# Containerization Is on the Fast Track in India

*K P V Ramanakumar **M Srinivas

## Abstract

Containerization is the method of packing goods in reusable containers for transportation. Containerization has gained in popularity due to its inherent advantages of supporting inter-modal transport, additional safety of goods, cost effectiveness and faster speed of transportation. More than 90% of world merchandise trade is carried by sea and over 50% of that volume is Containerization. However, in India containerization is picked up only in the last decade owing to better infrastructure, Government focus and increased private participation. Globally, the level of Containerization is 50%, as against just over 16% in India. Burgeoning trade particularly textile, auto & auto components, engineering and capital goods have been the major driving force behind Containerization in India. Remarkably, India's container traffic is growing faster than the global container traffic for the last 6-7 years, after private container terminals on BOT basis have started participating i.e. NSICT, CCTL, MICT, VCTPL and IGTPL state of art container terminals. The paper deals with many more such interesting issues and these issues are highly relevant as container trade forms a vital part of logistics and supply chain management.

## Introduction

Containerization is the method of packing goods in reusable containers for transportation. Containerization has gained in popularity due to its inherent advantages of supporting inter-modal transport, additional safety of goods, cost effectiveness and faster speed of transportation. More than 90% of world merchandise trade is carried by sea and over 50% of that volume is Containerization.

However, in India containerization is picked up only in the last decade owing to better infrastructure, Government focus and increased private participation. Globally, the level of Containerization is 50%, as against just over 16% in India. The main purpose of this paper is to

Analyze the factors and reasons for the slow pace of containerization growth in India in contrast to the economy where in Gross Domestic Product is predicted to cross the double-digit mark as well as in contrast to the rapid growth rate progress of global containerization.

*Dean (R&D), Sri Chandrasekharendra Saraswathi Viswa MahaVidyalaya, Enathur, Kanchipuram

**PIL India, Chennai

The scope of this paper includes overview of

a) India's ports/terminals
b) Container throughput
c) Demand in comparison to global scenario,
d) Capacity Utilizations vs. demand growth,
e) Prevailing infrastructure bottlenecks,
f) Government role and plans on development strategies,
g) Port/terminals /Rail Road connectivity ,
h) Container transport movements by sea in volumes

## Current Scenario

Burgeoning trade particularly textile, auto & auto components, engineering and capital goods have been the major driving force behind Containerization in India. Remarkably, India's container traffic is growing faster than the global container traffic for the last 6-7 years, after private container terminals on BOT basis have started participating i.e. NSICT, CCTL, MICT, VCTPL and IGTPL state of art container terminals.

Containerized traffic in India has posted a steady growth of 12.9% CAGR during the period 1997-2006 outpacing the overall cargo traffic which grew at 7.1% CAGR during the same period. This has helped boost the share of container traffic in total port traffic from 9.1% in FY 1997 to 14.6% in FY 2006. In terms of volumes handled measured in Twenty feet equivalent units (TEUs), containerized traffic has posted a CAGR growth of 11.6% from 1.7M TEUs handled in 1997 to 4.6M TEUs handled in 2006. It is expected that the container traffic to grow at 14-16% CAGR between FY2007- FY2015 to cross the 10M TEUs mark by 2010-11. Capacity at major ports has been the biggest constraint for growing container traffic in India.

However, the situation is improving with increasing private participation by major international players like Maersk and Dubai Port Authority. Currently, private sector operators handle over 65% of the container traffic in India. As of June 2005, there were 11 container terminal projects at an estimated cost of Rs. 13,155 Crores at various stages of implementation.

## Traffic concentrated on few terminal posts

JNPT and Chennai together account for almost 70% of the container traffic in India. JNPT's third terminal has already commenced operations and is expected to scale up by end of CY2007 bringing in an additional 1.3M TEUs of capacity. The fourth terminal at JNPT is expected to be completed in two phases bringing in another 3M TEUs capacity by 2012-15. However, the first phase of this expansion is expected to be completed by 2011 with 1.5M TEU capacity. The Chennai port is also setting up a second container terminal with a capacity of additional 0.8M TEUs and is expected to commence operations in 2010. Ports like Mundra and Pipavav are also undergoing expansions and would aid increasing the port handling capacity of

India. Containerization of general cargo in India began in 1970s as against its advent in 1960s in developed countries and gained momentum in 1980s.

The level of Containerization in India is still at a level of 45-48% in India compared to 65-75% in the developed countries. India has kept pace with the growth of container trade world over during the last decade; as a matter of fact container traffic at Indian ports has increased at a rate higher than the world average. There has been impressive growth of container traffic of 14.2% per annum during the five years ending in 2000-05. Due to the continued liberalization and increasing globalization of the Indian economy, India's overseas trade has been growing at a rapid pace. The general cargo (liner) trade is an important part of the India's overall overseas trade constituting about 18-20% of the total sea borne trade by volume, which would be much higher in terms of value. At the present stage of economic development, India's liner trade will certainly be a high growth area as there will be increased trade of semi-finished, finished goods and value-added products. Furthermore, India's potential to become a manufacturing hub, augurs well for the liner trade of the Country.

The Government has targeted doubling Indian Share in world export by 2009 from the current 0.8%. Amongst the Indian ports, JN Port is by far the largest, handling about 55% of the container traffic at the Major Indian ports. JNP ranks 32$^{nd}$ amongst world's top 100 container terminals and during 2004-05, handled 2.37 million TEUs, which is roughly 10-11% of the traffic handled by Hong Kong port.

World over the container trade is evolving as the shipping lines foresee the requirement of the trade and acquire suitable tonnage. The average ship size in 1980 was 975 TEUs and the largest ship was 3,057 TEUs. In the year 2007, the average size of a fully cellular container carrier is 2,218 TEUs and the largest size is about 9,200 TEUs and still increasing. The draft requirement has also changed accordingly. The most noticeable feature of this new generation ships is their speed. Thus, there has been a phenomenal rise in ship size and speed to feed the hub-spoke system. Thus, the lines are not only trying to meet the trade requirement for Just-In-Time deliveries, but are also trying to achieve economies of scale to be competitive.

India still lacks deep draft in many of its ports. Today Mundra Port is the only port having a draft required to handle the containership behemoths (10,000 – 12,000 TEU ships) that are being delivered from the leading shipbuilding yards of the world. In the global container ship order book, compared to the growth of 7.18% CARG during 2006 – 2010 of the Sub-Panamax Fleet (< 4,000 TEU), the Post-Panamax Fleet (> 4,000 TEU) is expected to grow at a CARG of 17.24%. In this context, it is worthwhile to note that Hyundai Heavy Industries and Germanischer Lloyd have unveiled a design for a 13,000 TEU ship powered with 2 main engines and 2 propellers, which is 382 m long, 54.2 m wide and having 13.5 m draft. In the future, we could probably see the containership size reaching its zenith viz. the Malacca max – 18,154 TEU ship having dimensions of 400m length, 60 m beam and 21 m draft.

The Container Liner Shipping Industry is currently facing a series of financial difficulties created by the general stagnation in market growth and the dramatic increase in capacity in both number of ships and containers made available in the market. Recent developments in the industry have created a situation where doing business the old way simply will not work anymore.

With depressed annual world trade growth expected to be less than 2% while container fleet capacity is increasing by 12.6%, freight rates will remain intensely competitive. For the majority of container carriers, financial break-even will only be achieved through further cost reductions and better Revenue Management. Since operational expenses have already been pared to the bare minimum, on-going savings can only be achieved by increased efficiency and productivity.

New effective sales channels and e-business initiatives are being implemented to better address the market place, however the necessary back office decision support tools are still lacking, with access to information being the primary obstacle.

Since the introduction of the maritime container in the mid 1950's, liner-shipping groups have migrated from traditional inefficient cargo handling techniques to the fully cellular vessels regularly seen today at any of the world's major ports. Both shippers and carriers have benefited dramatically from the use of the container, with improved inter-modal productivity, faster point-to-point transit times and reduced cargo damage. The maritime container fleet of carrier-owned and leased equipment has quickly grown to over 15.5 million TEU's worldwide. The world's leading container operators currently control 80% of the world's international movement of containers. But along with the obvious benefits of the container have come increased operational complexities and a multitude of new fixed and variable costs that must be properly managed.

