CHAPTER – IV

CONTAINERISATION: THE INDIAN SCENARIO VIS-À-VIS THE GLOBAL SCENARIO

1. INTRODUCTION

International trade continues to grow rapidly, spurred by market and trade liberalisation, reductions in transportation and communication costs and the development of new information and communication technologies. Global trade patterns are also changing with the emergence of large, rapidly growing Asian economies, most notably China and India. Firms are developing sophisticated global supply chains to improve their competitiveness, focusing on their core competencies and outsourcing other parts of the production processes. Efficient supply chains also facilitate just-in-time deliveries and enable better responsiveness to dynamic customer demand. Container shipping has been one of the prerequisites – probably even the driving force - for the dynamic development of global trade. It is difficult to imagine globalisation taking place without the assistance provided by the freight container or containerisation, as it is popularly known. The container has been called the box that makes the world go round. When it was introduced no one could have imagined how quickly the ocean freight business would evolve, thanks to the container. In the past decade containers have been increasingly used for transportation of almost all types of general cargoes. This has led to lowering of transportation costs as shown in the box below.

TRANSPORTATION BY SEA

Journey of a $100 Shoe . . . . . .

From Bangalore to a warehouse in Chicago

Cost of transportation of a Forty foot container	=	$ 3,879
Pair of Shoes in a Forty foot container	=	4,500
Cost per pair of shoes	=	86 Cents

Containerisation makes it possible for the goods to be consumed at a minimal cost of transportation.

Lowering of transport costs results into benefits for all parties involved because transport costs impact not only trade, both domestic and international, but also have an indirect impact on the economic growth of a country.

1.1 Impact of Transport Costs

International freight has an impact on trade equivalent to customs tariffs or the exchange rate: a reduction in the cost of transport directly stimulates exports and imports, just as an increase in the exchange rate (the rate at which the national currency may be exchanged against another) makes exports more competitive, and a reduction in national customs tariffs lowers the cost of imports.

1.1.1 The Impact on Trade

The price of the vast majority of traded goods is exogenous for developing countries. If the shipping of imports becomes more expensive, higher inflation ensues as a result of the increased cost of imported goods; in the case of intermediate and capital goods, this also increases the costs of local production. If exports become dearer to ship, the result is a drop in earnings for the exporting country or simply the loss of a market, depending on the elasticity of demand and the availability of substitutes. Econometric estimates suggest that the doubling of an individual country's transport costs leads to a drop in its trade of 80 per cent or even more (Limao and Venables, 1999 & 2001; Hummels, 2000)[1].

1.1.2 The Impact on Economic Growth

Empirical studies have concluded that greater transport costs lead to lower levels of foreign investment, a lower savings ratio, reduced exports of services, a reduced access to technology and knowledge and a decline in employment. It is estimated that a doubling of transport costs leads to a drop in the rate of economic growth of more than half a percentage point (Radelet and Sachs, 1998)[2]. This impact may appear low, but it should be noted that lower growth over the long term results in sizeable variation in per capita incomes.

Introduced in the sixties for the transportation of such goods as beer, which had a tendency to disappear en route when shipped in open pallets, the container has found its way to most finished products. Today this trend is continuing towards semi-products as well as agricultural products and even some commodities. Coffee and Tea, and refrigerated as well as frozen cargoes are transported in containers. Even paper products and wooden logs as well as chemicals and other liquid products are being containerised. With containerisation of cargoes of all types, new specialised containers are being built and sometimes special ships are developed for their transportation. Open top containers for bulky cargoes such as scrap metals or open side containers for live stock transport are successful today. The sealed shipper to receiver transport is thoroughly convincing. Marc Levinson[3], in his recently released book "The Box – How the Shipping Container Made the World Smaller and the World Economy Bigger" presents plausible evidence to suggest that today's strong global economy was made possible in large part by the introduction of the shipping container. "Before the container was in international use, ocean freight costs alone accounted for 12 per cent of the value of U.S. exports and 10 per cent of the value of U.S. imports. ... [It] was so expensive that in many cases selling in the international market was not worthwhile." Today, ocean transportation is a very small percentage of the cost of most goods; it costs less than a postage stamp to ship a new pair of athletic shoes from Asia and three cents to ship a bottle of beer.

2. WHAT IS CONTAINERISATION?

Containerisation is the technique of stowing freight in reusable containers of uniform size and shape for transportation. The freight may be oddly shaped and in different quantities, but when stowed and shipped in containers, it can be handled as a single piece. Break-bulk had become overly expensive due to many port calls, labor cost, loss & damage to cargo. Container Shipping was invented to reduce & control cost, limit port calls, & eliminate damage & loss to cargo. Containerisation changed the basics of cargo transport by standardizing the dimensions of the container and simultaneously improving the productivity of ports by mechanizing handling of container-carrying ships and reducing their handling to a few hours only, thus allowing shipping to become streamlined & allow cargo to arrive at destination faster. Another way of looking at importance of this innovation is that almost every manufactured product humans consume spends some time in a container. Containerisation is an important element of the innovations in logistics that revolutionized freight handling in the 20th century.

2.1 ISO Definition of Freight Container

According to the ISO definition, a freight container is an article of transportation which is of a permanent character and accordingly strong enough to be suitable for repeated use, is specially designed to facilitate the carriage of goods by one or more modes of transport without intermediate reloading, is fitted with devices permitting its ready handling - particularly its transfer from one mode of transfer to another, is so designed as to be easy to fill and empty and having an internal volume of 1 m^3 (1 cubic meter) or more.

2.2 History of Containers

Containers were first used in tramways of England, Silesia and America for transporting ores, coal, etc. They were small containers of 5 – 10 tons. Then, 50 years ago, on 26th April 1956, Malcolm MacLean loaded the first container aboard the ship called "Ideal X" which set sail from Port Newark, New Jersey to Houston. This ship carried 58 containers of 35' and liquid cargo also. In 1957-58, six more ships were converted into 'Trailer ships', as they came to be known then. Ideal X was loaded using shore cranes, but these later vessels had their cranes.

In 1960, 'Santa Eliana' of Grace Lines became the first container ship in international trade as she sailed from Newark, New Jersey to Venezuela. 1960 also became the year in which McLean renamed his company Sealand Services Inc (which was subsequently acquired by the Maersk group in 1999). Port of New York Authority built Port Elizabeth Marine Terminal – world's first exclusive container terminal. In 1966, McLean constructed Rotterdam – Europe's first container port. History was created again in April 1966 as 'SS Fairland" arrived from Port Elizabeth to Rotterdam – the first transatlantic service carrying containers. The cargo arrived at its destinations four weeks in advance.

- **Coining of TEU**

Richard F. Gibney, was a journalist with Shipbuilding and Shipping Record, U.K in the 1960's. His job was to compile tables of ships ordered and completed. In 1969, when faced with different sizes of containers used by different lines (e.g. Matson's 24' and Sealand's 35'), he coined 'Twenty Foot Equivalent Unit' as a measure of comparison. The term stuck!

2.3 Classification of Containers

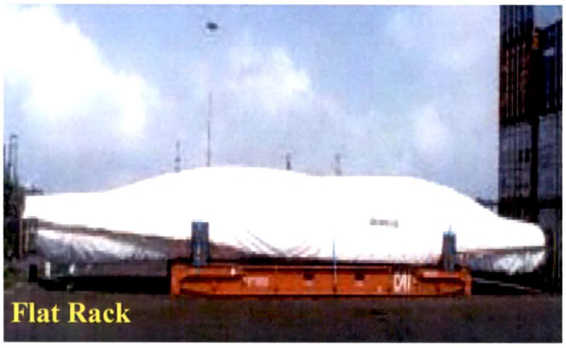
The container can be classified by the raw material from which it is constructed or by its size. Currently the maximum numbers of containers are made from Steel and Aluminium. The International Standards Organization (ISO), after conducting a detailed study, standardized the size of containers to 20' and 40' in length, 8' in breadth and $8^{1/2}$ / $9^{1/2}$ feet in height. The internal volume of a Twenty foot equivalent unit (TEU) is 33 M^3 (cubic meters). Thus, containers can be classified according to their size, 20', 40', 45', 48'and 60'.

The containers can also be classified according to their ***use and construction.***

Closed containers carrying general cargo not requiring temperature control are called dry cargo containers. Closed thermal containers are designed to carry cargoes requiring temperature control and are usually made of steel and aluminium with polystyrene foam insulation. These, in turn, can be further classified into Refrigerated, Insulated and ventilated containers.

20' Container

Containers can be **open containers**, **open top**, **open side**, **flat racks**, **half height** and **pens** to carry different types of cargoes like grain, cement, over sized machinery, cars and live stock. To transport bilk liquid or compressed gasses, we have **tank containers**.


Flat Rack


Open Side Container


Open Top Container


Open Top Container

Custom-made containers are also available to cater to special needs of highly sensitive and specialised cargoes, which do not fit into the conventional twenty and forty footers. A few examples of these include: twenty-foot flat racks, with fold-down end walls and coil wells also known as coil containers; platform containers with corner posts and special load retainers; twenty-foot platform with folding free-standing corner posts and forty-foot platform with complete folding end walls.


Coil Container


Platform Container


20' Platform Container


40' Platform Container

These steel boxes have become the building blocks of the new global economy. Container transportation - efficient, secure, clean and economical - is so convincing that almost any cargo will stay with the container concept, once shippers have seen the benefits and become used to them. A crane operator can load and unload cargo that would have taken an army of dockworkers in the 1950s. Port turnaround times of ships have been reduced from 3 weeks to less than 24 hours. According to Daniel Y. Coulter in his article "Globalisation of Maritime Commerce", the greater efficiency (through containers) has dramatically reduced the cost of shipping. Before containers the cost of sea freight was typically 5 per cent to 10 per cent of the value of the retail price. Now a $6,000 motorcycle can be shipped on an intercontinental journey for $420.00 – at just 7 per cent of its value, including insurance and customs duties, and a $1 can of beer for one cent.

Another way of looking at importance of this innovation is that almost every manufactured product humans consume spends some time in a container. Containerisation is an important element of the innovations in logistics that revolutionised freight handling in the 20th century.

2.4 Benefits of Containerisation

Time and costs are inter-related in the investments of all modes of transport. Each asset has its own cost depending on capital and revenue expenses. Increase in asset utilisation with reference to time yields more revenue and hence higher profits (UNESCAP Report No 73)[4]. Thus with a view to saving time and cost, cargoes/goods are consolidated and converted into as big a unit as possible. The developed countries of the west preferred this system thereby increasing productivity by displacing expensive labour. Further as unit load becomes bigger, mechanization becomes imperative, involving capital investment. The container serves this purpose perfectly whereby bigger units of cargo can be stored and carried in one go.

Once the containerised cargo lands at the gateway ports it is transported by rail/road/ waterways to hinterland warehouses/distribution centres. The containers are stripped and the cargo is stored in these warehouses/distribution centres and is subsequently transported in assorted lot sizes to the wholesalers and retailers. Time is of essence in this entire process (Paul, J; 1997)[5]. The entire parties involved endeavour to minimize the time factor during which the goods are in their possession. This gave rise to just in time concept of inventory levels. This results in compressing the time from when the goods leave the factory premises of the manufacturer till the time it is sold to the final consumer. The cost benefits of this compression are passed on to the consumer which in turn offers a competitive edge to the manufacturer. This would not have been possible without the advantages offered by the economics of containerisation.

The most important aspect of containerisation is the suitability for door to door service, i.e. a shipment can be made, complete in all respects, from the shipper's premises in one country to the consignee's premises in another country under a single contract, freight and document which covers transport by all modes like rail, road, ship, inland waterways and airways. This is termed as Multi Modal or Inter Modal transport.

Trade in general and exports and imports in particular have benefited by containerisation and Multi Modal transport in two ways: By reduction in costs and improved customer service. (Handbook on Containerisation – UNESCAP)[6]. The cost saving has been on account of reduced freight, packaging costs, insurance premiums and warehousing costs and lower inventory in the following manner:

a. **Freight rates:** They are assessed per container unit, for all kinds of cargo, popularly known as FAK – Freight of all kinds

b. **Packaging costs:** Earlier when general cargo was transported in non unitized form, weather proof and sturdy packaging was a necessity. But in container transport this need has been eliminated and package size has been reduced to optimize container space usage.

c. **Insurance Premium:** Marine risks by way of weather damage, thefts, etc. are reduced due to cargo being transported in containers. It results in lowering of insurance premium.

d. **Warehousing Costs:** Transportation of cargo in earlier era by general cargo vessels necessitated warehousing at ports of loading and discharge for storage, sorting, packing, inspection, etc. Containerisation has dispensed with such processes, leading to cost savings.

e. **Inventory costs:** Container carriers sail at high speeds and maintain strict schedules. This allows the exporters and importers to do forward planning and maintain lower inventory.

f. **Customer Service:** Containerisation leads to better service to customers in the form of quicker delivery, assured transit times and less damage to cargoes in transit because container carriers are high speed vessels which spend less time in ports due to improved efficiency of port handling equipment.

Thus, maritime containerisation has become a logistics tool that has dramatically affected location of manufacturing industries around the world. What camels and clippers had done for silk and spices during the Middle Ages, and bulk carriers did for raw materials during the first half of the 20th century, container vessels are now doing for manufactured goods. Containers now move 'seamlessly' from factory floor to port, across the ocean, and then inland at destination, continuing all the way to the customer's warehouse. This represents an enormously simplified operation compared with the old-fashioned break-bulk systems, which required individual packaging, handling, stowing, etc. of each item shipped. The transition from traditional break-bulk operations in pre-container times to multimodal thorough transport can be compared with the transition from forge to factory or from 'job shop' to 'flow shop'.

Containerisation has **facilitated four trends** resulting from world trade and globalisation:

1. ***Shift from ocean carrier to total logistic systems or inter modalism:*** The carriers' strategy has shifted from a port-to-port to a door-to-door focus. The container made this shift possible by virtue of its interchangeability among the various modes of transport (road, rail and sea), giving birth to the term *intermodalism*. Containers packed with goods at the point of production can be transported over water and land without ever being opened until they reach their point of sale of final destination, creating a secure, seamless flow of goods from the manufacturer to the retailer.

