated by the sellers market.

4. The industry productivity could be further improved since only one-third of the trucks operate between 300 to 400 km per day and about 12 percent of trips are empty trips without load (Vijayaraghavan, 2007).

### 1.3.2 Ports

The long coastline of India is dotted with 11 major ports (Map 1.1) that are managed by the Port Trust of India under Central Government jurisdiction. There are also 139
minor operable ports under the jurisdiction of the respective State Governments. The major ports are located at Calcutta/Haldia, Mumbai, Jawaharlal Nehru Port at Nava Shiva, Madras, Cochin, Vishakhapatnam, Kandla, Mormugao, Paradip, New Mangalore and Tuticorin. The major ports handle 90 percent of the all-India port throughput, and thus bear the brunt of sea-borne trade. Dry and liquid bulk make up about 85 percent of the port traffic in volume with general cargo, including the containerized cargo, constituting the remaining traffic (Indiabudget, 2001).

Map 1.1: Map of Indian Ports

![Map of Indian Ports](http://www.pearlshipindia.com/images/img_india_map_s.gif)

Source: [http://www.pearlshipindia.com/images/img_india_map_s.gif](http://www.pearlshipindia.com/images/img_india_map_s.gif)
1.3.2.A  The Indian ports are characterized by the following:

1. Ships have to wait long in the channel for berthing, and productivity in loading and unloading is low. The national average turn-around time of vessels for liquid, dry bulk, and general cargo is estimated at 3.4 days, 9 days and 3.6 days respectively (Vijayaraghavan, 2007).
2. It is labor intensive and mechanization process is non-existent or slow.
3. Night navigation is not available, and ships have to wait for daylight.
4. Equipment used is outdated and obsolete.
5. Restrictions in navigation channels do not allow bigger vessels to be berthed.
6. Handling vessels and feeder vessels in container berths is time consuming.
7. The road links to ports are insufficient and badly maintained.
8. Lack of coordination between ports and the custom authorities delays quicker dispensation of documentation and goods.

1.3.2.B  Railways

The Indian Railways consists of extensive network spread over 62,915 km covering 7068 stations and is considered as the fifth largest in the world after USA (2,24,000 km), Russia (1,54,000 km), China (78,000 km), Canada (72,961 km) (The Times of India, 2005). Of late, Indian Railways has started to look much more efficient and revenue earning is also increasing.

With a vast geographical area and favorable location, India has the potential to network with CIS countries, especially through Iran to provide necessary infrastructure. This, facilitated by the availability of vast network of railways, roads, sea and airports that needs to be upgraded technically and managerially. As it is the linkage between organization’s customer and the sources of its products or services that the organization provide to the market place. This particular design is not only important as it involves consideration of distribution cost which forms a significant percentage of total marketing costs.
1.3.3 India Vis-à-Vis the World:

India Inc. continues to grow strong in terms of expanding businesses across the world, but when it comes to cross-border transportation of goods, the country ranks below a number of other major economies such as the US, UK and China. India holds the 39th position on the Logistics Performance Index (LPI) that is based on the ability to transport goods reliably and in a cost-effective manner to and from a country. The list of 150 countries has been topped by Singapore, followed by the Netherlands (2nd), Germany (3rd), Sweden (4th) and Austria (5th). Others in top-ten include Japan, Switzerland, Hong Kong, UK and Canada (The Economic Times, 2007).

The Logistics Performance Index is based on a survey of operators on the ground worldwide (global freight forwarders and express carriers), providing feedback on the logistics friendliness of the countries in which they operate and those with which they trade. They combine in-depth knowledge of the countries in which they operate with informed perceptions of other countries with which they trade, and experience of global logistics environment. Feedback from operators is supplemented with objective data on the performance of key components of the logistics chain in the home country, data collected for 100 countries.

The LPI consists therefore of both perception and objective measures and helps build profiles of logistics friendliness for these countries. It measures performance along the logistics supply chain within a country and has three parts:

1. Perceptions of the logistics environment of trading partner countries
   a. Efficiency and effectiveness of Customs and other border procedures,
   b. Quality of Transport and IT infrastructure for logistics;
   c. Ease and affordability of arranging shipments;
   d. Competence in the local logistics industry (e.g., transport operators, customs brokers);
   e. Ability to track and trace shipments;
   f. Domestic logistics costs (e.g., local transportation, terminal handling, warehousing); and
   g. Timeliness of shipments in reaching destination.

9
2. Information on the logistics environment in the home country of operation
   a. Direct freight costs
   b. Quality of transport and IT Infrastructure,
   c. Competence in the delivery of input services logistics operators need,
   d. Performance of the clearance process of exports and imports,
   e. Constraints affecting logistics performance,
   f. Trends

3. Real time-cost performance data for country of operation
   a. Number of border agencies,
   b. Customs performance indicators (time release, inspection data, possibility of review for imports),
   c. Percentage of damaged shipments,
   d. Lead times to export and import (based on best 10%, median 50% and worst 90% of shipments).

India has been ranked below the US (14th), China (30th), Finland (15th), Australia (17th), France (18th), New Zealand (19th), Italy (22nd) and South Africa (24th) (The Economic Times. 2007). However, the country has found a place higher than as many as 111 nations including Saudi Arabia, Poland, Qatar, Cyprus, Pakistan, Bangladesh and Sri Lanka. India is the second highest ranked nation among the BRIC countries after China. Brazil and Russia have been positioned at 61st and 99th place respectively.