Over the last decade Container Carriers have significantly under performed financially compared to other industries resulting in a status quo in share prices. The weaker performance can be related to the combination of the capital-intensive operation and the high risks associated with the revenues. Due to the intense competition between Container Carriers the market prices are constantly under pressure, which, together with uncertainty of Cargo Costs, creates a high uncertainty for actual contribution per shipment. Many Carriers employ a "marginal cost-only" approach in their pricing policies on low load trades, which have had a tendency of reducing the average yield per TEU significantly, resulting in direct operational losses on these trades. On the cost side the Vessel and Voyage costs have been increased dramatically in order to establish competitive Networks satisfying the global requirements. At the same time the Container Fleets have been increased dramatically to ensure availability and in response to the imbalance of trades.

Increases in the size of the box fleet through acquisitions of new containers and use of leased

equipment have brought a number of new challenges.

- Growing Fixed Costs
    - Cost of ownership, finance and leasing charges
    - Maintenance and repair
    - Storage
- Growing operational budgets (repositioning, inland transportation, etc.) and a constant focus on cost savings and improved productivity.
- Stock control management; global carriers operate large fleets in excess of 100,000 TEU and require to optimize inventory at global, regional, area and depot level.
- Monitoring and tracking of both loaded and empty containers in a timely and accurate manner.
- Forecasting of future container demand requirements and the optimization of equipment repositioning expenses.
- Demand for more up to date and user friendly IT systems, which will enhance decision-making processes.

In view of the industry's expenditure on the transportation of "empty air" around the world, it is not surprising that the major carriers are examining ways of reducing this unproductive element of costs. With average yields under pressure and increasing operational costs the Container Carrier need to have an up-to-date view of demands for each route, within each area and even per port and depot operated, in addition they need to have a clear view of the contribution and profit forecast per cargo in order to offer sound business options on the individual trading. Demand forecasting is a key to improved revenues and reduced container fleet costs.

**Indian ports/terminals throughputs vs. capacity utilization in comparison to global scenario :**

Analysis on Port/Terminals/Road/Rail Infrastructure inadequacies being stumbling block and critical factor for time delays attributing to high costs with limited by Choice or no options being available forming the base for performance efficiency.

Critical analysis of the flow sequence of transaction with focus on factors attributing to time delays. At every stage in the value chain for overall costs being high with low productivity. Secondary data is collected from different reference articles from websites, however, criticalities of operational and commercial issues underlying have not been touched upon in the study which is left to infer depending on the applicable on case to case basis.

Collection of primary data by meeting top officials of major shipping lines/ports & terminal/transport and CFS operators etc for feedback through questionnaire and analyzed accordingly.

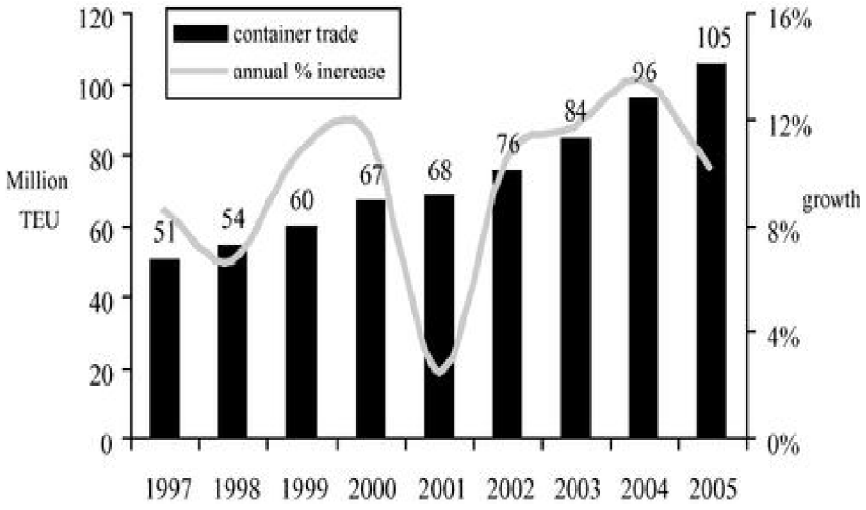



**Fig. 5.01 – World wide Container Trade & growth**

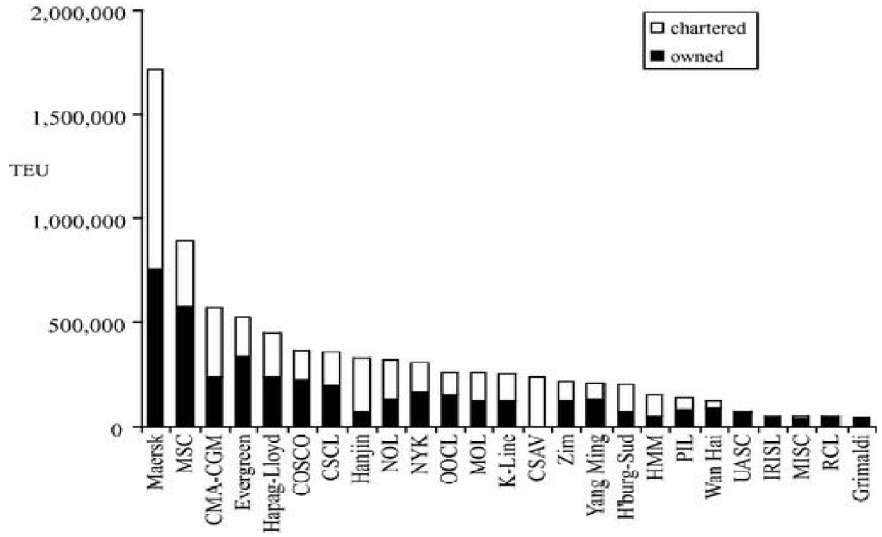



**Fig. 5.02 – Top Global Liner Operators by TEU**

Source: CRS and industry sources, September 2006.

Shipping is a global industry and its prospects are closely tied to the level of economic activity in the world. The maritime shipping industry is fundamental to international trade because it is the only practicable and cost effective means of transporting large volumes of many essential commodities and finished goods. Shipping markets are highly competitive and ship charter hire rates are very sensitive to changes in demand for and supply of capacity, and are consequently volatile. There are four main segments in the shipping industry, namely tankers, which carry such cargo as crude oil, petroleum products, etc.; bulk carriers, which carry coal, grain, etc; containerships, which carry only containers; and gas tankers, which carry mostly LPG and LNG. According to the latest available figures, in 2005 total annual world sea borne trade was estimated at 7.2 billion metric tonnes, of which dry bulk cargoes amounted to 2.6 billion tonnes and oil cargoes amounted to 2.6 billion tonnes. Global container trade exhibited the highest annual growth rate during the period shown, at 9.9%, which was well above the annual growth rate of world's sea borne trade of 3.8%.

Container shipping is responsible for the movement of a wide range of goods from one part of the world to another in a unitized form. Participants in the container shipping industry include "liner" companies, who operate container shipping services, containership owners, often known as charter owners, who own containerships and charter them out to the operators, and shippers who require the sea borne movement of containerized goods. Container shipping represents an important and increasingly significant part of the global sea borne movement of goods. In 2005, global container trade stood at an estimated 105 million TEU. As of September 1, 2006, the global containership fleet contained 3,848 fully cellular containerships, with a total standing slot capacity of almost 9.0 million TEU, while the total container capable fleet capacity stood at almost 11.0 million TEU.

The range of containership owners is diverse, including liner companies, which are often significant corporate entities, and charter owners, who are often part of wider groups involved in other shipping activities. Ship owning generally requires a relatively high level of capital investment. Ownership of the Panamax and above sized sector is less fragmented than the ownership of smaller vessels. There are a large number of charter owners who own a small number of containerships, with over 200 owning just one or two containerships, and the average age of the worldwide containership fleet as of September 1, 2006 was 11.3 years.

Growth in the liner shipping market has been relatively rapid in comparison with other major shipping sectors such as tankers and bulk carriers. In terms of loaded containers moved from origin to destination, estimated global container trade increased from 50.8 million TEU in 1997 to 105.2 million TEU in 2005, a compound average annual growth rate of 9.5%. In the last three years demand for container shipping has accelerated strongly, with estimated growth in world container trade reaching 11.6% in 2003, 13.4% in 2004 and 10.1% in 2005.