2. ***Globalisation of production facilities***: Manufacturing is now a process of bringing together and assembling raw materials, parts, and semi-finished products from all over the world. Only final assembly adjustments are carried out in local markets. To better understand this particular aspect of a global business, consider as an example the automotive giant, Ford. Ford owns 154 factories worldwide. Of these, 58 are "vehicle operations" plants, which make tools/dies, fabricate body frames and stampings, and actually assemble vehicles. Then there are 55 "powertrain plants" making castings, forgings, transmissions, chassis, and engines. A further 41 plants make "automotive components," i.e., body trim, glass, fuel systems, electronics, climate control equipment, and plastic items. Then there are another 30 joint-venture plants (mainly Asia) making a whole range of items. Many of these plants' outputs must be moved to other plants as the production processes progress. In addition, the plethora of "vendor" components - brought in from outside suppliers - have to get to where they are needed. The scale of the complexity of such operations boggles the mind!

3. ***Greater concentration of trade flows:*** The worldwide spread of containerisation through globalisation has led traditional commodities such as raw cotton, sugar, wood pulp, waste paper, raw timber, and grain to become increasingly containerised. The results - once-specialised trade flows carrying specific commodities to ports with general cargo-handling facilities are merging to form a steady stream of containers to ports equipped only to handle containers. For bulk commodities such as iron ore, coal, and crude oil, there is less concentration due to geographical diversity of supplies.

4. ***Rise of supply chain management as a discipline***: The constant need to reduce inventory investment and speed products to the market has prompted companies to focus on supply logistics in their quest for a competitive edge. In some cases consumers are choosing to view how a product gets delivered as an actual part of what they will or will not buy. The theory is that as the goods move faster, then the logistics directly affect the value, and overall buyer appeal rises. Speed and selection can become more important

than price. Therefore, many companies are shifting logistic strategies from "operational effectiveness" to one of customer "value maximisation."

3. GLOBAL CONTAINER MARKET

Container shipping has been the fastest growing sector of the maritime industries during the last two decades. As outlined by Drewry Shipping Consultants (2006)[7] a number of fundamental drivers underlie demand growth in container shipping. First of all, organic growth is spurred by increasing economic activity, trade liberalisation, reduced import tariffs, globalisation and outsourcing. This organic growth is compounded by the fact that break bulk cargo is increasingly being carried in containers (substitution effect), by changes in carriers' scheduling strategies (for example an increased focus on transhipment) and by port development. Finally, "incidental" demand growth can be triggered by regional variations in import and export activity (for example related to exchange rate swings) causing imbalances in directional containerised trade flows.

There is an ever growing demand in the western countries for the goods manufactured in Asian countries. Asia, particularly China, serves as the world's manufacturing hub separated by the sea to the major consumption markets of Europe and the USA. This demand is being met by transporting the goods cheaply in containers to the consumers by sea. Nowadays traders stipulate transport of cargo in containers as a precondition for commercial contracts. This ever increasing demand has led to economies of scale being realized in manufacturing and transportation sectors.

Efficient, cost effective and reliable transportation is a key component of successful supply chains. Spurred by the development of these global supply chains, particularly in manufacturing, container shipping is the fastest growing sector of marine transportation. The development of global supply chains is shaping international trade and transportation patterns. The past five years have been characterised by strong demand in North America and Western Europe for imports from Asia. Growing trade volumes between Asia and North America are placing greater demands on shipping lines to service these flows with consequent shifts in global shipping patterns. Shipping lines are deploying larger vessels to accommodate trade flows between Asia and North America while ports in the Far East, North America and around the world, are ramping up investments and expanding infrastructure to better accommodate rapidly increasing shipping volumes. The benefits of containerisation, together with the growth of world trade, have been the basis for a continuous growth of container shipping. The success of containers is a direct result of the ease of handling and the protection it offers against damage and theft. Containers now account for 60 per cent of the world's trade by value and are expected to reach 70 per cent by 2010.

3.1 World Container Throughput

The global container throughput has risen consistently over the past decade, as can be seen in table: 4.1 given below.

Table: 4.1 Development of International Seaborne Trade

	Annual Percentage Change			
Year	**Total Seaborne Trade**	**Liquid Bulk Cargo**	**Dry Bulk Cargo**	**Container Cargo**
1995	3.7	2.1	5.0	5.2
1996	2.3	3.8	1.1	6.9
1997	4.1	2.1	5.7	9.9
1998	13.4	-4.1	27.0	9.5
1999	1.0	-0.8	2.0	10.2
2000	5.5	4.6	6.0	11.6
2001	0.6	0.6	0.6	14.0
2002	1.7	-1.7	3.6	5.2
2003	6.2	4.1	7.4	13.5
2004	5.3	4.1	5.9	29.0
2005	3.8	4.5	3.5	8.7
2006	4.3	10.4	1.2	13.5
Average Annual Growth (1995-2006)	**3.3**	**2.4**	**3.6**	**10.3**

Source: *Review of Maritime Transport, UNCTAD: various issues*

Chart: 4.1 Development of International Seaborne Trade

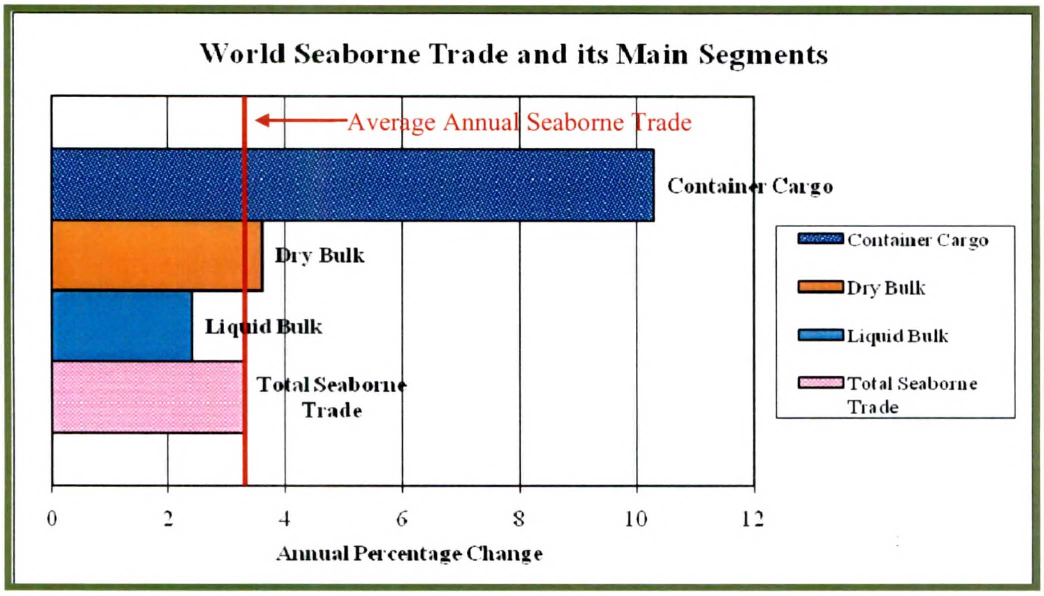


Table: 4.1 and chart: 4.1 analyse the total world seaborne trade and its broad segments, viz. liquid bulk, dry bulk and container cargoes. During the period 1995-2006, world seaborne trade increased at an average annual rate of 3.3 per cent – visualized by the red line in the chart. Among the major segments, liquid bulk grew at a comparatively slower rate of 2.4 per cent, whereas dry bulk grew slightly faster at 3.9 per cent per year. Container cargo grew the fastest at 10.3 per cent– over three times more than the overall seaborne trade.

In view of the above, it is hardly surprising that container traffic has been hailed as the driving force behind the growth in cargo handling in many seaports around the world. Review of Maritime Transport (2007), UNCTAD estimates that the total throughput handled by the world's container ports (not to be confounded with the trade route volumes mentioned below) increased from around 137 million TEU in 1995 to an estimated 440 million TEU in 2006 (Figures for 2006 are preliminary), representing an average annual growth rate of nearly 10.3 per cent during the years 1995-2006 (table: 4.2 and chart: 4.2). As far as the near future is concerned, worldwide container handling is expected to increase further to 627.7 million TEU in 2010 (nearly 60 per cent above the 2005 level).

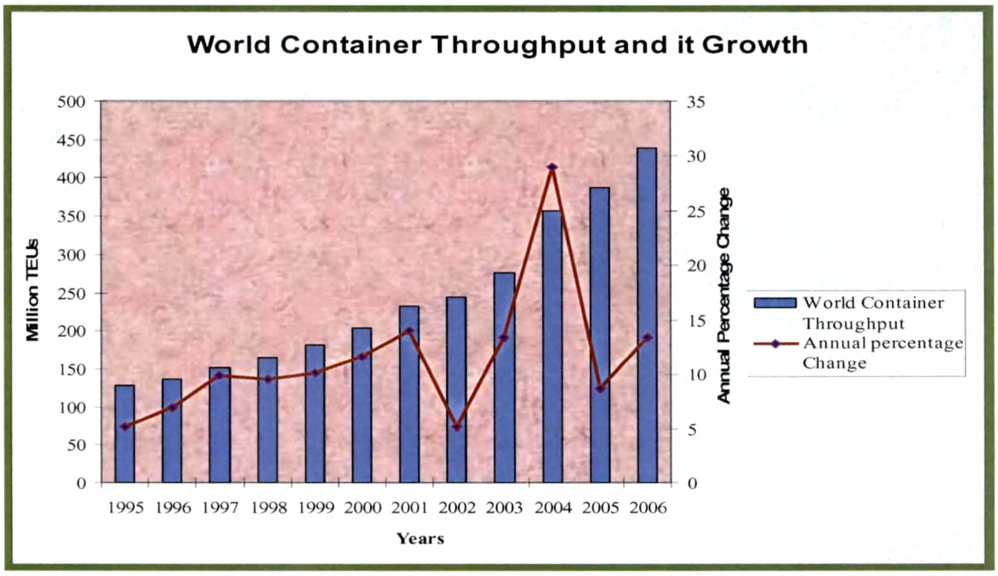
Table: 4.2 World Container Throughput

Year	World Container Throughput (million TEUs)	Annual Percentage Change
1995	137.2	5.2
1996	150.8	6.9
1997	165.2	9.9
1998	182.0	9.5
1999	195.3	10.2
2000	231.7	11.6
2001	243.8	14.0
2002	276.6	5.2
2003	299.3	13.5
2004	356.7	29.0
2005	387.7	8.7
2006*	440.0	13.5
Average Annual Growth Rate (1995-2006)		**10.3**

* Preliminary Figures

Source: *Review of Maritime Transport, UNCTAD: various issues*

Chart: 4.2 World Container Throughput and its Growth



On analysing and comparing the container trade volumes and the key drivers of the world economy, viz., the world GDP and world merchandise trade in table: 4.3, we find the container market has grown at nearly four times faster than the world economy and two and a half times than the world trade. This is depicted very clearly in Chart: 4.3 where the average annual growth rates of all three have been laid out.

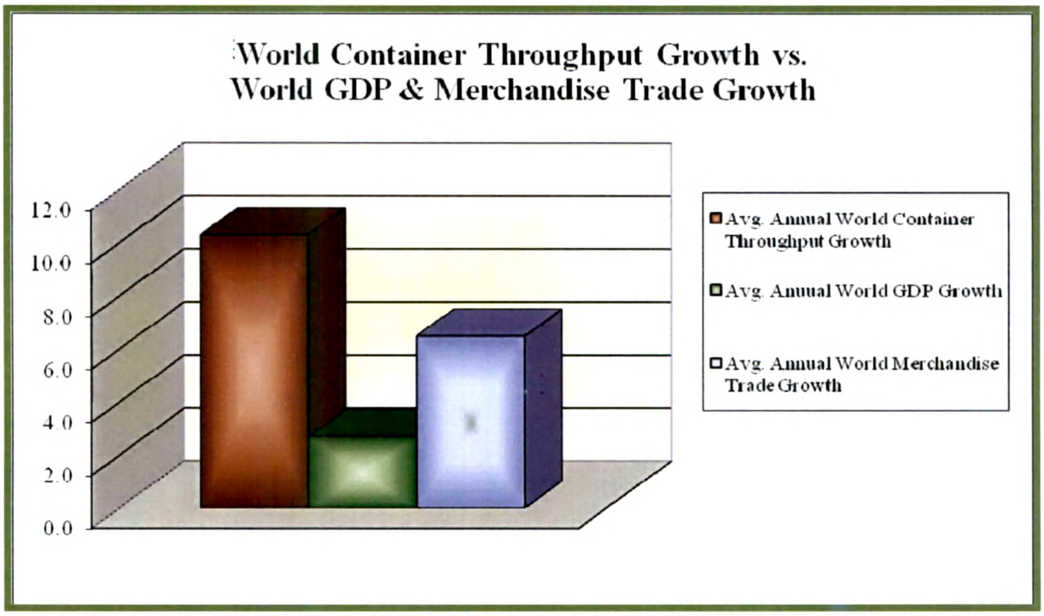
Table: 4.3 World GDP, Merchandise Trade and Container Throughput Growth

Year	Annual percentage changes		
	World GDP Growth*	World Merchandise Trade Growth	World Container Throughput Growth
1995	2.4	9.0	5.2
1996	3.3	6.0	6.9
1997	3.3	10.5	9.9
1998	1.9	5.0	9.5
1999	2.6	5.0	10.2
2000	3.8	11.0	11.6
2001	1.4	-0.5	14.0
2002	1.8	3.0	5.2
2003	2.6	5.0	13.5
2004	3.9	9.5	29.0
2005	3.3	7.0	8.7
2006	3.6	8.0	13.5
Annual Average Growth 1995-2006	**2.6**	**4.9**	**10.3**

*GDP at constant 1995 dollars

Source: *Review of Maritime Transport, UNCTAD; various issues and International Trade Statistics, WTO; various issues.*

Chart: 4.3 Container Throughput Growth vs. World GDP and Merchandise Trade Growth



3.1.1 Containerised Cargo Flows along Major Trade Routes

Global container trade is spread over a range of long-haul, regional, and intra-regional routes. The "mainlane" container trades on the major East-West routes are the world's largest in terms of volume, with the Transpacific forming the world's largest container trade, with 17 per cent of the total volume in 2005, followed by the Far East-Europe trade and the Transatlantic. In addition to these trades, there are "intermediate" trades on the mainlane East-West corridor serving the Middle East and the Indian Sub-Continent. North-South trades form the second layer of the global liner network, connecting the Northern hemisphere (North America, Europe and Asia) with the Southern hemisphere (South America, Africa and Australasia). Additionally, there are also important intra-regional container trades, for example, intra-Asia or intra-Europe. We will trace out only the East-West trade routes in this section.