Further, India is ranked 46th in terms of logistic costs. These costs are higher in the country compared to China (43rd) but less than Sri Lanka (47th) and Bangladesh (48th).

In terms of timeliness, India is ranked at the 47th place while China is at the 36th position. On a scale of one to five, India has been given an overall score of 3.07 points on Logistics Performance Index (LPI) reflecting parameters like customs, infrastructure, international shipments, logistics competence, tracking and tracing of shipments, domestic logistics costs and timeliness (Table 1.1).

The performance of customs, trade-related infrastructure, inland transit, logistics services, information systems, and port efficiency are all critical to whether
countries can trade goods and services on time and at low cost. And this trade competitiveness is central to whether countries can harness globalization’s new opportunities for development. The LPI uses a broader and comprehensive approach to supply-chain performance to measure some of the critical factors of trade logistics performance, including the quality of infrastructure and logistics services, the security of property from theft and looting, the transparency of government procedures, macroeconomic conditions, and the underlying strength of institutions.

1.3.3.A India and CIS in terms of LPI

As mentioned above the Logistics Performance Index (LPI) and its indicators provide the first in-depth cross-country assessment of the logistics gap among countries. A comparison between India and major CIS countries is offered in this section on the basis of LPI.

**Table 1.1: Logistic Performance Index table of India and major CIS countries**

<table>
<thead>
<tr>
<th>Country</th>
<th>LPI</th>
<th>Customs</th>
<th>Infrastructure</th>
<th>International Shipments</th>
<th>Logistics competence</th>
<th>Tracking &amp; tracing</th>
<th>Domestic logistics costs</th>
<th>Timeliness</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>3.07</td>
<td>2.69</td>
<td>2.9</td>
<td>3.08</td>
<td>3.27</td>
<td>3.03</td>
<td>3.08</td>
<td>3.47</td>
</tr>
<tr>
<td>Ukraine</td>
<td>2.55</td>
<td>2.22</td>
<td>2.35</td>
<td>2.53</td>
<td>2.41</td>
<td>2.53</td>
<td>3.25</td>
<td>3.31</td>
</tr>
<tr>
<td>Belarus</td>
<td>2.53</td>
<td>2.67</td>
<td>2.63</td>
<td>2.13</td>
<td>2.13</td>
<td>2.71</td>
<td>3.13</td>
<td>3</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>2.37</td>
<td>1.94</td>
<td>2.23</td>
<td>2.48</td>
<td>2.46</td>
<td>2.17</td>
<td>2.4</td>
<td>2.94</td>
</tr>
<tr>
<td>Kyrgyz Republic</td>
<td>2.35</td>
<td>2.2</td>
<td>2.06</td>
<td>2.35</td>
<td>2.35</td>
<td>2.38</td>
<td>2.8</td>
<td>2.76</td>
</tr>
<tr>
<td>Moldova</td>
<td>2.31</td>
<td>2.14</td>
<td>1.94</td>
<td>2.36</td>
<td>2.21</td>
<td>2.5</td>
<td>2.92</td>
<td>2.73</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>2.16</td>
<td>1.94</td>
<td>2</td>
<td>2.07</td>
<td>2.15</td>
<td>2.08</td>
<td>2.91</td>
<td>2.73</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>2.12</td>
<td>1.91</td>
<td>1.86</td>
<td>2</td>
<td>2.05</td>
<td>2.19</td>
<td>2.81</td>
<td>2.65</td>
</tr>
<tr>
<td>Armenia</td>
<td>2.14</td>
<td>2.1</td>
<td>1.78</td>
<td>2</td>
<td>2.11</td>
<td>2.22</td>
<td>3.43</td>
<td>2.63</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>2.29</td>
<td>2.23</td>
<td>2</td>
<td>2.5</td>
<td>2</td>
<td>2.38</td>
<td>2.88</td>
<td>2.63</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>1.93</td>
<td>1.91</td>
<td>2</td>
<td>2</td>
<td>1.9</td>
<td>1.67</td>
<td>2.33</td>
<td>2.11</td>
</tr>
</tbody>
</table>


The above table (1.1) shows the comparison of India and major CIS region with respect to various trade related indicators. The indicators summarize the performance of countries in seven areas that capture the current logistics environment. They range from traditional areas such as customs procedures, logistics costs (such as freight rates), and infrastructure quality to new areas like the
ability to track and trace shipments, timeliness in reaching a destination, and the competence of the domestic logistics industry. The LPI and its indicators are given on a numerical scale, from 1 (worst) to 5 (best). This scale can also be used to interpret performance outcomes measures. For example, the analysis based on the additional country information gathered in the survey, indicates that, on average, having an LPI lower by one point (say, 2.5 rather than 3.5) implies six additional days for getting imports from the port to a firm's warehouse and three additional days for exports. It also implies that a shipment is five times more likely to be subject to a physical inspection at entry.

The LPI of India is 3.07 which are better than any of the CIS countries. Best among CIS countries is Ukraine (2.55) closely followed by Belarus (2.53), Russia (2.37) and Kyrgyz Republic (2.35). India is ranked better than any of the CIS countries on the parameters like Customs, Infrastructure, International shipments, logistics competence and timeliness. On the other hand, Armenia (3.43), Ukraine (3.25) and Belarus (3.13) score better than India (3.08) in terms of domestic logistics cost.

Details of the ranking procedures and results are given in Appendix 2.
References