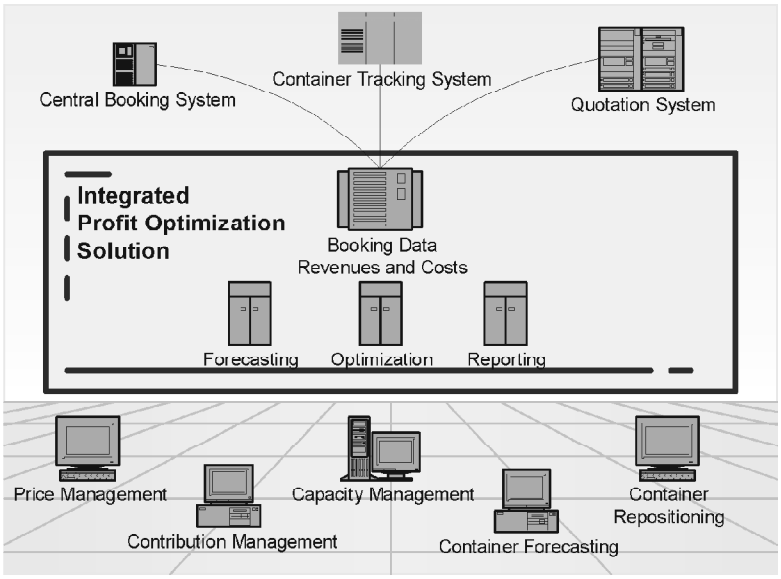
The demand for containership capacity is dependent on the volume of traffic on the world's container

trades. Effective demand is also dependent on trade distance, with longer distance trades generating greater demand for capacity in terms of "TEU-miles', absorbing a greater level of dynamic capacity to move each unit of containerized cargo. Container trade is also seasonal, with the peak season running from the late summer through autumn in the build up to the world's peak consumption period.

Although this seasonality is felt more sharply in container trade volumes than on the containership charter market, the charter market remains volatile. The volatility of charter rates results from changes in the supply of, and demand for, charter owners' capacity. The degree of charter rate volatility has varied among different sizes of containerships and charter rates for smaller vessels have generally tended to be less volatile. The containership charter market has also been cyclical with periods of relative over-supply of capacity alternating with periods when demand grew more rapidly than available capacity. During each of these periods, the charter market has remained competitive, with charterers seeking competitive rates from a range of owners.

## Voyage Management System

Deregulation and intense competition are bringing new challenges to container carriers. Other industries with similar characteristics – fixed capacity, high fixed costs, relatively low variable costs, time-varied demand and similarity of inventory units – have been able to adapt and prosper using Revenue Management techniques. This approach relies upon market segmentation, price differentiation, knowledge of historical demand and forecasting capabilities. The net effect is to preserve revenues from "service sensitive" customers, while capturing "price sensitive" customers as well.



## Container Fleet Management

One of the single largest expenses for most container operators is the repositioning of empty containers. A small percentage reduction in unremunerated repositioning costs, will be reflected in improved "bottom line results". The key is to improve the quality of information regarding container demand and supply in order to minimize empty repositioning costs and maximize equipment utilization. Ultimately such optimal solutions should lead to a pro-active pricing mechanism for improved revenues and reduced costs.

Logistics optimization is about doing things more efficiently. Lower transportation and repositioning costs, reduced planning time, increased flexibility plus quick and better insights into the efficiency and profitability of your logistics operation are typical benefits that can be expected. In prosperous times, optimization technology will help container carriers to do more with the same resources, while in a slow economy optimization techniques are frequently implemented to find cost saving opportunities. Logistics optimization technology has already delivered billions of dollars in cost savings and revenue enhancements to some of the world's leading transportation corporations.

The following modules and functionality are available:

- **Forecast container surplus and deficits in regions, areas and depots**

  Having a reasonable understanding of what will be required in the different regions, areas and depots around the world is valuable information when it comes to logistics optimization. Highly sophisticated forecasting techniques can be used to analyze historical data to better estimate what will happen in the (near) future in terms of (empty) cargo movements and stock levels by container type.

- **Optimal matching of import and export cargo demands**

  In order to optimally use transportation resources (vessels, trucks, rail) import and export freight will be analyzed and optimally matched where possible according to customer requirements to minimize empty repositioning costs. This takes into account excess empties and will result in optimal utilization of equipment while total transportation costs (for both full and empty containers) are reduced and trade imbalances will be compensated.

- **Determine on-hires, off-hires and new boxes at port level**

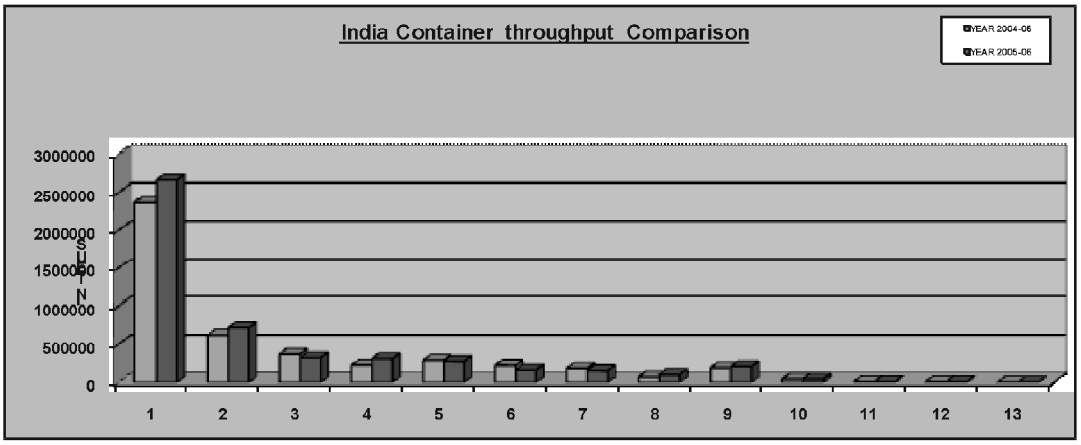
  Based on (forecasted) stock levels at the various locations over time, vessels schedules, vessel capacity, relevant cost/ revenue structure and other relevant parameters, mathematical models can be used to determine the number of on-hires, off-hires and new boxes at every port over time, together with the optimal repositioning of empty containers that will minimize total operational costs while satisfying all carrier constraints.

- **Scenario analysis and 'what-if' modeling**

  Once all relevant data is correctly modeled in the system, what-if questions can be answered and simulations can be run using the optimization models and engines. For example, existing and new contracts can be evaluated with respect to their impact on total logistics costs and net value contribution; an important issue here is how each contract is related to the network imbalance and the existing (empty) container flows.

As may be seen from the above that future new building deliveries of container vessels would predominantly be in the bigger size ranges. Thus, the Indian economic growth and trade pattern indicate potential of double-digit growth of the Indian container trade. The moot question is – are Indian ports ready to handle this changing trade pattern and match the efficiency parameters of the world ports? A look at the readiness of Indian ports shows that although there are success stories, the Indian ports as a collective sector has to improve on the parameters such as draft, Average Turnaround time, Average Pre-berthing Time, etc. In order to sustain the projected double-digit growth in container traffic, apart from port development, the maritime industry also has to look at the other areas such as rapid and unhindered hinterland connectivity, improvement in Cold chain infrastructure, and legislation in line with world practices.

The Government has placed greater emphasis on private sector participation to address the issue of infrastructure shortfall in port sector. The new projects would give the shippers and carriers more choice ushering in more competitive freight transport environment, which will in turn increase the transport efficiency and reduce the costs. The land-based leg will be faster with widening of National & State Highways. Liberalization of rail services and opening of container train business to private sector participation is a step towards further improving the transport infrastructure in the Country. Development of dedicated freight corridors is also being put on a fast track.



| Year | NSA | MAA | TUT | MUN | CCU /HAL | BOM | KDL | PAV | COK | VTZ | GOA | MNL | PRT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IN TEUS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 2004 -2005 | 2370000 | 616530 | 370700 | 220142 | 288030 | 218714 | 180379 | 68885 | 185175 | 44149 | 10320 | 8943 | 2281 |
| 2005-2006 | 2667000 | 714738 | 320928 | 310050 | 272393 | 156122 | 149000 | 100010 | 203112 | 46126 | 9456 | 9646 | 3417 |

**Fig. 5.3 India Container throughput Comparison**

Overcapacity inevitable, despite increasing demand. International container shipping is one of the most dynamic economic sectors of the last few years. Between 1990 and 2005 the container trade at the world's ports expanded by just under 10% p.a. on average (2005: +11%). The sector greatly surpassed sea borne trade overall and even the growth in international air transport.