Asia's prominence as an exporter to markets in Europe and North America is reflected in recent shipping and container trends. Asia's (developing countries) share of global container throughput increased from 25 per cent in 1980 to 53 per cent in 2004. Traffic on the Trans-Pacific (Asia-North America) and Asia-Europe routes have been the fastest growing, particularly container movements from Asia. Table 4.4 gives an overview of the estimated container trade on the three arterial East-West trades, i.e., the Transpacific, transatlantic and Asia-Europe. As this table indicates, both the Transpacific and Asia-Europe trade have enjoyed healthy growth during the period 1995-2006 and this is expected to continue throughout 2007-2008 as well. Charts 4.4 (i) and 4.4 (ii) as well as figure: 4.4 (i) corroborate the figures presented in table: 4.4.

Table: 4.4 Estimated Cargo Flows in Major Trade Routes

Year	Percentage change											
	Trans-Pacific				Asia-Europe				Transatlantic			
	Asia-USA		USA-Asia		Asia-Europe		Europe-Asia		USA-Europe		Europe-USA	
	m TEUs	% change	m TEUs	% change	m TEUs	% change	m TEUs	% change	m TEUs	% change	m TEUs	% change
1995	4.0	-	3.5	-	2.8	-	2.3	-	1.2	-	1.44	-
1996	4.1	2.2	3.5	1.4	3.1	11.0	2.6	12.2	1.2	1.7	1.42	-2.1
1997	4.7	13.7	3.6	2.6	3.3	5.1	2.73	5.8	1.55	4.1	1.27	9.9
1998	5.2	12	3.3	-7.8	3.5	5.8	2.71	-0.7	1.7	4.7	1.33	9.0
1999	5.8	4.8	3.4	-1.8	4.0	4.0	2.9	0.0	1.71	2.3	1.34	2.4
2000	5.59	2.2	3.25	-0.6	4.53	24.8	3.59	32.5	2.19	61.0	2.94	69
2001	7.19	28.6	3.86	18.8	5.93	30.9	4.02	12.0	2.71	23.7	3.62	23.1
2002	8.81	22.5	3.90	1.0	3.94	3.4	6.13	-2.0	2.72	-44.6	3.80	-28.5
2003	10.19	15.7	4.05	3.8	7.26	18.4	4.92	24.9	1.72	14.7	2.9	12.0
2004	12.4	21.7	4.2	3.7	8.9	22.6	5.2	5.7	1.7	-1.2	3.2	10.3
2005	12.4	0.0	4.4	4.8	10.8	21.3	5.5	5.8	2.1	23.5	3.8	18.8
2006	13.9	12.1	4.6	4.5	12.5	15.7	5.8	5.5	2.3	9.5	3.9	2.6
2007[@]	14.8	6.5	5.0	8.7	14.4	15.2	6.1	5.2	2.4	4.3	3.9	0.0

[*]m – million; [@] Forecast

Source: *Review of Maritime Transport, UNCTAD; various issues.*

There are three times as many containers moving from Asia to the United States (14.8 million TEUs in 2007) than there are from the United States to Asia (5 million TEUs). This implies an American imbalance of 9.8 million TEUs with Asia. The Asia-Europe trade route is facing a similar imbalance, but at a slightly lesser level; 8.3 million TEUs. Such imbalances in physical flows clearly reflect production and trade imbalances in the global economy. Meanwhile, the trans-Atlantic route has grown more slowly in terms of volumes, reflecting slow growing trade between Europe and North America. Imported container volumes from Asia to North America and Europe, the biggest consuming markets in the world, are overwhelming ports in these continents.

Chart: 4.4(i) Estimated Transpacific Container Volumes, 1995-2007

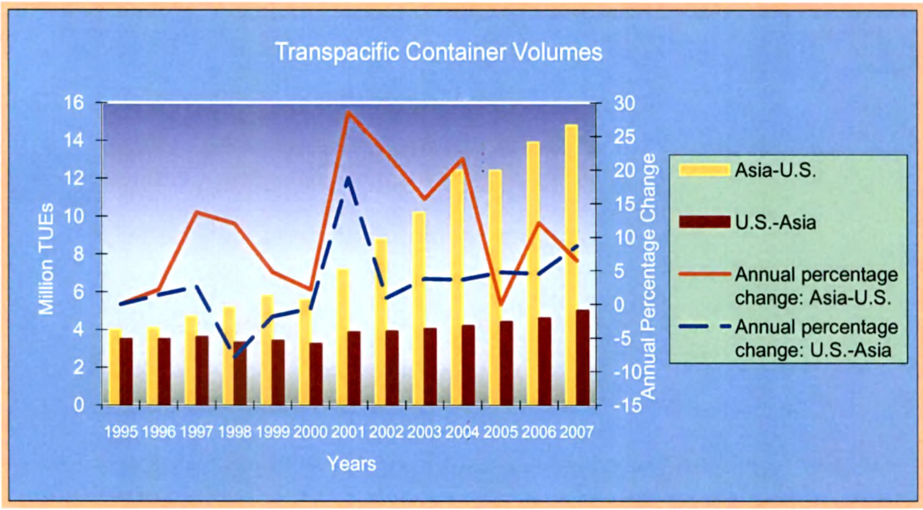


Chart: 4.4 (ii) Estimated Asia-Europe Container Volumes, 1995-2007

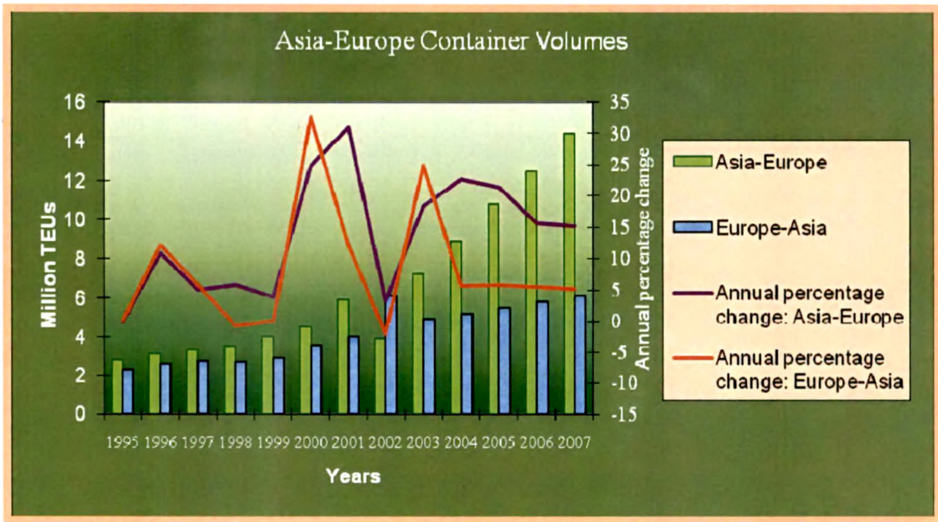
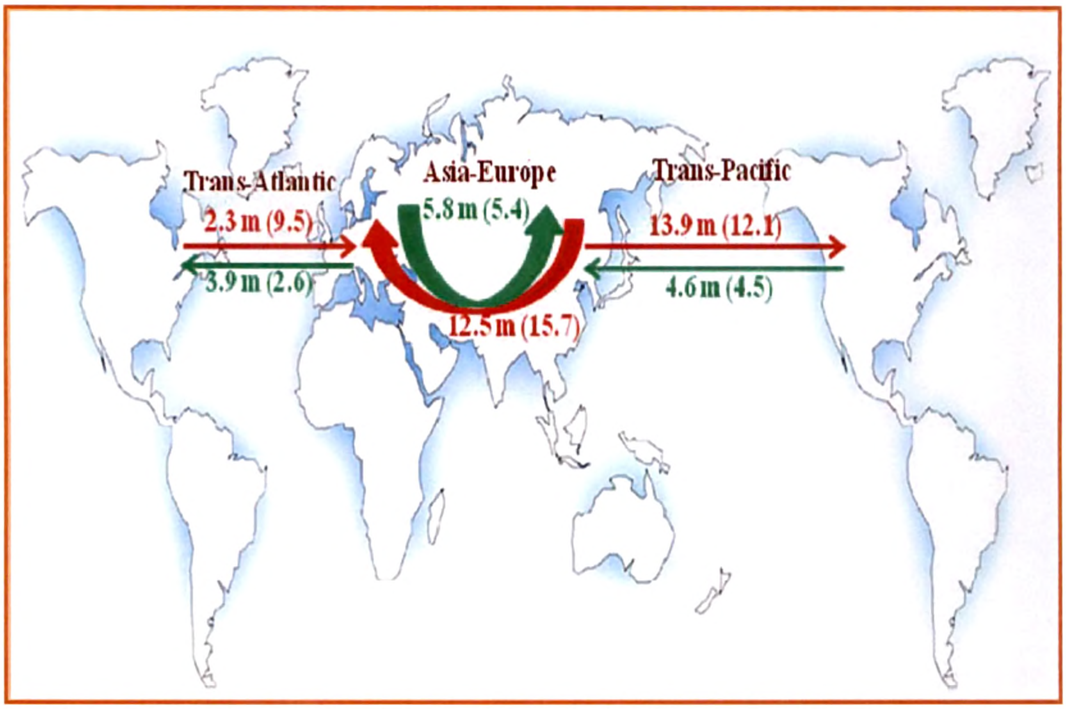


Figure: 4.1 Major Global Container Trade Routes, 2006



Note: Chart shows container traffic (in million TEUs) and growth rate (%) in 2005.

Other major trades include intra-Asia (32 million TEUs), other intra-regional (13 million TEUs) and North (North America, Europe, Asia)-South (Latin America, Africa, Australasia) trade (20 million TEUs).

According to Dynamar (2007)[8] the total number of full containers shipped on worldwide trade routes reached an estimated 110.2 million TEU in 2006. This is nearly twice as high as the 60.5 million TEU in 2000, corresponding to an average annual growth rate of 10.5 per cent. For 2007 a further double-digit increase to 121.5 million TEU is forecasted. Similarly, UNESCAP (2005)[9] forecasts a figure of 177.6 million TEU for 2015 (excluding transhipment). More specifically, container volumes shipped on worldwide trade routes are expected to develop as follows[10]:

- Volumes on the *east-west trades* (i.e. Transpacific, Transatlantic and Asia/Europe) are expected to increase from 39 million TEU in 2005 to 70 million TEU in 2015, representing an average annual growth rate of nearly 8 per cent.

- Volumes on the *north-south trades* (linking the major production and consumption centers of Asia, North America and Europe with developing countries in the Southern Hemisphere) are expected to show a similar average growth rate, increasing from about 17 million TEU in 2002 to about 36 million TEU in 2015.

- *Intra-regional trades*, however, are expected to show significantly higher growth during the same period. Mainly as a result of booming intra-Asian trades, they are expected to surge from 28 million TEU in 2002 to no less than 72 million TEU in 2015, corresponding to an average annual growth rate of 7.5 per cent.

- According to UNCTAD, global containerised trade would grow at 6.5 per cent during 2005-2011 and the decadal growth would be 120 per cent in 2001 to 2011. The increased trade container volumes on international routes have led to an increasingly growing demand for container ships.

3.2 Global Container Fleet

As mentioned earlier, containers are more cost effective in transporting high volumes over long distances. Increasingly world trade is handled by containers. Some products that were traditionally shipped as bulk cargo are now being shipped by containers, such as pulp and paper products. The composition of world fleet is slowly changing over the years to reflect this phenomenon. Also, there is a growing trend of increased container vessel sizes to cater to the above mentioned growing container trade. These vessels save on operational costs and time — two crucial factors affecting economies of scale in ship operations.

3.2.1 The World Fleet

Comparative time series data of the world fleet for the period 1994-2006 (table: 4.5) shows that the world merchant fleet grew at an average annual rate of 2.6 per cent to reach over 104 million dwt at the end of year 2006. Among the principal types of vessels, it is the world container fleet which shows the fastest growth of any ship type. The fleet of fully cellular container ships grew at a whopping average annual rate of 9.9 per cent and stands at 128.3

Table: 4.5 Composition and Growth of World Fleet Size by Principal Types of Vessels

Year	Total World Fleet (000 dwt)	Annual % change	Oil Tankers (000 dwt)	Annual % change	Bulk Carriers (000 dwt)	Annual % change	General Cargo Ships (000 dwt)	Annual % change	Container Ships (000 dwt)	Annual % change	Liquefied Gas Carriers (000 dwt)	Annual % change
1994	719805	-	270997 **(37.7)**	-	250294 **(34.8)**	-	103731 **(14.4)**	-	39005 **(5.4)**	-	14044 **(2.0)**	
1995	734917	2.1	267651 **(36.4)**	-1.2	261628 **(35.6)**	4.5	104145 **(14.2)**	0.4	43849 **(6.2)**	12.4	14691 **(2.0)**	4.6
1996	758172	3.2	271454 **(35.8)**	1.4	272564 **(36.0)**	4.2	104642 **(13.8)**	0.5	48776 **(6.4)**	11.2	15507 **(2.1)**	5.6
1997	775927	2.3	272023 **(35.1)**	0.2	281012 **(36.2)**	3.1	103880 **(13.4)**	-0.7	56108 **(7.2)**	15.1	16021 **(2.1)**	3.3
1998	788725	1.6	279508 **(35.4)**	2.8	275519 **(34.9)**	-2.0	101259 **(12.8)**	-2.5	61147 **(7.8)**	9.0	16471 **(2.1)**	2.8
1999	798995	1.3	282458 **(35.4)**	1.1	276091 **(34.6)**	0.2	101481 **(12.7)**	0.2	63637 **(8.0)**	4.1	17334 **(2.2)**	5.2
2000	808376	1.2	285441 **(35.3)**	1.1	281654 **(34.8)**	2.0	102653 **(12.7)**	1.2	69216 **(8.6)**	8.8	18525 **(2.3)**	6.9
2001	825652	2.1	285519 **(34.6)**	0.0	294588 **(35.7)**	4.6	99872 **(12.1)**	-2.7	77095 **(9.3)**	11.4	19074 **(2.3)**	3.0
2002	844235	2.25	304396 **(36.1)**	6.6	300131 **(35.6)**	1.9	97185 **(11.5)**	-2.7	82793 **(9.8)**	7.4	19469 **(2.3)**	2.1
2003	856974	1.5	316759 **(37.0)**	4.1	307661 **(35.9)**	2.5	94768 **(11.1)**	-2.5	90462 **(10.6)**	9.3	20947 **(2.3)**	7.6
2004	895843	4.5	336156 **(37.5)**	6.1	320584 **(35.8)**	4.2	92048 **(10.3)**	-2.9	98064 **(10.9)**	8.4	22546 **(2.5)**	7.6
2005	959964	7.2	354219 **(36.9)**	5.4	345924 **(36.0)**	7.9	96218 **(10.0)**	4.5	111095 **(11.6)**	13.3	24226 **(2.5)**	7.5
2006	1042328	8.6	382975 **(36.7)**	8.1	367542 **(35.3)**	6.2	100934 **(9.7)**	4.9	128321 **(12.3)**	15.5	26915 **(2.6)**	11.1
Average Annual Growth (1995-2006)		**2.6**		**2.9**		**3.0**		**-0.2**		**9.9**		**5.0**

Figures in parentheses indicate the share of each ship type in the overall fleet

Source: *Review of Maritime Transport, UNCTAD; various issues.*

million dwt, accounting for 15.5 per cent of the world merchant fleet tonnage. In 1994 this share was at a mere 5.4 per cent. The share of other ship types has remained more or less the same, with the exception of general cargo ships, which are being increasingly replaced by container ships.