The major reasons for the growth in container shipping are, on the demand side, the increasing international division of labor in the course of containerizations and the resulting trade movements; and also the rise in importance of goods eminently suited to transport by container. On the supply side, the considerable expansion of the container ship fleets and faster loading and unloading of container ships are playing an important part; they allow short turnaround times in port.

The growth in next 10 years, with an only slightly reduced impetus. We expect annual the growth in international container shipping will continue for the growth of about 9% in container handling up to 2015. The main routes that are likely to achieve the greatest expansion include intra-Asian transport as well as the routes from North America and Europe to Asia. In contrast, transport between North America and Europe will increase less strongly. of the 25 largest container ports in the world, 16 are in Asia, only three in North America and six in Europe.

Despite the increasing demand for container transport, until 2008 freight charges will probably stay below the level of the last two exceptional years. The main reason is the anticipated massive expansion of global container ship capacity. Between 2006 and 2008 the available container capacity worldwide will expand by about 50%. The shipyards' long order books for container ships argue against a rapid redress of the excess supply.

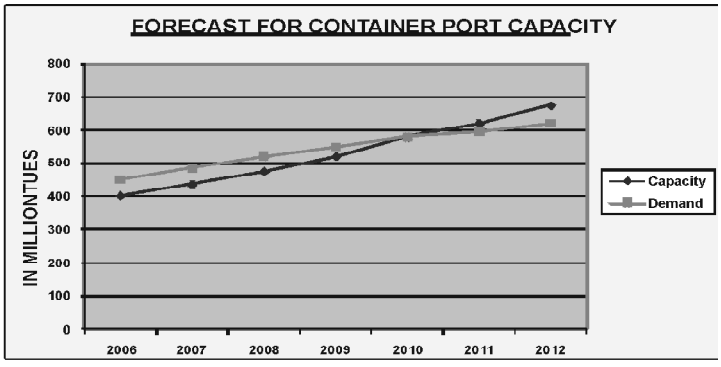



**Fig. 5.4 Forecast for Container Port Capacity**

India is the seventh largest and second most populous country in the world. The ambitious economic reforms initiated by the Government during early 1990s aimed at deregulating the country's economy and stimulating foreign investment and has moved India firmly into the front ranks of the rapidly growing Asia Pacific region. The real GDP growth in Indian since 1997 has averaged at about 6% per annum. Over the period 1991 to 2005, the import and export have grown at average rates of 8.8% and 9.27% respectively in terms of value. The turn of the century has witnessed rapid growth in the country's merchandise trade as imports and exports have risen at a much rapid rates of 21% and 16% respectively over the past five years.

During the year 2005-06, the value of India's exim trade was US$ 236 billion. India is a maritime country with approximately 95% of India's international trade by volume and 70% by value being sea borne. India has 12 major and 185 minor/ intermediate ports along the 7517 km coastline. Coastal shipping caters to domestic trade. The maritime sector has a multiplier effect on the economy & creates employment.

The total tonnage of cargo handled by Indian ports was around 412 million tonnes (MT) in 2002-03. Of this major ports handled 76 per cent, while the remaining was handled by minor ports (mainly on the western coast). In 2003-04, major ports handled 344.5 MT as against 313.5 million tonnes in 2002-03, a growth of 10 per cent. Sea-borne trade is expected to touch 656 MT by 2006-07, and minor ports would cater to around 25 per cent of this trade.

About 85 per cent of the total volume of port traffic is in the form of dry and liquid bulk, the remaining being general cargo (inclusive of containers). Currently, there is an increasing focus on containerization of ports, given the large potential for growth (as a large portion of the world's cargo moves in containers).

There are plans to increase the share of coastal shipping from 7 per cent to 12-13 per cent of the total domestic cargo by 2012. Lower vessel rates (40 per cent lower than foreign going vessels) are expected to act as an incentive in this regard. The river-interlinking scheme (Sagarmala project), with an estimated investment of Rs.1 trillion, will also provide a fillip to the port sector.

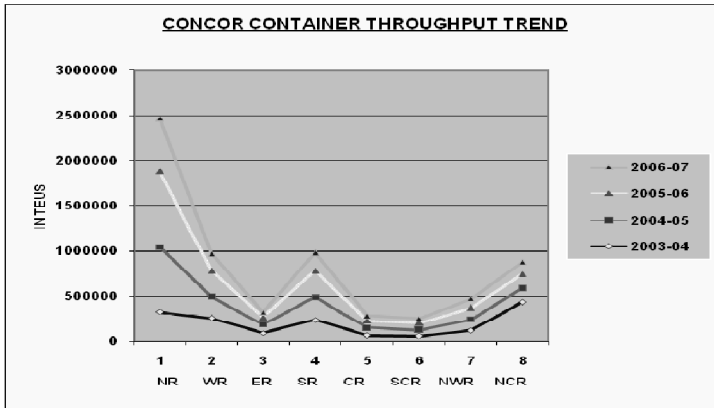


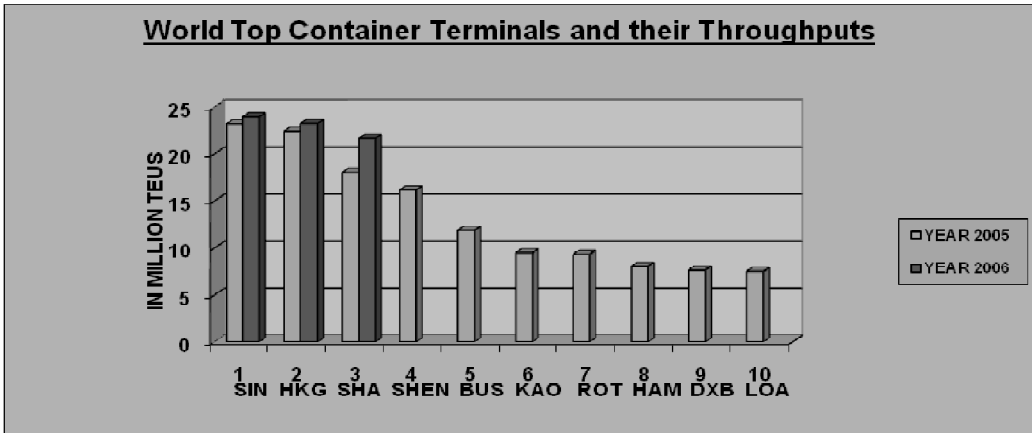

**Fig. 5.5 Concor Container throughput Trend**

Given the increased impetus on exports, there is an urgent need for better port connectivity infrastructure. Focus on providing hinterland connection to various ports through railways and roads will reduce congestion levels at many ports. Private participation with respect to railways connecting ports is considered a positive development.

Privatization has helped increase investment in the industry and has also improved operating performance. However, the pace of containerized and corporatization of ports has been slow. Further, labor related problems and a lack of clear policy could affect private investment and result in slower growth in this sector.

The Union Budget 2004-05 provides a significant fillip to the port sector, given its higher focus on infrastructure sector. The setting up of the Inter-Institutional Group for development of infrastructure, and higher commitment on the Sethusamudram Ship Canal Project, will ensure a focused lending approach and speedier project-approval process. This will aid timely completion of projects in this sector. Approval process. This will aid timely completion of projects in this sector.

The development of the International Container Transshipment Terminal (ICTT) at the Kochi port will help it compete with the Dubai and Colombo ports, which are currently used as transshipment hubs. The introduction of tonnage tax would provide a level playing field to the Indian shipping industry. This would translate into higher tonnage and traffic on the Indian ports.




| Year | Singapore | Hong Kong | Shanghai | Shenzhen | Busan | Kaoshiung | Rotterdam | Hamburg | Dubai | Los angels |
|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | 23.19 | 22.43 | 18.04 | 16.2 | 11.84 | 9.47 | 9.3 | 8.05 | 7.62 | 7.48 |
| 2006 | 23.98 | 23.23 | 21.71 | | | | | | | |

**Fig. 5.6 World Top Container Terminals and their throughput**

As export activity moves up the value chain, containerization is bound to increase. Over the past decade, container volumes have grown by six to eight per cent per annum, or between two and three times GDP growth. This growth is expected to continue in the future. Cargo that used to be shipped in break bulk is increasingly getting containerized in spite of the fact that sometimes freight costs are higher! The reasons being cited are general ease of handling, lower transit times and savings on cargo contamination, damages and insurance premiums.

For example, in Chennai alone, around 90 per cent of the cargo like newsprint, wood pulp and nylon for the tyre industry, which used to ship in break bulk are now being containerized.

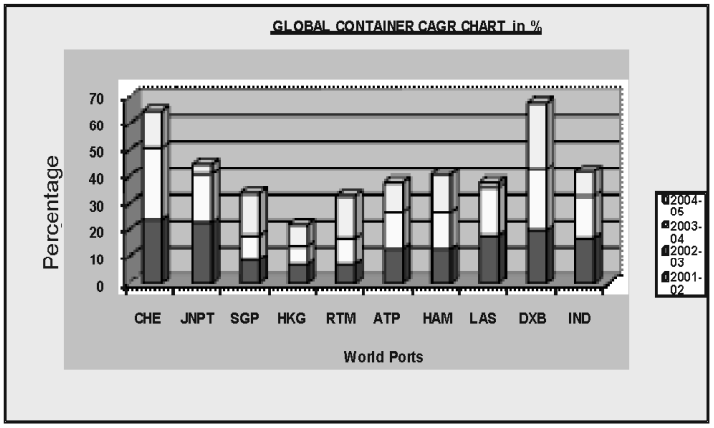



**Fig. 5.7 Global Container CAGR Chart**

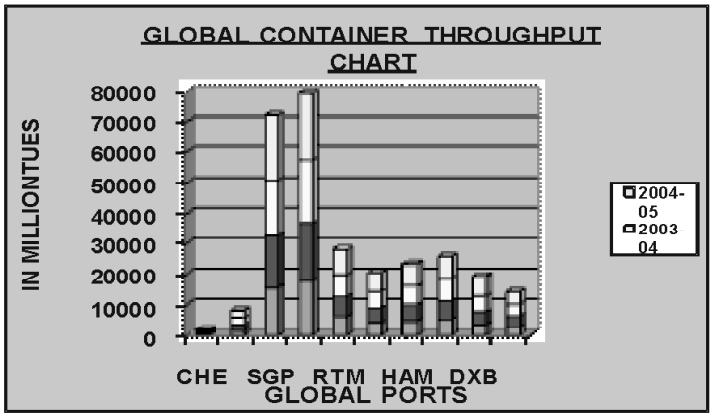



**Fig. 5.8 Global Container throughput Chart**

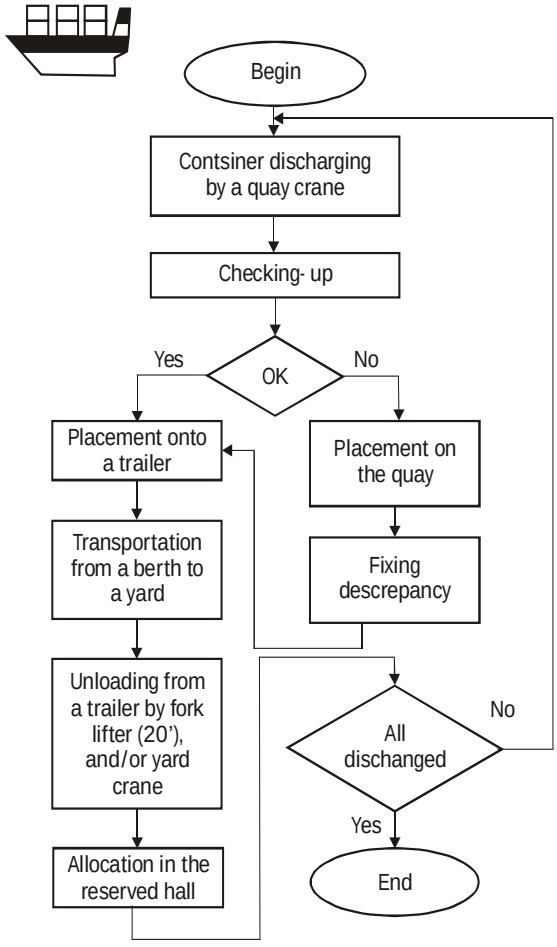



Fig. 5.9 Container flow chart

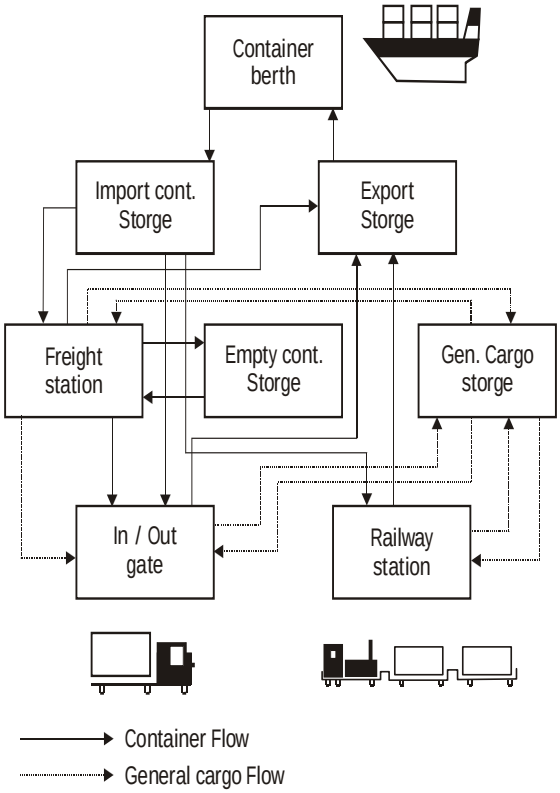



Figure 2. Structure of Bct Material Flows

**Fig. 5.10 Container import/export flow chart**

Basis on the primary and secondary data and the feedback received from the terminal operators, Shipping lines, CFs operators, ICD rail/road service provider it is inferred that in spite of the constraints and the Limitations of the infrastructure in place the targets and achievement By the service providers in tonnes containerization had been good and with the infrastructure bottlenecks being addressed on priority by the Government which would propel further progress of containerization growth in line with the GDP forecasted to achieve in coming years. Therefore to achieve, the projected double-digit growth in the container traffic, which is definitely in the realm of reality as the entire transport infrastructure in the supply chain is gearing up to meet the challenge.

Containerization is an end-to-end solution. It only adding the opportunity, which presents it for small exporters and importers to do business. Take the example of agricultural products like rice and sugar. They used to be shipped in bulk and safe warehousing to avoid contamination was always a challenge. Added to it are today's soaring bulk charter rates where money still won't land you a vessel! This, though it sounds negative, gives small traders an opportunity to ship smaller parcel sizes in containers to respond the Middle East are now being containerized. The cost factor does play its part in segments since the handling cost is lower for boxed cargo as opposed to break bulk, some mineral exports to market opportunities.

Another cost advantage occurs because of India's balance of trade, so to speak! With 40 per cent more imports than exports, incoming containers wait for repositioning to other locations. Container lines, instead of spending on shipping out empties, offer good deals for shippers to specific locations as a result of which Soya, sugar, steel plates and agro products have gone the container way. Shippers wanting to handle smaller parcel sizes because customers want just in time deliveries, prefer containers where tracking transit and transit times – given the technology and communication facilities today – is easier. On the handling side, consignees – in a lot of cases retailers – opt for door delivery even of commodities like sugar and grains. It is the container that allows for inter-modal transportation – the movement of goods using different modes of transport without the necessity of unloading and reloading – and a sealed container leaves a factory in a country and is delivered to a warehouse in another country without ever being opened.