Chart: 4.5(i) Composition of World Fleet by Principal Types of Vessels

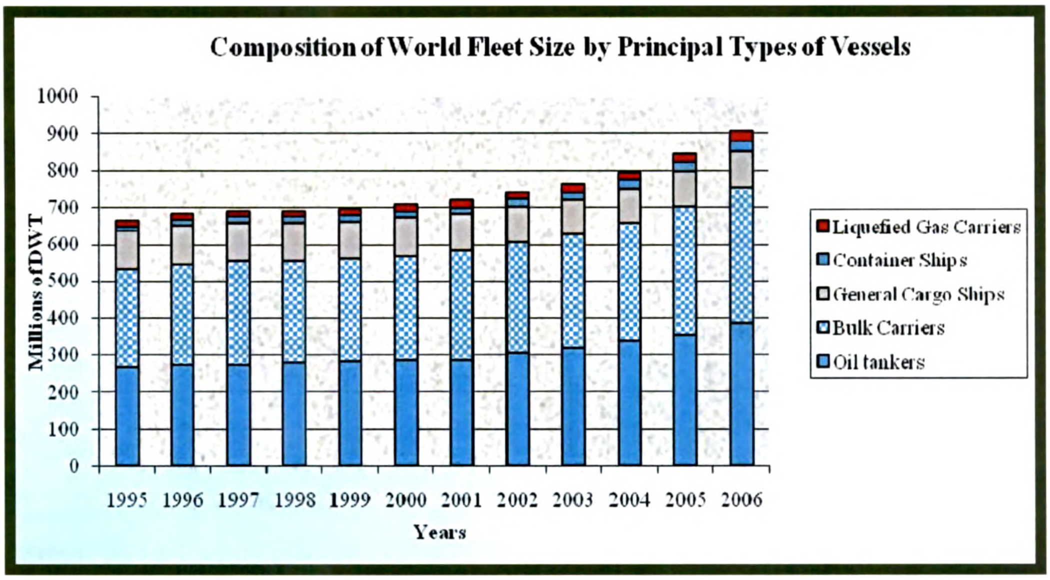
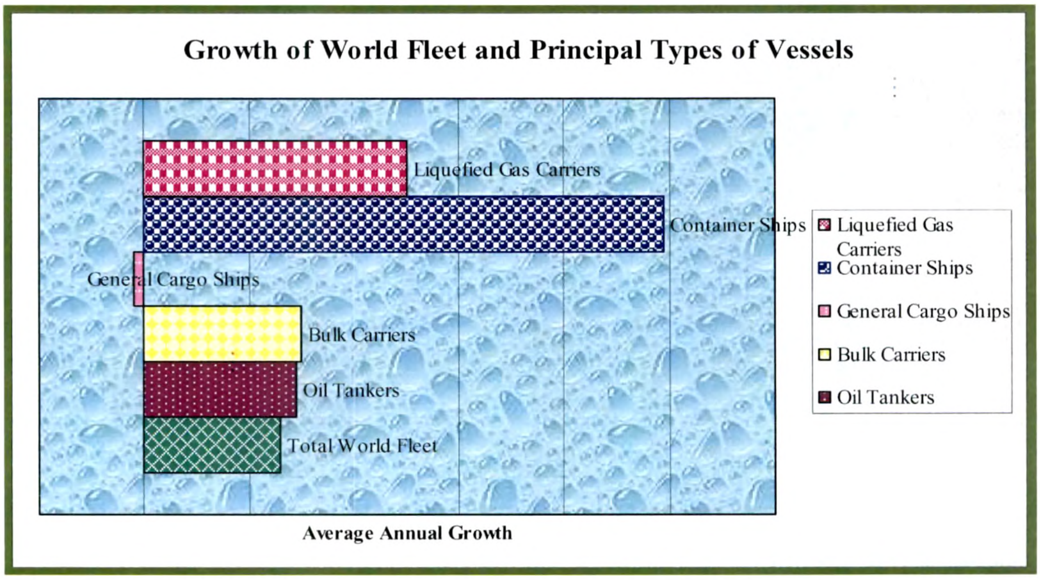


Chart: 4.5 (ii) Growth of World Fleet and Principal Types of Vessels



There has been no comparable development with any other ship type in the history of shipping. This relatively high rate of increase reflects the growing portion of manufactured goods being traded, mostly in containers. Some of the growth is at the expense of the traditional general cargo ship which, as can be seen from table: 4.5 show a negative average growth during the same period. This ship type is being replaced today by multi-purpose vessels or by pure containerships. The containership has become the dry cargo carrier of the future.

3.2.1.1 World Containership Fleet

Container vessels transport standardised container units worldwide. A container carrier is, in principle, an open box with hatches as wide as the vessel and with cargo compartments and cell guides allowing containers to be stacked quickly and held in place inside the vessel. The ships have hatch covers that are strengthened to support more containers to be stacked above deck. Newer vessels also have cell guides on deck to allow higher stacking and faster securing of the containers.

The container ships' capacity is measured in TEU (Twenty-foot Equivalent Unit). The fleet is classified in different categories according to the ships' TEU capacity. A vessel's TEU capacity is influenced by the size and shape of the vessel and the equipment installed to stack and secure the containers. In most cases a vessel with a capacity of, for example, 4.000 TEU will not have enough capacity to carry 4.000 loaded TEU units, but it will be able to carry 3,200 loaded and 800 empty TEU or 3,500 loaded units.

The vessel-sizes are dependent upon the operating distance and the cargo volumes available for transport. Other limitations are port draught, fairway width, quay length, and cargo handling facilities. The general rule is that large container vessels operate on intercontinental routes and smaller vessels, called feeder vessels, transport containers from large continental and regional hubs to smaller national hubs and ports.

The world fleet of fully cellular containerships has expanded substantially over the years, both in terms of number of ships as well as their carrying capacity in number of TEUs, as can be seen from table:4.6 and charts: 4.6(i) and 4.6(ii). Since 1995, world-TEU capacity has grown on an average of 11.0 per cent per year, whereas the number of containerships has risen by only 6.7 per cent, thus underlining a continuous trend towards large vessels. The carrying capacity of the world container fleet of 3945 ships (at the end of 2006) has more than doubled during the past 10 years and has reached 9.6 million TEUs.

Table: 4.6 World Fleet and TEU Capacity of Fully Cellular Containerships

Years	Number of Ships	% Change	TEU Capacity	% Change	Average Carrying Capacity per Ship
1994	1742	-	2643976	-	-
1995	1917	10.0	2973081	12.4	1551
1996	2112	10.2	3351367	12.7	1587
1997	2342	10.9	3857889	15.1	1647
1998	2523	7.7	4279300	10.9	1696
1999	2622	3.9	4508708	5.5	1720
2000	2746	4.7	4919526	9.1	1792
2001	2904	5.8	5523456	12.3	1902
2002	3045	4.9	6109473	10.6	2006
2003	3186	4.6	6651629	8.9	2088
2004	3359	5.4	7301982	9.8	2174
2005	3618	7.7	8240755	12.9	2278
2006	3945	9.0	9583190	16.3	2429
Average Annual Growth (1995-2006)		**6.7**		**11.0**	

Source: *BRS-Alphaliner, Cellular Fleet Projections; various issues*

The average containership size today is 2429 TEUs compared to 1551 TEUs in 1995. This reflects the commissioning of larger ships in order to achieve economies of scale. With vigorously growing container volumes on most routes, the development and introduction of larger ships has been a logical consequence. Also, as can be seen from the table, at the beginning of 2000, 2622 cellular containerships were deployed on worldwide trade routes providing a total slot capacity of about 4.51 million TEU. By the beginning of 2007 these have increased to 3945 ships and 9.58 million TEU, respectively. Hence, the total capacity provided by cellular containerships has more than doubled in just seven years time, representing an average annual increase of 11.3 per cent.

Chart: 4.6(i) World Container Ship Fleet and its Growth

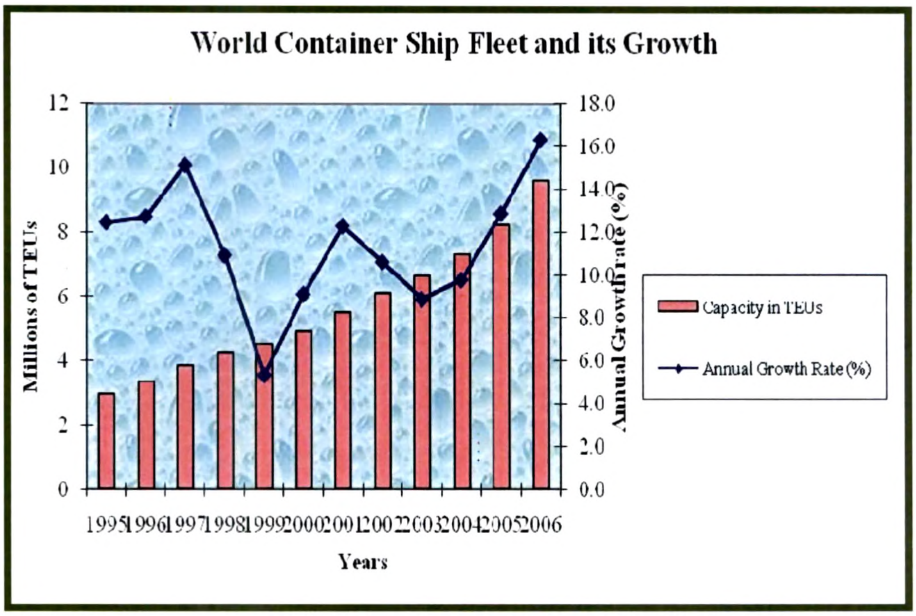
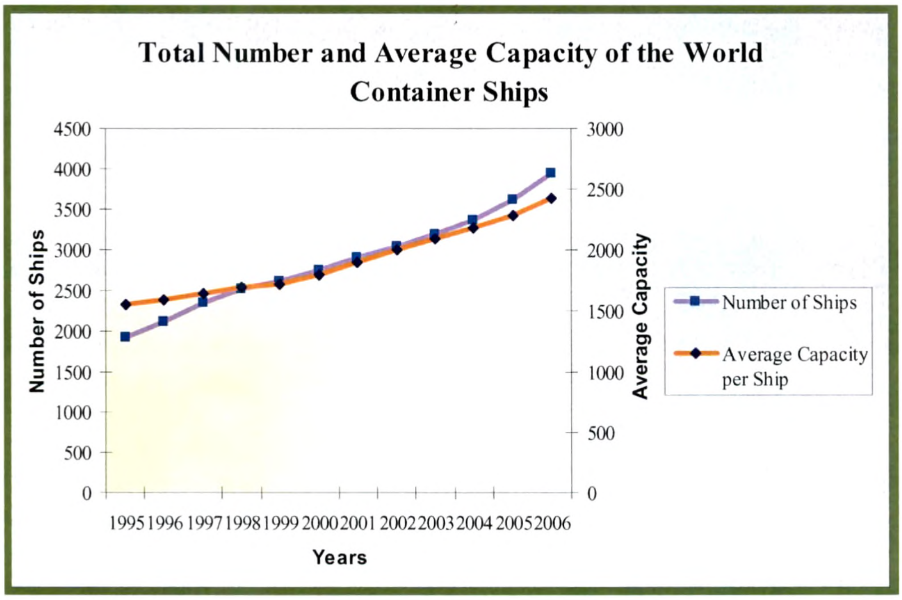


Chart: 4.6(ii) Number and Average Capacity of World Container Ships



According to ESCAP, some analysts argue that the search for economies of scale is inexorable and will drive vessel sizes up through 12,000 TEU and beyond within the next decade. Large ships typically have a lower cost per TEU-mile hour than smaller units with the same load factor. Cullinane and Khanna (1999)[11] have demonstrated that economies of scale increase steadily with ship size (see Table 4.7). They restrict this finding to the longer transpacific trade routes.

Table: 4.7 Estimates for Transpacific Trade Routes

TEUs	Cost per TEU
1000	$328
2000	$249
3000	$219
4000	$201
5000	$190
6000	$182
7000	$177
8000	$174

Source: *Cullinane, K. and Khanna, M, (1999).*

Samsung has demonstrated that a vessel of 12,000 TEU on the Europe-Far East route would generate an 11 per cent cost saving per container compared to a 8,000 TEU vessel and even 23 per cent less than a 4,000 TEU ship. Drewry Shipping Consultants also made similar calculations to report that when compared to a Panamax ship of 4,000-TEU a 10,000-TEU mega post-Panamax ship results in 37 per cent operating cost savings. The shipping industry is rapidly moving to take advantage of economies of scale by increasing ship size, and reducing the number of port calls. Shipping lines have pursued more fuel economy and economies of scale in vessel size to reduce cost, increase market share and take leading positions in the sector. Container ships have evolved from less than 1000

TEU to the present 10,000 plus TEU carrying capacity. Intense competition and economies of vessel size lie behind recent increases in the size of container ships. Economies of vessel size arise from the technical characteristics of container shipping: the capital cost per container slot falls as vessel size increases, while the ratio of crew to carrying capacity and the consumption of fuel per unit of cargo carried also decline as vessel size increases.

- **Evolution of Container Ships**

While the so called container ships of the first generation constructed more than thirty years ago in the late 1960s were still confined to the carriage of approximately 700 TEU, the first container ships of the third generation carrying up to 3000 TEU were delivered already in 1972. These ships had Panamax dimensions (length 285 m, breadth 32.2 m) and are only now beginning to be phased out. Before we trace out the evolution of the different container ships, let us first know what the terms actually mean.

Panamax Ships: The Panama Canal, built in 1914, can only handle ships up to 32.5 metres wide, which for container ships typically equates to 4,500 TEUs in capacity.

Post-Panamax Ships: Ships that carry over 5,000 TEUs are known as post-Panamax vessels. By definition, they do not fit through the Panama Canal but can traverse the Suez Canal between the Indian Ocean and the Mediterranean Sea.

Super Post-Panamax Ships: Some analysts use this term for ships that carry between 10,000 and 12,000 TEUs.

Suezmax Ships: A Suezmax type vessel is a cargo container ship which is sized to the maximum capacity possible while still being able to transit the Suez canal. The Suez Canal contains no lift locks, unlike the Panama Canal, so the length of a Suezmax ship is not as sharply restricted as those of a Panamax vessel, which must fit into the lock chambers. The constraints on a Suezmax ship's length are imposed by its ability to navigate the canal's turns as well as maneuver into and out of the canal, and by its ability to potentially utilize the several turning bays that the canal incorporates along its length.

These are required because the Suez is a single-lane canal, unlike the Panama; as a result, ships can only pass in opposite directions if one or the other can be diverted into a side bay for the event.

Malacca-max Ships: Considered the theoretical limit of ship sizes – 18,000 TEUs – or the largest ships that could sail through the straits of Malacca between Indonesia and Malaysia (separating the Indian and Pacific Oceans). Such a ship would also require 23 meters of draught. A Malacca-max ship would also strain the landside unloading capabilities at the port. Unloading its 9,000, 40' containers onto trucks, for example, would result in a string of vehicles 68 miles (110 km) long! This process of transferring containers from ship to truck would also take as much as a week.

Table 4.8, which traces the evolution of shipping vessels in different periods, clearly indicates that the sizes of the vessels along with their draft requirement are on the increasing trend.

Table: 4.8 Evolution of Ships

Era	Period	Length (m)	Draft (m)	TEUs
Post Suezmax	2006-	397	15.5	>12,000
Suezmax	2005-06	-	-	10,000-12,000
Post Panamax Plus	2000-05	335	13-14	5,000-10,000
Post Panamax	1988-00	275-305	11-13	4,000-5,000
Panamax class	1980-88	250-290	11-12	3,000-4,000
Cellular Containership	1970-80	215	10	1,000-2,500
Converted Cargo Vessel/Tanker	1956-70	135-200	<9	500-800

Source: *www.solentwaters.co.uk*

With a length of around 400m, a breadth of 69m and a draft of more than 14m, few ports would be able to accommodate these vessels at their present facilities. This calls for special port facilities like deeper drafts, infrastructural facilities like wide berthing, high crane handling capacity, quicker and safe loading and unloading capabilities and direct shift of containers to the feeder vessels.

In August 2006, the Odense Steel Shipyard delivered the long-awaited EMMA MAERSK to Maersk Line. With a length of 397m, a width of 56.4m (22 rows across), with a hull height of 30 meters and draft of 15.5 meters and an estimated nominal capacity of 14,000+ TEU when carrying 9 tiers above deck, the EMMA MAERSK is the largest container vessel in the world. In fact, as at March 2007 she is about 50 per cent bigger than the second-largest container vessels afloat (CSCL's 350m long and 18-wide XIN LOS ANGELES of 9580 TEU). Hence, just as was the case with the 7000 TEU REGINA MAERSK in 1996, Maersk Line again took a very important lead over its nearest competitors as far as the deployment of large vessels is concerned. Together with seven identical sister ships (of which the ESTELLE MAERSK, ELEONORA MAERSK and EVELYN MAERSK have already been delivered) the EMMA MAERSK has been deployed on the Far East-Europe trade. In fact, as from April 2007, these giant ships are only calling at a handful of ports, namely Rotterdam, Bremerhaven, Algeciras, Tanjung Pelepas,, Ningbo, Xiamen, Hong Kong, Yantian (Shenzhen), and back to Rotterdam. Given their 28,000+ TEU nominal two-way capacity, these ships generate massive import/export call sizes for the ports involved. The largest ship ever built was the supertanker Knock Nevis, now retired. (**Source:** Dynamar (2006, 2007), AXS-Alphaliner and various trade press articles).

The next step will be the Malaccamax ship, with 18,000 TEUs of carrying capacity, of 200,000 DWT, 470m long, 60m wide, 16m of draft, with more than 100 MW power for 25.5 knots. This is expected to be the limit before a major restructuring of world container trade routes. The biggest constraint of this design, the absence of a capable single engine, has been overcome by the MAN B&W K108ME-C [Source: http://en.wikipedia.org]. It has become increasingly clear now that there are no insurmountable technical barriers to the future increase in size of container ships. Concept designs already exist for ships up to 18,000 TEUs. The limits to grow, if there are any, will be market driven.

Growth of Containership Size

When we trace the growth of container ship size over the last two decades we find that there has been a phenomenal growth during the last five years. This can be clearly visualized from table: 4.9.

Table: 4.9 Growth in Container Ship Size

Year	Average Ship Size (TEU)	Largest ship in World Container Fleet (TEU and max. draft in mtrs)
1980	975	3057 - 11.6 m
1990	1370	4409 - 14.0 m
2000	1720	7200 - 14.5 m
Current	2383	13500 - 15.5 m (Emma- Maersk)

Source: *AXS Alphaliner Database; various years.*

The average ship size in 1980 was 975 TEUs and the largest ship was 3,057 TEUs. In 2000, the average ship size increased to 1720 TEUs, with the largest vessel having a carrying capacity of 7200 TEUs. Currently, the average size of a fully cellular container carrier is 2,218 TEUs and the largest size is about 13,000 TEUs and still increasing. Thus, what took nearly two decades has been achieved in just five years. The average ship size grew by over one and half times in two decades from 1980 to 2000. Nearly the same growth was achieved in the five year period 2001-2005, showing a phenomenal growth in the ship size during this period. The draft requirement has also changed accordingly. The most noticeable feature of this new generation ships is their speed. Conventionally, the average speed at sea has been 15 knots (or 28 km per hour), but nowadays ships can reach top speeds of 35 to 30 knots (45 to 55 km per hour). The challenge of reaching even higher maritime speeds is excessively costly to overcome and it limits the future improvements in maritime speed (Rodrigue 2006)[12].

The demand for bigger vessels becomes logically clear on comparing the costs of 4000 TEU Panamax ship with those of 10,000 TEU mega-size post-Panamax ship. According to an UNESCAP study on operating costs of panamax and mega-size post-panamax ships, while the volume of a 10,000 TEU vessel is 2.5 times greater than a 4,000 TEU vessel, its total annual operating cost is only 57 per cent higher. This translates into 37 per cent savings in operating costs of a 10,000 TEU vessel over a 4,000 TEU vessel.

Composition of the World Cellular Containership Fleet

The growing size of container vessels meets the aim of reducing costs by an economy of scale phenomenon. Given the relentless search for cost savings at sea (cf. economies of scale), it is hardly surprising to see that many shipping lines' expansion plans are heavily focused towards large post-panamax (i.e. 5000+ TEU) containerships. Whereas 5000+ TEU ships provided just 10 per cent of the total cellular fleet capacity at the beginning of 2000, their share will have increased to 40 per cent at the beginning of 2010.

As seen from tables: 4.10 and 4.11 and charts: 4.7 and 4.8, whereas 98 of post-panamax ships provided a total slot capacity of just 590613 TEUs during the year 2000, these numbers amounted to 594 units and 4.0 million TEUs, respectively, during 2007 and are expected to further increase to 820 units and nearly 5.7 million TEU by the beginning of 2010. This equals a more than 12-fold increase of the TEU-capacity in a time span of ten years, or an average increase of nearly 30 per cent per year. As seen in Table: 4.10, in terms of TEUs, the share of post-panamax ships has been constantly on the rise, from just 12 per cent in 2000 to 36.8 per cent in 2007. The magnitude of this increase in share is nearly three times and it has been at the cost of ships of size 4000 TEUs and less. In terms of number of ships (Table: 4.11), the share of post-panamax has once again shown a high increase with a three and a half times increase in the share, from just 3.6 in 2000 to 13.8 in 2007.

Table: 4.10 Composition of World Containership Fleet by TEUs

Size	2000		2001		2002		2003		2004		2005		2006		2007	
	TEUs	% Share	TEUs	% Share	TEUs	% Share	TEUs	% Share	TEUs	% Share	TEUs	% Share	TEUs	% Share	TEUs	% Share
>5000	590613	12.1	983902	17.8	1254175	20.7	1514233	22.8	1933740	26.6	2458020	29.9	3320302	34.7	4019863	36.8
4000/4999	779630	15.9	806887	14.6	973341	16.0	1109565	16.7	1185499	16.3	1360940	16.6	1528448	16.0	1743765	16.0
3000/3999	726934	14.9	785806	14.2	851109	14.0	885099	13.4	901432	12.4	923326	11.2	956165	10.0	1065855	9.8
2000/2999	1070221	21.9	1190478	21.5	1197732	19.7	1282319	19.3	1358959	18.7	1475148	18.0	1630887	17.0	1740911	15.9
1500/1999	627157	12.8	651490	11.8	672155	11.1	698604	10.5	716406	9.8	747648	9.1	786591	8.2	877492	8.0
1000/1499	574436	11.7	586629	10.6	583419	9.6	590578	8.9	603426	8.3	635799	7.7	703034	7.3	781169	7.2
500/999	387967	7.9	391983	7.1	403994	6.7	422617	6.4	448848	6.2	487127	5.9	525664	5.5	576577	5.3
100/499	135801	2.8	134951	2.4	132509	2.2	126450	1.9	126690	1.7	126690	1.5	122944	1.3	117078	1.1
Total	**4892759**		**5532126**		**6068434**		**6629465**		**7275000**		**8214698**		**9574035**		**10922710**	

Source: *Cellular fleet projections, AXS-Alphaliner; various years.*

Chart: 4.11 Composition of World Containership Fleet by Ship Size in Nos.

Years	Annual Percentage Share																
	>5000		4000/4999		3000/3999		2000/2999		1500/1999		1000/1499		500/999		100/499		Total
	No. of Ships	% share	No. of Ships	% share	No. of Ships	% share	No. of Ships	% share	No. of Ships	% share	No. of Ships	% share	No. of Ships	% share	No. of Ships	% share	
2000	98	3.6	178	6.5	210	7.6	431	15.6	371	13.5	480	17.4	547	19.9	440	16.0	**2755**
2001	164	5.6	185	6.3	218	7.5	478	16.4	387	4.3	491	16.8	554	19.0	437	15.0	**2914**
2002	207	6.8	223	7.3	249	8.2	484	15.9	400	13.3	489	16.1	568	18.7	424	13.9	**3044**
2003	247	7.6	251	7.9	260	8.2	517	16.2	415	13.1	496	15.6	595	18.7	404	12.7	**3185**
2004	314	9.3	168	8.0	265	7.9	547	16.3	425	13.0	507	15.1	629	18.7	405	12.1	**3359**
2005	390	10.8	208	8.5	272	7.5	591	16.3	444	12.7	535	14.8	676	18.7	405	11.2	**3618**
2006	504	12.8	346	8.8	282	7.1	648	16.4	466	11.8	594	15.0	722	18.3	387	9.8	**3949**
2007	594	13.8	393	9.1	313	7.2	690	16.0	519	12.0	661	15.3	784	18.2	364	8.4	**4318**