Indian ports have been seeing many hitherto break bulk cargoes like rice, maize, glass, granite, garnet sand, Soya, cement and flowers now moving in containers. Some break-bulk cargoes such as banana, cotton and green coffee beans have become permanent container fixtures, while others such as pulp, lumber, cocoa and onions migrate from container to ship holds and back to containers, according to the rise and fall of box rates. E.g. an exporter successfully tried exporting iron ore from Chennai to China in containers. Liquid cargo handling is also possible given the example of palm oil containers at Port Klang.

ACTL, the first private ICD in Northern India was commissioned in July 1997. ACTL has been notified as a public bonded warehouse under section 57 of the customs act. This ICD has been notified to handle DEEC and DEPB shipments for Imports and Exports. Exporters can avail of drawback at ACTL. The initiative was a collaborative effort between Konsortium Logistics Berhad of Malaysia, a leading conglomerate specializing in trade logistics managing several container terminals and ports worldwide, and Mr. R. R. Joshi who has been in the logistics trade for over three decades.

Before Concor was formed the group was appointed the turn key handling contractor for Indian Railway's first Container Terminal at Pragati Maidan (Exhibition Ground in New Delhi). This was a landmark because this project became the launching pad for containerization for the entire North India. The group initiated this project for CWC at Patparganj as a turnkey Operator. As in the above case this too was a landmark for CWC as it was their first effort in this

field. The group owns a 24-axle heavy-duty wagon capable of carrying 350 MT of single package. This has been utilized extensively for various Power & Fertilizer Projects in the country.

The relevance of this experience in terms of operating this wagon is that permissions from 3-5 Regional Railways (Central, North, Eastern, Western etc.), Research Design and Standards Organization (RDSO), Railway Ministry's Engg. Departments, as well as Railway's ODC Section's clearance are required to be taken. This wagon always moves with entire train of MT wagons in order to maintain center of gravity of the wagon and its very heavy cargo. This over the last 15 odd years has given us tremendous experience in dealing with the mind-boggling government machinery in all its varied forms such as commercial, technical and operational. The group also has a dedicated team of railway professionals who are fully competent in handling this task.

Some of the big logistics projects handled on turnkey basis by the group are as follows:

a) Nhava Sheva Port Construction project for Mitsui & Co, lead Japanese Consortium

b) Farakka Power Project on behalf of ANSALDO of Italy

c) Anpara Power Project of Mitsui & Co. lead consortium of 17 Japanese companies.

Privatization is giving the competitive edge to Indian ports—and increasing competition between them. Ennore Port, designed as Asia's energy port, Operating on a landlord port concept, it is outsourcing all services required for operation and maintenance, and new terminals are being developed with the participation of the private sector. "Today Ennore is a good example of how synergy of a clear vision, sophisticated technology, and a well-trained workforce can usher in efficiency and profitability to the port functions," says T.K. Arun, Company Secretary, Ennore Port Limited.

The Government of India, on the other hand, has also initiated various steps to expand the infrastructure and management base of key ports of the country. To encourage private sector participation in developing ports facilities, policies and procedures have been significantly liberalized. Other measures include involvement of the private sector, provision of deeper berths, and containerization that would enable the port to attract bigger ships. The port had already succeeded in finding some alternative cargo to coal. With the number of car manufacturing companies located around Chennai, Chellapan was confident that potential exists to increase large-scale car exports through car carrier shipments for Chennai.

Chennai is India's major port for trade with Southeast Asia. Its hinterland covers the states of Tamil Nadu, Andhra Pradesh, and Karnataka. The region has important industries and major exports including minerals such as iron ore and barites. ADB has provided assistance to Chennai Port for its expansion and modernization plan to increase cargo-handling capacity of containers and other general cargoes. Further, the project also involved private sector participation in providing container

handling equipment and operating container terminal.

Logistics in India differs from that in developed nations in three important aspects. Relatively small manufacturing base, high logistics cost relative to the GDP. The very low penetration of specialist 3PL providers in the country. This is due to the lack of proper logistics infrastructure (both physical and information technology and telecommunications), containerized paper-based and manual processes, and fragmented supply Chains and other systemic flaws in the country that have resulted in huge process inefficiencies.

The lack of a countrywide infocomm B2B network and the poor conditions of roads results in capital being tied up in huge stockpiles of obsolete goods both in terms of moving inventory as well as at the factory sites. The lack of proper infrastructure has also resulted in the absence of world-class logistics service providers. In fact, there is no general awareness of standard logistics practices. A part of the reason is probably the lack of professionally competent logisticians.

Furthermore, there has been limited concerted effort by the Government to articulate an industry growth policy and also to prioritize the formation of industry clusters and identification of their logistics needs. All this has resulted in high inland freight costs, high port charges, etc. Developing the infrastructure and using IT for customs compliance are some of the issues that need to be given attention.

Till jun'05 – 19 projects involving private Investment of over Rs. 60 billion were approved, 13 projects of Rs. 21 billion already operational & 6 projects of Rs. 39 billion in different phases of implementation.

## National maritime development program

Launched by Ministry of Shipping, on 30.12.2005 envisaging investment of Rs. 1,003 billion in 387 projects in port & shipping sector spread over 20 years. Port sector investment of Rs. 558 billion over next 6 years to be funded through public private partnership.

- Aggregate cargo handling capacity of 12 major ports to be enhanced from 397.5 mtpa to 820 mtpa by 2011-12
- 76 projects for construction of berths & jetties, 25 projects for deepening port channels, 52 projects for procurement, replacement & up gradation of port equipment
- 45 projects for improving port connectivity to hinterland & 78 schemes to improve storage capacities, internal circulation systems etc.
- Investment of Rs. 445 billion for developing shipping

## Freight corridor

Dedicated rail corridor between Delhi & Kolkata and Delhi & Mumbai at an investment of over Rs 250 billion.

- Western corridor to connect jnpt, mumbai, & tughlakabad, rewari as well as dadri, near

national capital region, through state of rajasthan.

- Eastern corridor to connect ludhiana & sonnagar (Bihar) through mughal sarai, kanpur, khurja, meerut, saharanpur & ambala

## Rail containerization

- Government of India opening containerization operations to pvt. & Public sector undertaking players breaking monopoly enjoyed by concor.
- Sector to see significant investments from private operators, leading to cheaper, quicker & smoother transportation of containerization cargoes to & from ports.
- Cost of rail transportation is at US cents 7.9 per km, at 5.5, in France, 3.7 in Japan, 2.6 in china & 2 cents respectively.
- NMDP freight corridor & rail containerization to provide an integrated transportation infrastructure critical to moving trade & commerce cheaply, efficiently & reliably.

After several years of only modest growth, Colombo, Sri Lanka, has recently found itself on a roll. In the first five months of 2006, container traffic rose more than 20% to1.1 million TEU and this followed a strong 2005, when volumes increased by 10.5%, to 2.4 million TEU. The port's core traffic base is inextricably linked to growth in the economies of the Indian Subcontinent (ISC), particularly India, and its ability to handle containerization cargo efficiently and cost competitively. In this respect, the port faces stiff competition from other regional hubs, such as Dubai and Salalah in the Mid-East, and Asian ports, such as Port Klang, Port Tanjung, Pelapas Singapore. In addition, with significant amounts of terminal container-handling capacity having come on stream in India over the past five years, the country has successfully encouraged more ocean carriers to cut out much containerization by calling there directly.

For example, APM Terminals will soon open another terminal in JNP, the latter port's third container-handling facility. This will add 712m to the port's berthing line and provide an additional annualized container-handling capacity of between 800,000TEU and 1.4 million TEU. However, these extra slots are likely to be immediately swallowed up, as India's burgeoning container trade shows no signs of slowing. Hence, another 2km of quay is planned to be constructed at JNPT in the coming years.

Elsewhere, DP World has a huge development project in place at Vallarpadam, while a Chinese consortium is funding the Vizhinjam project. Despite these substantial capacity increases, however, congestion has continued to be a problem in India's ports, especially in the Mumbai area, and Colombo has benefited accordingly. But India is keen to handle a greater share of its own cargo, and a project that might aid this, and limit Colombo's role in the containerization sector, is the India canal project (see 'The will and the way').