Source: *Cellular fleet projections, AXS-Alphaliner; various years.*

Chart: 4.7 Composition of World Containership Fleet by Ship Size in TEUs

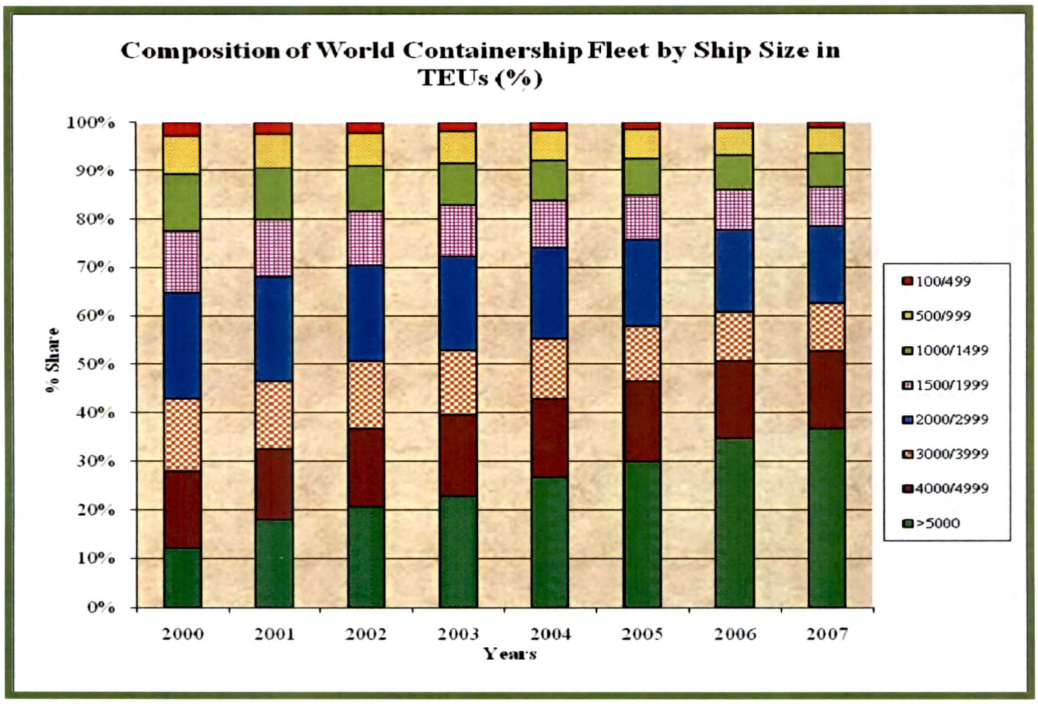
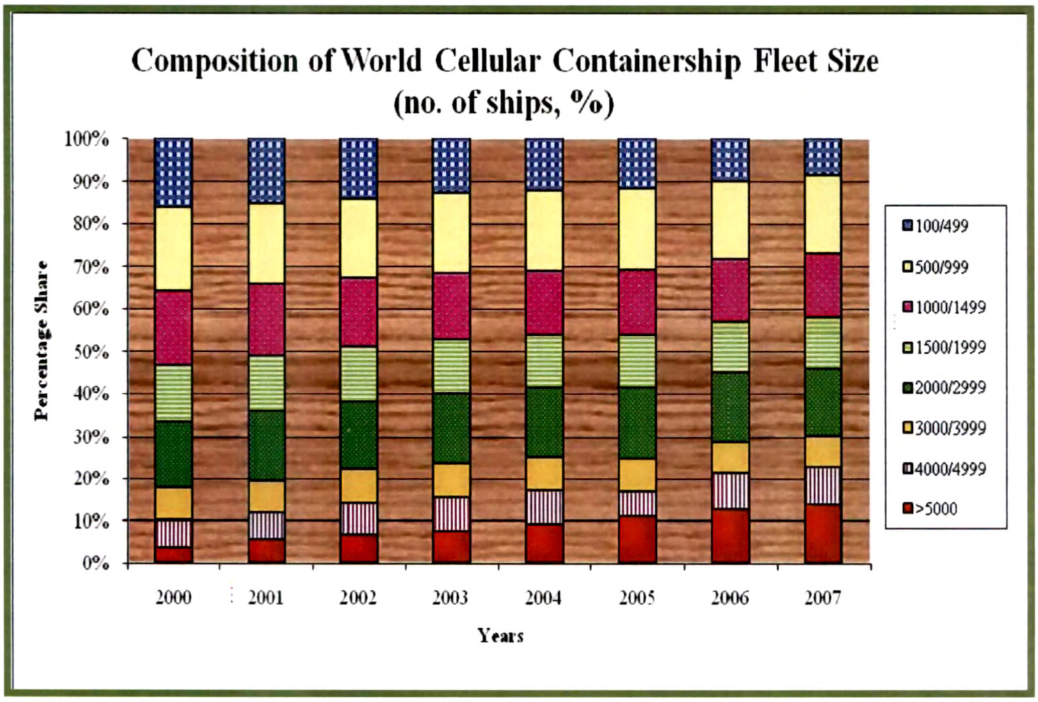


Chart: 4.8 Composition of World Containership Fleet by Ship Size in Nos.



Thus, the number and the size of post-panamax container ships are permanently growing. The post-panamax fleet in operation has a share of nearly 35 per cent of the total TEU capacity today and is expected to grow still further by 2008. In the period 2000 to 2005, the capacity of the container fleet grew to 8.2 million TEUs, with the following increases for different size categories:[13]

Ship Size	Increase in the Number of Ships
Upto 1999 TEUs	+ 4%
2000 to 3999 TEUs	+ 5%
4000 to 5999 TEUs	+ 12%
Above 6000 TEUs	+ 44%

If we take into account the average annual growth of the number of ships that have been delivered and added to the fleet for each size category, we find that it is once again the post-panamax ships that have shown the highest growth in number of total vessels at 27 per cent per year during the period 2000-2007 (Table: 4.12 and Chart: 9(i)). Chart: 4.9(ii) charts the growth of post-panamax containerships.

Table: 4.12 Growth of World Containership Fleet in Nos. (By Ship Size)

Years	Annual Percentage Change															
	>5000		4000/4999		3000/3999		2000/2999		1500/1999		1000/1499		500/999		100/499	
	No. of Ships	% change	No. of Ships	% change	No. of Ships	% change	No. of Ships	% change	No. of Ships	% change	No. of Ships	% change	No. of Ships	% change	No. of Ships	% change
2000	98	25.6	178	14.1	210	-7.5	431	10.8	371	13.5	480	-0.8	547	1.5	440	4.3
2001	164	67.3	185	3.9	218	3.8	478	10.9	387	4.3	491	2.3	554	1.3	437	-0.7
2002	207	26.2	223	20.5	249	14.2	484	1.3	400	3.4	489	-0.4	568	2.5	424	-3.0
2003	247	19.3	251	12.6	260	4.4	517	6.8	415	3.8	496	1.4	595	4.8	404	-4.7
2004	314	27.1	168	6.8	265	1.9	547	5.8	425	2.4	507	2.2	629	5.7	405	0.2
2005	390	24.2	208	14.9	272	2.6	591	8.0	444	4.5	535	5.5	676	7.5	405	0.0
2006	504	29.2	346	66.3	282	3.7	648	9.6	466	5.0	594	11.0	722	6.8	387	-4.4
2007	594	17.6	393	13.6	313	11.0	690	6.5	519	11.4	661	11.3	784	8.6	364	-5.9
Average Annual Growth		**27.1**		**13.8**		**4.1**		**6.5**		**5.1**		**4.0**		**3.9**		**-1.8**

Source: *Cellular fleet projections, AXS-Alphaliner; various years.*

Chart: 4.9 (i) Growth of the Different Sized Containerships

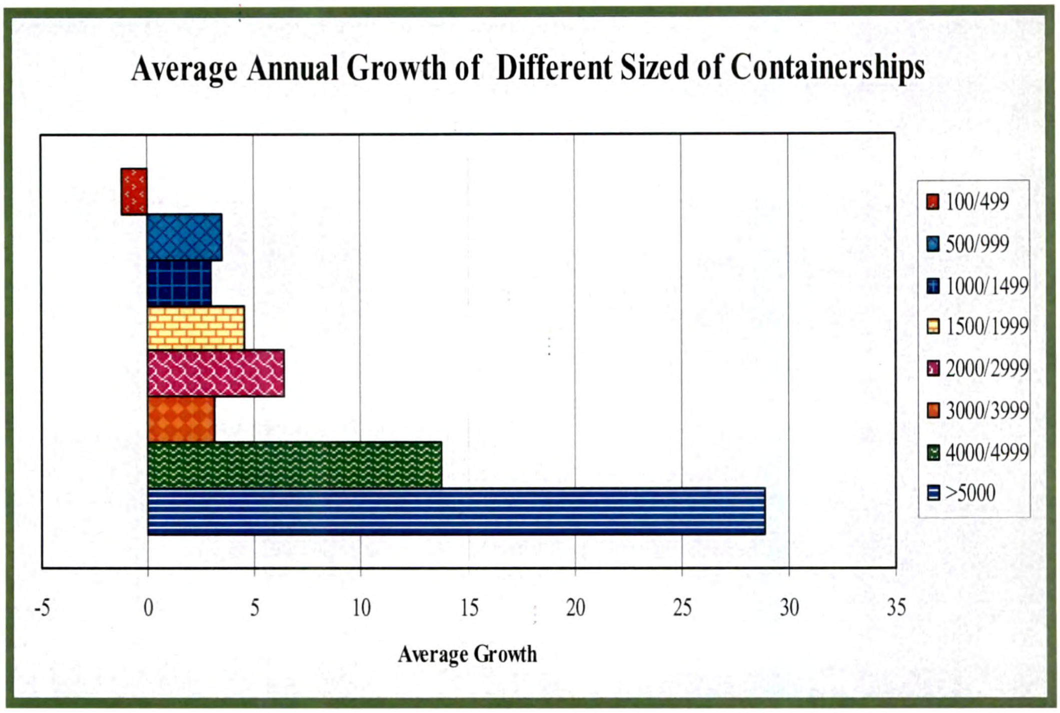
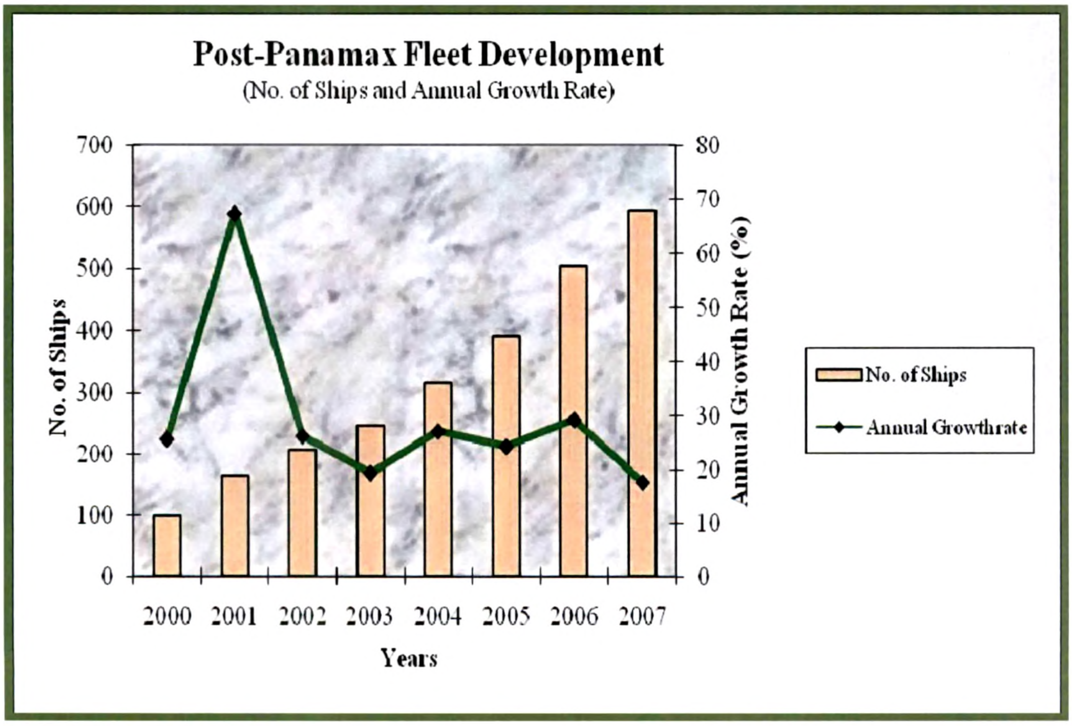


Chart: 4.9 (ii) Post-Panamax Fleet Developments



The Present Fleet and Order Book (in Terms of No. of TEUs)

As a result of strong growth on the arterial container trade routes in recent years, and in order to anticipate on future volume increases, many shipping lines have embarked upon ambitious expansion plans to upgrade the capacity of their ship fleets. An analysis of the global container ship order book in table: 4.13 shows that, it is the Post-Panamax fleet (> 4,000 TEUs) that has been ordered more than the Sub-Panamax fleet (< 4,000 TEUs). The Post-Panamax fleet forms a very high proportion of the total fleet to be delivered, a huge 80.4 per cent. At 27.2 per cent, the Super-Post-Panamax ships of 10,000+ TEUs are the highest on order. According to the AXS-Alphaliner Cellular Fleet database, as on 1st January, 2008, the containership fleet counted 9 units of more than 10,000 TEUs and there are 324 more of these giants on order.

Table: 4.13 Containership Order Book by Size and Scheduled Delivery Year - TEU Capacity (as on 1st March, 2008)

Size Range (TEUs)	Order Book (TEUs)					% of Total Fleet on Order	
	2008	2009	2010	2011	Total		
<500	0	0	0	0	0	0	
500-900	86101	39974	10700	0	136775	2.0	
1000-1499	106107	63033	55669	22858	247667	3.7	
1500-1999	102044	86764	31141	13916	233865	3.5	
2000-2999	173368	125315	90727	24345	413755	6.1	
3000-3999	89095	101117	98708	0	288920	4.3	
4000-4999	277551	431013	219925	176200	1104689	16.4	80.4
5000-7499	349954	331155	338662	111200	1130971	16.8	
7500-9999	321947	293585	542593	183330	1341455	19.9	
10000+	163352	290636	514897	861587	1830472	27.2	
Total	**1,554,519**	**1762592**	**1903022**	**1393436**	**6728569**	**100.0**	

Source: *AXS-Alphaliner, Container Fleet Order Book, downloaded on 24th April, 2008.*

As may be seen from the above table, the future newbuilding deliveries of container vessels would predominantly be in the bigger size ranges. It is the post-panamax and over post-panamax ships ones that have been ordered more as compared to other containership sizes.

Based on the above order book, the predictions regarding the projected growth of global ellular fleet as on 1st January, 2008 stand as shown in table: 4.14. A recent ESCAP study has revealed that by 2011 a total of 490 very large container vessels will be in service globally out of which approximately 130 will be of 10,000 TEU and above.

Table: 4.14 Projected Growth of Global Fleet (January 2008)

Fleet as on	Additions		Total		Y-O-Y Growth
	NOS.	TEU	NOS.	TEU	
01.01.2006	-	-	3618	8,240,755	-
01.01.2007	331	1,333,280	3949	9,574,035	16.0%
01.01.2008	369	1,348,675	4318	10,922,710	13.9%
01.01.2009	506	1,655,031	4824	12,577,741	15.2%
01.01.2010	440	1,762,592	5264	14,340,333	14.0%
01.01.2011	345	1,903,022	5609	16,243,355	13.3%
01.01.2012	187	1,393,436	5796	17,636,791	8.6%

Source: *Cellular fleet projections, AXS-Alphaliner; various years (downloaded on 24th April, 2008).*

The Post-Panamax fleet in operation has a share of more than 25 per cent of the total TEU capacity today, and this is expected to grow to about 35 per cent by 2008. Moreover, based on shipping lines' order books as at 01/03/2007, the number of cellular containerships deployed on worldwide trade routes is expected to further increase to about 5200 units by 01/01/2010, providing a total slot capacity of 14.07 million TEU. This equals a massive increase of nearly 50 per cent in just three years time, or 14.3 per cent per year. To put this in perspective, the capacity increase of 4.50 million TEU during

2007-2009 means that a stunning 125,000 TEU slots will be added to the worldwide cellular fleet every month.

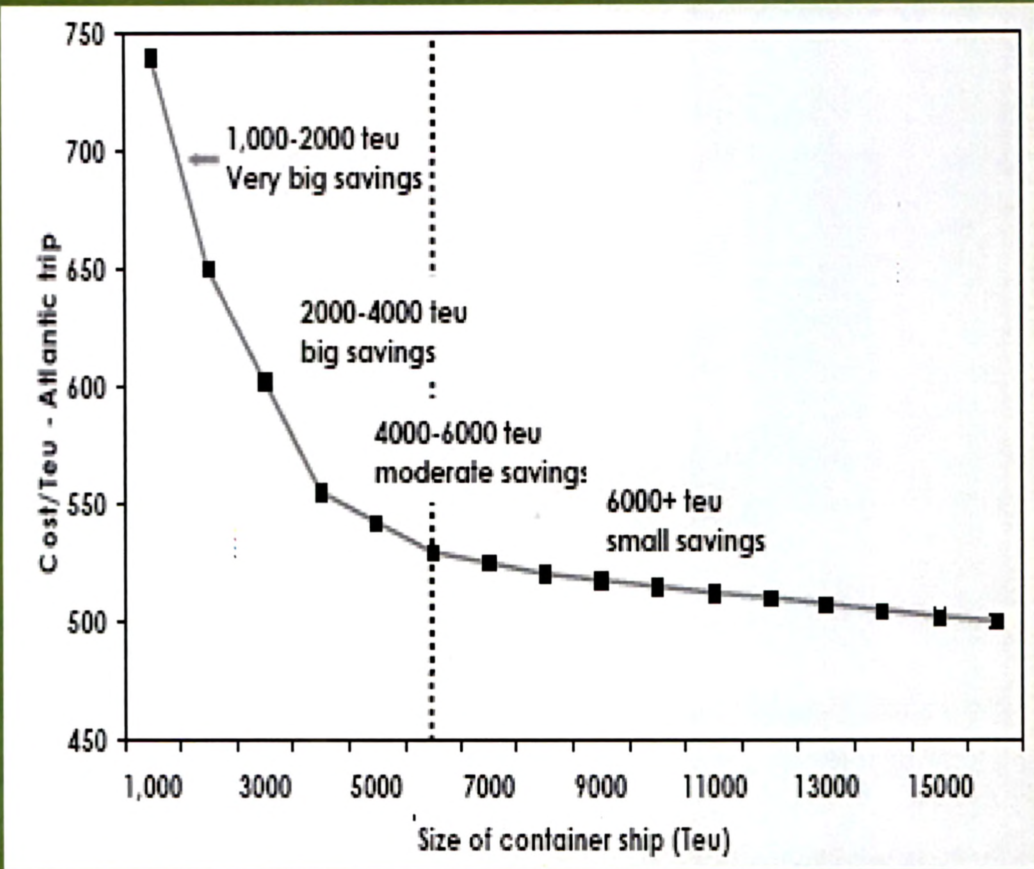
Economies of Scale

The size of future vessels and how quickly post-Panamax vessels are deployed depends on several factors including how quickly orders for these vessels can be filled, the cost of construction and their engine propulsion capabilities. The extent to which that shipping lines can operate these larger vessels efficiently and under full utilisation will also factor into how many post-Panamax vessels they deploy and on which routes. Larger vessels tend to have lower cost per TEU-mile but bigger will not always mean better economics for all shipping lanes. Many carriers have not experienced continuous full capacity utilisation.

Martin Stopford of Clarksons Research argues that the economies of scale in total transportation costs diminish beyond capacities of 3000 TEUs and become immeasurably low after 8000 TEUs. He also states that though crew reduction, fuel consumption, speed increase, advanced marine technology, liberalisation, slot agreement, etc. are the many means to modify the cost structure, some other market forces like limitations in port facilities (water depth, crane range, infrastructure capacity), limitations in vessel speed due to a single engine, current over-capacity in the East West trade inhibit increase of vessel size.

He expresses some doubts about the real benefit of economies of scale, stating that very big ships produce likely relatively small savings. Even if some operating costs (insurance, maintenance, bunker) diminish proportionally with the size, the container ship economies of scale curve shows the tendency for returns to diminish beyond the size of 6,000 TEU (Figure: 4.2). According to Stopford, increasing ship size from 1000 TEU to 2000 TEU saves 20 per cent in the unit cost of transport; from 2000 to 4000 TEU saves 7 per cent; and from 4000 TEU to 6000 TEU saves only 4 per cent. Beyond 8000 TEU, the economies of scale are hard to detect. So there are economies of scale, but because they diminish with the size, the biggest benefits will be derived by upsizing cargoes in the smaller segments of the container fleet, not by building super ships.

Figure: 4.2 Container Ships – Economies of Scale



Source: *Martin Stopford/ Clarksons*[14]

Furthermore, Stopford points out that there are significant diseconomies in dredging, congestion and redirecting the goods from ports. Another argument is about the fact that the biggest vessel will not call in many ports. Using hub ports, they will have to support additional transhipment costs. He goes on to suggest that greater economies lie in replacing small and medium ships with ships in size class of Panamax and post-Panamax containerships. Smaller ships mean more flexibility which is traditionally greatly appreciated by the logistics operators.

Transhipment and Feeder Ships

To maximise operating efficiency, Post-Panamax vessels will only call at a limited number of ports on one round trip voyage. The larger container ships operate mainly between regions calling at a limited number of high volume ports. The larger ships are often operated on trunk routes and call at 'hub' ports along the east-west axis where draft restrictions are not a problem. For cargo destined to ports not serviced by direct calls, smaller container ships, known as feeder ships, 'tranship' the container from the hub port to the port of final destination. Thus, a transhipment hub is "a container port that provides terminal and marine services to handle and facilitate the transfer or transhipment of containers between feeder and mother vessels in the shortest possible time" (Baird 2001). Cargo is transferred from large "mother" ships at load centre ports onto small "feeder" ships" destined for smaller, regional ports. The main operators use in-house feeder ships or third party companies to carry out these operations.

Table: 4.15 Estimated World Container Transhipment Incidence

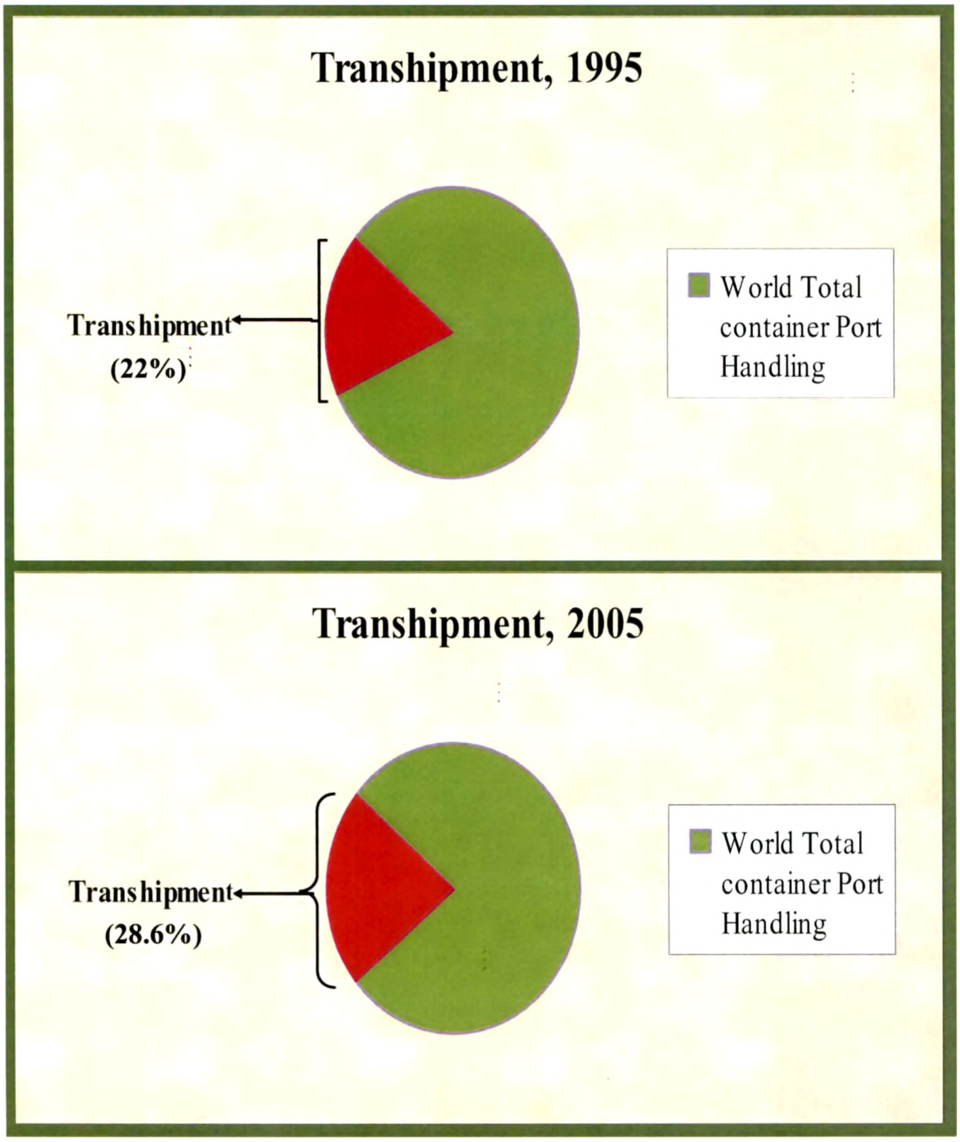
Year	Total Port Handling	Port-to-Port (mTEU)	Transhipment (mTEU)	Transhipment Incidence
1980	38.3	-	-	-
1990	87.8	72.0	15.9	18.1
1995	145.2	112.9	32.3	22.2
1996	157.1	120.2	36.9	23.5
1997	175.0	132.3	42.7	24.4
1998	189.3	141.6	47.7	25.2
1999	209.1	155	54.1	25.9
2000	235.4	173.2	62.2	26.4
2001	247.4	181.3	66.1	26.7
2002	275.8	200.4	75.4	27.3
2003	316.7	230.2	86.5	27.3
2004	354.5	254.6	99.9	28.2
2005*	394.9	282.0	112.9	28.6

*estimated

Source: *Drewry Shipping Consultants.*

Containerisation of cargo for smaller ports has supported 'hub-and-spoke' routing and has led to a steady increase in transhipment cargo, (table: 4.15 and chart 4.10). Transhipment activity rose from an estimated 32.3 million TEUs of the world total container port handling in 1995 (with the transhipment incidence being 22 per cent) to an estimated 112.9 million TEUs in 2005 (with the transhipment incidence rising to 28.6 per cent).

Chart 4.10 Growth of Transhipment, 1995-2005



In future, increase in trade growth will not only benefit hub & spoke development but also direct port calls. Transhipment as a generator of port handling activity is expected to continue to increase as carriers rely on filling their ever larger vessels with cargo which originates from an ever wider geographical radius. Though, at the same time, we'll see that as regional ports gain in importance, direct services will take over more and more cargo.

In regard to future transhipment prospects, Ocean Shipping Consultants (2000) state that:

"As ship sizes continue to increase and shipping line mergers and alliances become increasingly dominant within the industry, the economic advantages of reducing the number of port calls will become more pronounced. The share of transhipment within total demand is already high, and is forecast to continue rising, as major lines endeavour to serve the... market by as few direct calls as possible, thus increasing the hub-and-spoke distribution of containers."

Drewry Shipping Consultants (2002) echo this view, and in so doing highlight the changing nature of container shipping due to the increasing significance of transhipment:

"The increasing incidence of transhipment has had a massive effect on global container traffic volumes... the (average) transhipment incidence is 47.6% (as measured across key hub ports worldwide)... the last two/five years have seen a distinct shift from the traditional transhipment/natural hinterland ports to greenfield site developments whose existence is largely based on their transhipment potential."

Given the underlying global trend, a positive growth outlook is therefore anticipated for transhipment. Consequently, further new port developments with a strong transhipment orientation should be expected in all key regions of demand.

Big ships will alter shipping patterns. Vessel size may influence the number of port calls on a particular shipping route and some ports currently lack the harbour depth and crane capacity to handle containers from these bigger ships. The size of vessels also affects the choice of routing patterns as post-Panamax ships cannot currently transit through the Panama Canal. Thus, development towards bigger vessels in size and capacity is driving the whole industry towards major transformations in vessel technology (twin engines and specialisation) and especially in port infrastructure development (deeper berths and improved handling systems) (Yang 2004[15], Rodrigue 2006). The only remaining constraints in ship size are the capacity of ports, harbours and canals to accommodate them. (Rodrigue 2006). The emergence of large-sized ships has two significant effects on international shipping: ship size not only determines the competitive power in the shipping industry but also becomes a major criterion in determining the size of a port.

New ideas and concepts are needed here to keep pace with the developments of the large container vessels. The success of container transportation depends on excellent planning and detailed logistics. Route optimisation, reduction of port calls and optimum subdivision of the transportation chain between mega ships and feeder vessels are significant factors of this very competitive trade. The role of 15,000 TEU ships will be very different to that of the present large containerships. They will exclusively be used for maintaining the East-West/West-East long haul maritime segment; all containers carried will therefore have to be transhipped.

De Monie proposed a scenario in which 15,000 TEU or larger ships are deployed on the main East-West routes, on a site that is sufficiently central to serve a large sub-region and allows feedering costs to be minimised. North-South linkages are maintained with feeder ships of anywhere from 250 to 6,000 TEU. The most likely locations for the four "mega hubs" in the world are Southeast Asia, the Western exit of the Mediterranean, the Caribbean and the West Coast of Central America. Such "mega hub" facilities could well be 'off shore', as they will exclusively cater for transhipment. A tentative layout of an off-shore "mega hub" offers two berths for 15,000 TEU ships, six berths for large feeders and up to eighteen berths for large and small feeders. The establishment of a so called necklace of off shore mega hub container ports, underpinned by a multi-layered feeder port network, is also being proposed.

We now take look at containerisation in context of India.