This is years away, though, and difficulties in India's ports have already led to several services transferring out of the country. For example, the

Indamex service, which had called direct at Tuticorin, switched to Colombo when larger vessels were deployed, owing to draught and length restrictions at the southern Indian port. Maersk Line also appears to have placed more emphasis on Colombo as a regional relay with the Danish company scheduling new calls at Colombo on its ME2, MECL2 and AE5 services. This also gives the carrier the opportunity to switch cargo between its line haul vessels.

Mediterranean Shipping Company (MSC), Wan Hai Lines, Emirates Shipping and Regional Container Lines (RCL) have also decided to hub some of their ISC cargo via Colombo, while traditional users, such as Evergreen, Zim Integrated Shipping Services, Gold Star Line, OOCL continue to route increasing volumes of regional cargo through the port.

**Sri Lanka Port Authority, explained**

About 75-80% of their transshipment is from the ISC region, being main catchments area. Within the ISC, the market share is low in Chittagong and Karachi. But there is room for increasing this on the Indian east coast.' Colombo currently gains from a shortage of Indian port capacity. Its commanding location guarantees its place in sub continental trade development, serving rapidly growing lower-volume regions without overland access to direct-call ports. Recent traffic statistics confirm this situation, with Colombo's containerization throughput up nearly 30% in the January/May period this year, compared with the corresponding period of 2005. Relay cargo of more than 832,000TEU accounted for 71.5% of Colombo's total throughput in this five-month period. For the full year, the port's total traffic is expected to reach 2.8 million TEU, a jump of over 14%. It is important that Colombo containerized on this new-found optimism, by building facilities that its growing cargo base and customers want Wickramasuriya explained: 'Sri Lanka will maintain state ownership [landlord] of its ports, but it welcomes private sector participation in future projects, especially when it comes to terminal operations and marinas. Their marketing strategy will revolve around involving all key stakeholders in the investment envisaged in partnership with the government. 'There are examples of where private participation in the development of Colombo has helped raised productivity and efficiency levels, and this has to be encouraged in the future.'

In the next three four decades, India should be a leading hub for manufacture of automobiles, pharmaceuticals, high tech electronics, processed foods, oil, construction materials, etc and in services such as healthcare, IT, finance, construction and education. In these areas both national and international players should be able to get in and out easily, also called plug and play. The logistics infrastructure should efficiently and effectively support these sectors of the economy. A well articulated logistics and industry strategy should be put in place and marketed aggressively. This is not to say other areas should be inhibited. This is a long road and some unplanned ventures may succeed and should be given a chance.

Identify a set of manufacturing and service Industries where you want to excel such as automobiles, pharmaceuticals, hitech electronics, processed

foods, oil, construction materials, etc. Develop a well-articulated logistics strategy and the supply chain cluster: With products being uniform, containerized and commoditised, logistics has become a dominant part of the competitiveness equation. Indeed only 20 percent of world's population can afford 80 percent of goods and services currently offered.

Competition is indeed very high since every country and company will be competing to reach these affluent markets. Development of appropriate supply chain clusters to support the industries identified above in all the three sectors of the economy is the next step to gain competitive advantage.

India is a vast country with several states. Each state has its own rules and regulations when goods and vehicles cross from one state to another. The dominant industry in each state is different. In terms of geography India is more closely like China, the US or the European Union (without the multiple currency problems!). Logistics is closely related to the GDP and manufacturing and service activity. It may be difficult to benchmark a country and follow. In India, the goods transfers among businesses and also from a business to the customer are either by road or train. Logistics is asset intensive requiring investment in infrastructure: roads, airports, seaports and also state of the art warehouses. Thus one can benchmark for air cargo handling against Singapore or Hong Kong; for sea cargo against Singapore port etc. In the US for example, the big companies such as UPS, FedEx, etc use IT for increased efficiencies. India can learn both from small or big countries as well as companies for increasing its logistics efficiency.

Another idea that one should learn from newly containerizations countries such as Singapore is to build logistics as a part of industry cluster. The idea is to create a self-contained complex within which all-necessary industrial infrastructure and supporting facilities are provided. This way both the industry infrastructure and logistics and IT facilities will be ready simultaneously. With this kind of industry planning and sharing it with MNCs and other countries makes it easy for the companies to invest in India.

The advantages of economies of scale and optimal land containerized make the provision of common facilities an attractive pro-position to many industrialists. There are similar projects in various stages of development around the world. Continuing globalization of manufacturing, shipping & trade require reduced terminal costs & improved operational efficiency – as ports perceived as last bastion for effecting cost savings. Ports to evolve from a transfer point between different modes to an integrated logistics center in seamless multi-modal transport / logistics chains.

Investments for servicing mega ships feeding hub & spoke systems / increased transhipment activity – deeper / wider channels (capital dredging) & new berths with sufficient water depth & quay length. Rising demand for greater logistics integration & simultaneous efforts for providing better terminal services with lower costs Address shippers drive in minimizing / lowering transportation costs along entire supply chain & especially in ports for achieving greater economies of scale, operating efficiency &

profitability. Meet rising demand for greater differentiators from both lines & ports such as value added services (warehousing, customs clearance, packaging, labeling etc.). Manage accelerating impact of it (EDI & e-commerce etc.) – requiring integration of port with entire transport systems / sub-systems

## Strengths

- Consistently growing market – with high demand vs. supply
- Increasing cargo conversion from Break-bulk to containerization.
- Containerization had containerized the way cargo handling can be effectively cheap and safe in transporting to or from any part of the globe.
- India has abundant natural resources of land and waterways Also vast coastline with network of train/truck movement via Road and ship movement via sea routes to move the cargo in containers to domestic as well as international destinations at very cheap and economical mode of multi-modal transportation.
- Our strength as a developing economy had been our manufacturing skills and facilities and abundant cheap labor by international standards also we are pioneer in the information technology segment makes us to even more have a big advantage strategically globally competitive along with the required infrastructure support if in place.

## Weakness

- Inadequate long-term planning & time bound strategic plan – emphasis / focus on meeting trade requirements
- Port reforms guidelines focused on statutory / procedural aspects rather than on objectives / clearly defined roadmap etc.
- Policy ambivalent on issues of how much control ports to retain w.r.t. Regulatory / public interest functions, surplus labor, coastal regulation zone / environmental clearance etc.
- Less efficient & inadequate cargo carrying capacity of rail / road networks affected development of multimodal transport / logistics value chains depriving seamless flow of goods
- Lack of containerization / time lags in logistics infrastructure development – operational problems, sub-optimal returns / yield from port assets, inability to create integrated transport network
- Inadequate logistics infrastructure for other services viz. Customs facilitation, EDI, ICDs / CFSs – higher transaction costs
- Slow pace of containerization, lack of intra-port competition, large labor force, low productivity etc. clouding investor perception
- No proper infrastructure in place with regard to roads for transport, port/terminals for proper handling and movements of containers by either rail/road/ sea borne trade whether be for domestic or for international trade.

- Government priorities for projects ever since first five year plans had been on heavy industries such as steel, iron ore etc. Focus on ports/shipping and transportation by rail/ road for containerized goods had been inadequate.
- Containerization had been based on derived demand and had been given little attention since the cargo was mostly handled as break bulk by ships without much significance to containerization
- Over the past few decades until last decade when major port trusts were incompetent to handle containerization cargos since to handle containers port would need special equipments which were not available hence forcing the ship cranes or private stevedores were used in handling container vessels which had only delay in container operations for every vessel call and for all the delays was involving costs to the containerized and thereby being recovered from the ultimate customer i.e shipper/consignee.
- Another key factor for the slow pace of the containerization growth in containerization is the shortage of containers or imbalance of equipments for potential export of containers due to non-avail ability of the containers at the right place and at the right time, which had been not only a challenge but also a limitation to the containerization trade.
- Time delay costs money and this can have unnecessary charges adding up at every sequence of movements since it upsets the entire rhythm of action planned earlier with critical time factor and the additional costs would be inevitable as different agencies are all involved collectively in the chain link to execute the transaction and cannot undo someone's fault as he will have to pay the cost for the deviation, delays and alternate approach one has to be very proactive and alert to see closely that do not get such charges which could be avoid if carefully planned and constantly monitor the sequence 'in time'.
- Containerization purpose is to ensure that the containers worldwide are on the move with cargo always so that revenue is earned on every trip of its travel around the globe. At many instances the containers are bound to be in empty state at the port/depot idling i.e. it is just held in stock for future export cycle out until then all costs of storage handling and transport charges would be to incurred for which there may not be recovery for the empty container form.

## Opportunities

- With the advent of containerization cargo is the much sought after mode for transportation either by rail/road locally and by ship across the seas.
- It had also gained importance and opportunity of becoming a global product and opportunities are abundant and containers though in circulation worldwide is always in demand at either one location or the other.

- As per the track record yearly volumes of throughput increasing consistently by 10% globally only goes to show how strong the opportunities are abundant and increasing for the container trade.
- Success stories of opportunities turned into certainty of profit and containerization growth can be attributed to the countries that have touched milestones like ports of China, Hong Kong, who have contributed significantly to the growth of containerization.
- Nevertheless there are still unexplored opportunities yet to be discovered and exploit the potentiality.

## Threats

- China ports being one of the leading in the world since handling largest volumes as best operators in the world due to the strong base of the infrastructure investments made few decades back which will have cascading effect indirectly on the economies of the world. As we will not be able to compare or contrast with china at the rate of growth achieved so far and this phenomena could be a threat perception.
- Since global exports of china is very strong and have invaded in almost all countries with their products made in china being cheap and made at affordable pricing to the masses, the critical factor being making the product/ service available on demand.
- While as, India in contrast to china had been much lagging behind by a decade due to the lack of required infrastructure development to handle such demand which china had been successful and since Asia being the major hub controlling almost 48% of the world container traffic.
- Highest of the container volumes in India is at JNPT port by 2.4million TEUS, which is 60% of the total throughput of India ports. While in comparison to top global container ports, Singapore port is at the top handling container traffic by 23 million TEUS closely followed by Hong Kong port by 22 million TEUS. Followed by shanghai ports at 21.7 million TEUS with more captive volumes continuing to surge on the world scenario china being our neighbor country could be a threat having a cascading effect indirectly on our economy.
- Colombo port had also been in the reckoning of being a major containerization hub in south Asian region since handling almost 70% of containers handled at Colombo being of India origin, thereby India ports are losing huge container cargo to the other Asian ports due to the lack of port infrastructure of international standards. Since Colombo port is located strategically it is also a threat to Singapore port which had been so far undisputed international gateway hub is now having Colombo port giving a stiff competence due to its location advantage closest to India.

Other measures include involvement of the private sector, provision of deeper berths, and containerization that would enable the port to attract bigger ships. The port had already succeeded in finding some alternative cargo to coal. With the number of car manufacturing companies located around Chennai, there exists that potential to increase large-scale car exports through car carrier shipments for Chennai.

Chennai is India's major port for trade with Southeast Asia. Its hinterland covers the states of Tamil Nadu, Andhra Pradesh, and Karnataka. The region has important industries and major exports including minerals such as iron ore and barites. ADB has provided assistance to Chennai Port for its expansion and modernization plan to increase cargo-handling capacity of containers and other general cargoes. Further, the project also involved private sector participation in providing container handling equipment and operating container terminal.

## Conclusions

Industry developments are forcing Container Carriers to reexamine their current business practice to focus more on the profitability of individual shipments and to optimize the total flow of containers within their existing network. Experience from other industries are demonstrating the potential of new decision support tools in generating extensive demand forecasting information and utilizing this information in the optimization of container repositioning and voyage capacity management.

Total demand forecasting dramatically reduces the overall risk associated with the container carrier's revenue generation and allows for significant yield improvements through the application of integrated contribution analysis and contribution management. The direct impact on the container carriers profitability is significant, yield/contribution improvements of 5% typically increases the profitability by more than 50%, and a reduction in container equipment and repositioning costs of 10% potentially can have the same effect. Investing in these new decision support tools may offer the best Return on Investment of any investment currently evaluated within the Container Cargo Industry.

Over the last few years, traffic handled by Indian ports has been increasing at the rate of more than 10 per cent per annum. This increase in throughput has been achieved on the one hand by improved efficiency and expansion at existing ports and, on the other, by development and commissioning of new ports.

There has been considerable improvement in average turnaround time, in pre-berthing detention and in output per ship berth day. New terminals have been added at major ports. New minor and specialty ports have been developed. Even connectivity has improved at some ports. We will need to do better in the coming years. Indian imports and exports have been rising at a rate faster than port capacity. This rate will only accelerate as the Indian economy becomes more globalized, especially as it becomes a manufacturing hub for many industries. Indian ports will have to provide

significantly greater throughput to keep pace with this growth.

The increased throughput will have to be achieved by action on a number of different fronts – by further improvement in efficiency and capacity to containerize at existing ports, by addition of new terminals and facilities, by better connectivity, etc.

No doubting the future growth prospects of Indian port sector however, numerous challenges persist; fiscal, physical– port/logistics infrastructure & superstructure, connectivity platforms, regulatory, environmental pressures etc. Requires development of unique & sustainable business models & solutions such as enhanced port cooperation (sister port concept), inter-port investment etc.

Focus on urgent /time-bound ramping up of logistics / connectivity infrastructure / superstructure. Integration of ports (major & non-major), transfer nodes (rail / road / inland waterways etc.) for developing multimodal logistics chains to evolve specific seamless freight corridors where natural / strategic advantages present, planned diversification into related areas such as bunkering, cruise terminals, repair facilities etc. to augment revenue flows to elevate India inc. to 3rd largest economy by 2050.

Coastal trade under developed in India unlike china the containerization within the coastline of India for movement of cargo effectively as feeders by barges to major gateway ports have not been untapped unlike china's effective usage of the coastal cargo movements by barges. By relaxing the cabotage laws as the entry of foreign shipping companies in the coastal trade would relieve major port terminals of the excessive congestion they are currently grappling with.

According to draft maritime policy, dedicated terminals for coastal shipping should be constructed; to enable coastal vessels to berth quickly and BCCI observes that, these dedicated terminals should be free from the control of customs and immigration authorities, with separate tariffs. The coastal shipping is seen as an alternative to roads and railways as TCS report on coastal shipping shows that, the two crucial sub-systems of transport viz. rail and road are highly congested, giving rise to myriad problems including escalating social costs. Also, economic losses due to congestion and accidents on roads are estimated to result in the loss of around Rs 400 billion annually.

In spite of limitations in infrastructure, they were able to exceed the targeted throughput in certain locations. The study would enlighten on the basis of present GDP at 8.1% forecasting to touch double figures keeping in mind the investments being made by the Government of India on the Infrastructure projects in the pipeline. However, since shipping had been a derived demand which would propel forward along with the capacities for achieving the targets in future while the GDP factor of "two digits" would be a reality overcoming the infrastructure as well as capacity constraints.

Government's role will be critical in achieving the above proactively with PPP participation further expanding the horizon with more terminals and augmenting infrastructure to meet the propelling demand for growth of containerization in India to achieve 7-8Million TEUS by 2010.

## References


- Articles - Angel Brokering – India research journal Dt 23-10-06
- Articles - CII Towards Logistics Effectiveness in India Monthly Journals
- Articles - Container International Aug2006 – Is Colombo OK – Pg 56.
- Articles - Container Traffic at India ports by S.Hajira
- Articles - containerization by IICL.org presentation
- Articles - Drewry Annual Container Forecase 2005-06.
- Articles - Ensuring Capacity meets demand- Port development in sight of growing trade- by M.John vickermanz.
- Articles - I-maritime consultancy knowledge center infolab Logistics
- Articles - National Maritime development Program 2005
- Articles - Review of Maritime Transport 2006.
- Articles - United we stand- The Cluster Approach theme Paper by Prof. N.Viswanathan and Dr.Roshan Goankar.
- Books – CII-Centrum 2006 – Containerization for Trade Momentum
- CII Containerization in India news letter May 2006
- Edited Volumes – Containerships (Box Ships)
- Edited Volumes – CRISINFAC Analysis – july2004
- Edited Volumes – Deutsche Bank Research dt 25/4/06 – Container Shipping
- SCI CMD presentation.