4. CONTAINERISATION IN INDIA

Ironically containerisation was introduced for the first time in Indian domestic market way back in 1966 by the Indian railways to provide door to door service to their customers and attract cargo from roadways. They used containers with a 5 ton payload. Containerisation of general cargo in India began in 1970s as against its advent in 1960s in developed countries and gained momentum in 1980s. The first container was handled at Cochin in 1979 carried by a vessel owned by American President Lines which also commenced a scheduled service from Mumbai followed by several other foreign companies. However the International Marine Container failed to become popular right up to the late 1980s which, in turn, affected international trade growth. Hence the necessary infrastructure required for multi modal transport was never created till almost too late. It was only in 1987 that the Government of India realized the importance of containerisation and started constructing a satellite port at Mumbai which commenced operations in 1988 and was christened The Jawaharlal Nehru Port. Subsequently, a Corporation called CONCOR (Container Corporation of India) was created the Indian Railways for inland haulage of containers by rail. It constructed the first ICD (Internal Container Depot) at Tughlakabad in New Delhi. The shippers and consignees also responded positively to this new development and forced the government to make heavy investments in the infrastructure for growth of containerisation in India.

4.1 Indian Throughput

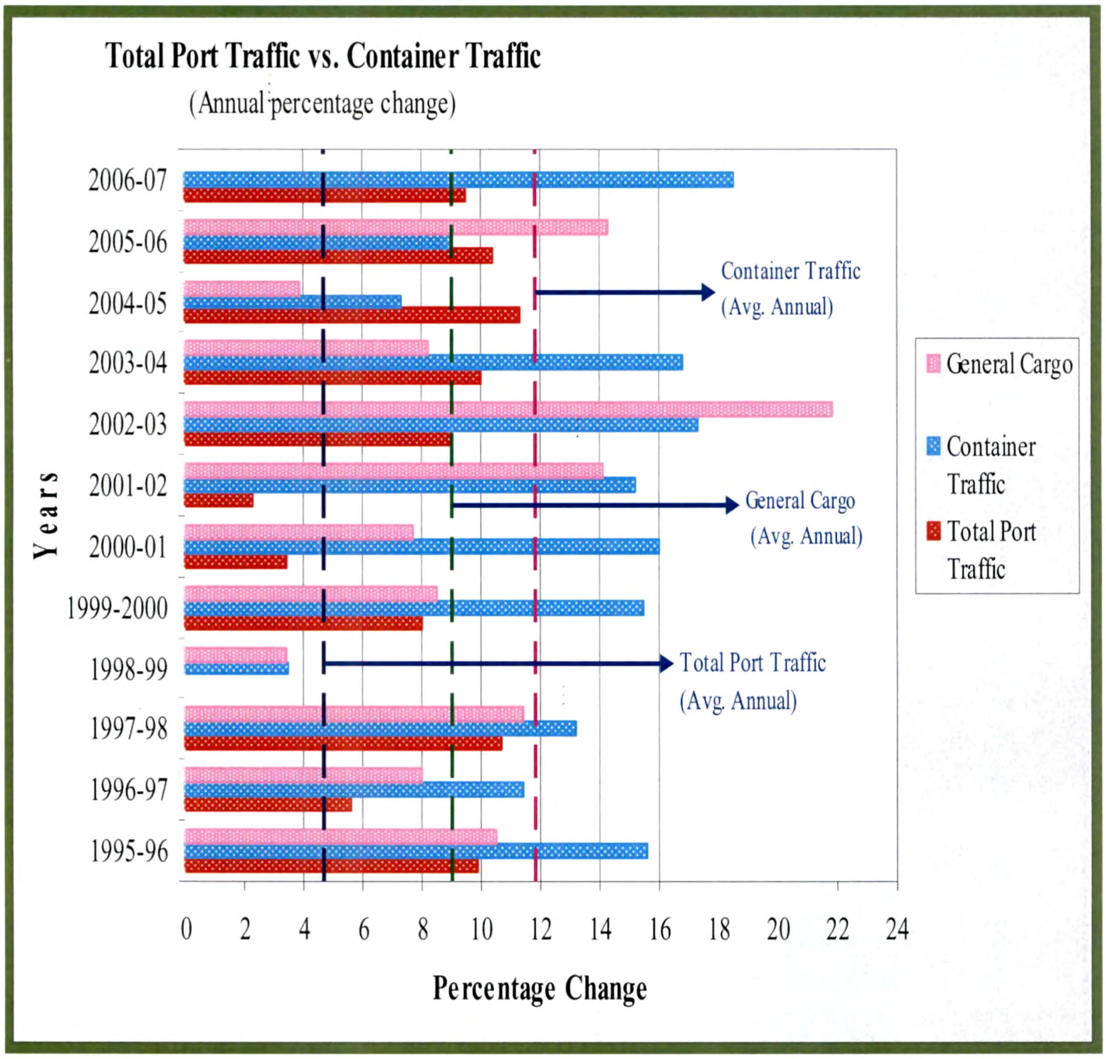
Table: 4.16 and chart: 4.11 analyses the traffic of the major ports of India, for the period 1995-96 to 2005-06. As can be seen in the table, the total port traffic grew at 4.7 per cent per annum, of which the general cargo grew at 8.6 per cent per annum. The container traffic grew at an impressive growth of 12.4 per cent per annum. The share of container traffic in total port traffic has also been rising steadily and now stands at 15.8 per cent of all cargo carried through ports.

Table: 4.16 Container Traffic at the Major Ports of India

Year	Total Port Traffic		General Cargo		Container Traffic			
	Million Tonnes	Growth (%)	Million Tonnes	Growth (%)	Million tonnes	Growth (%)	% of Container Cargo	
							To Total Port Traffic	To General Cargo
1994-95	195.89	-	28.87	-	16.0	-		
1995-96	215.21	9.9	31.90	10.5	18.50	15.6	8.6	58.0
1996-97	227.26	5.6	34.44	8.0	20.60	11.4	9.1	63.7
1997-98	251.66	10.7	38.37	11.4	23.31	13.2	9.3	58.6
1998-99	251.74	0.03	39.66	3.4	24.12	3.5	9.6	60.8
1999-2000	271.97	8.0	43.04	8.5	27.87	15.5	10.2	64.7
2000-01	281.13	3.4	46.37	7.7	32.34	16.0	11.5	69.8
2001-02	287.58	2.3	52.92	14.1	37.25	15.2	13.0	70.4
2002-03	313.55	9.0	64.47	21.8	43.69	17.3	13.9	67.8
2003-04	344.80	10.0	69.77	8.2	51.04	16.8	14.8	73.1
2004-05	383.76	11.3	72.50	3.9	54.79	7.3	14.3	75.6
2005-06	423.57	10.4			62.00	13.2	14.6	
2006-07	463.839	9.5			73.49	18.5	15.8	
Average Annual Growth Rate (1995-96 to 2006-07)		**4.7**		**8.6**		**12.4**		

Source: *Basic Port Statistics of India (2005-06), Transport Research Wing, Ministry of Shipping, Road Transport and Highways, Govt. of India.*

Chart: 4.11 Container Traffic at the Major Ports of India



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, as seen from Table: 4.17 and Chart 4.12 (i). The global throughput grew at an average annual growth rate of 9.3 per cent during the period 1995-2004 and for the same period, the Indian throughput grew at an impressive average annual rate of 13 per cent per year (Table: 4.17 and Chart 4.12 (ii)).

Table: 4.17 Growth of Global and Indian Throughput

Year	Global Throughput (million TEUs)	Growth (%)	Indian Throughput (million TEUs)	Growth (%)
1994	130.4	-	1.26	-
1995	137.2	5.2	1.36	7.9
1996	150.8	6.9	1.51	11.0
1997	165.2	9.9	1.46	-3.3
1998	182.0	9.5	1.75	19.9
1999	195.3	10.2	1.95	11.4
2000	231.7	11.6	2.45	25.6
2001	243.8	14.0	2.76	12.7
2002	276.6	5.2	3.21	16.3
2003	299.3	13.5	3.92	22.1
2004	356.7	29.0	4.46	13.8
2005	387.7	8.7	4.98	11.7
2006	440*	13.5	5.64	13.3
Average Annual Growth Rate (1995-2006)		**10.3**		**13.3**

* Preliminary Data

Source: *Review of Maritime Transport, UNCTAD; various issues.*

Chart: 4.12 (i) Growth of Global and Indian Throughput

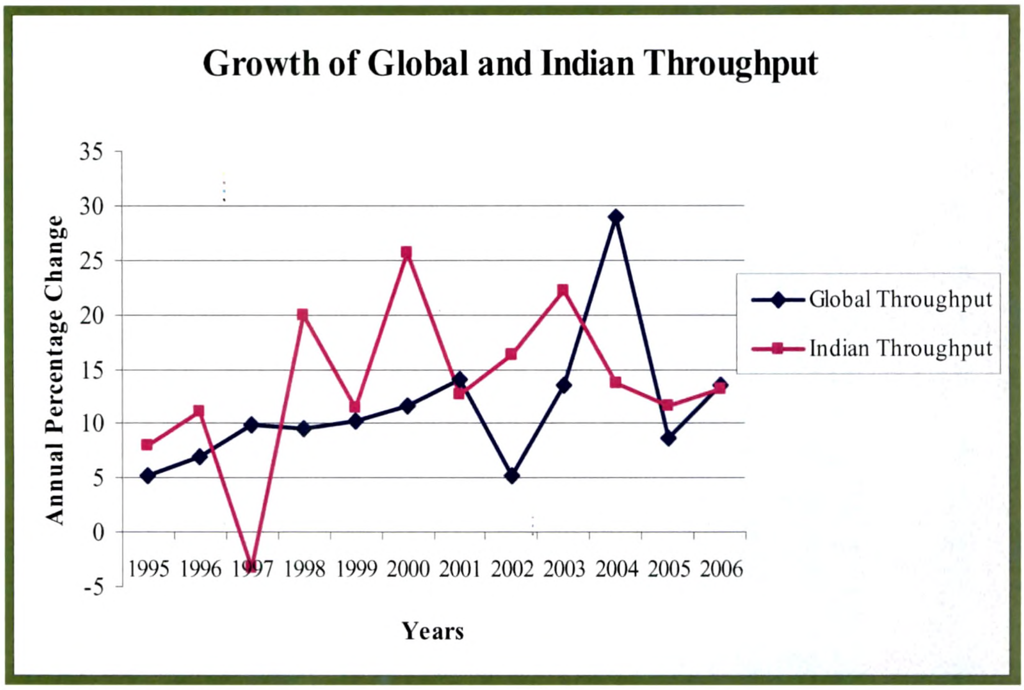
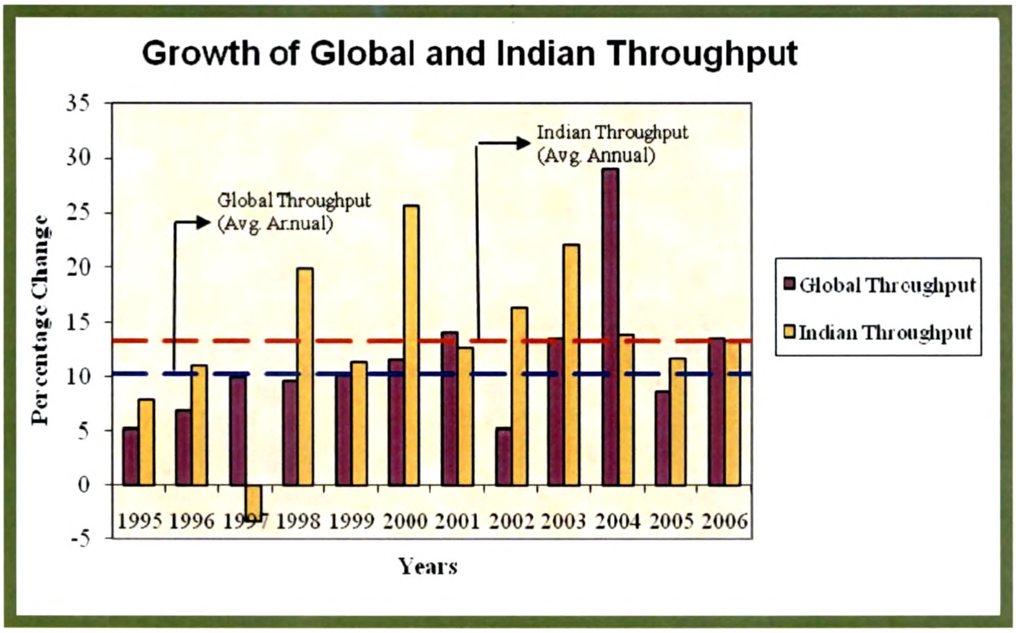


Chart: 4.12 (ii) Growth of Global and Indian Throughput



A study conducted by i-maritime and IPA in May 2006 predicts the container traffic to reach 20.9 million TEUs (by a low estimate) and 24.1 million TEUs (by a high estimate) in 2015-16. As per National Maritime Development (NMDP) forecast, container traffic would increase at a compounded annual growth rate (CAGR) of 15.71 per cent per annum to reach 12.50 million TEUs by 2011-12 with the major ports handling 11.71 million TEUs (93 per cent share) and the rest would be handled by the minor ports.[16]

The growth of container traffic would be driven by:

- Economic (GDP) Growth
- Trade growth
- Penetration of containerisation

- **Economic and Trade Growth**

There are a wide range of factors that impact on the volume of container imports and exports, including exchange rate fluctuations, changes in economic structure etc. But growth in the container trade is ultimately driven by economic growth, which in turn, is spurred by trade growth. Encouraged by the robust EXIM growth, the Prime Minister of India, Dr Manmohan Singh, has set a target of achieving a trade figure of $ 500 billion by 2010. ***Does India have adequate port capacity to handle the expected increase in the volume of foreign trade by 2010?*** [Source: http://www.public-freight.com].

- **Penetration of Containerisation in India**

The level of containerisation in India is still at a level of 60-65 percent in India compared to 75-80 percent in the developed countries. According to Containerisation International, currently 60 percent of India's traded commodities are containerisable as compared to 70 percent internationally. ESCAP assumes the level of containerisation to grow at the rate of 2 percent every year from the present level of the projected general cargo and is expected to get stabilised at 75 percent.[17] Of the principal commodities that India trades in, the commodities that are containerised include engineering goods, agricultural commodities, textiles and readymade garments, pharmaceutical products (bulk formulations) and machinery (auto and electronic), as seen in table: 4.18. Increasingly, more and more general cargo is being carried in containers. Containerisation is being introduced in new products like dyes and colours as also the level of containerisation is being increased in the products which were already being carried in containers, e.g., chemicals, drugs and medicines, fodder, etc.

Table: 4.18 Level of Containerisation at Major Ports

	% of Containerisation to General Cargo	
	2004-05	**2005-06**
Loaded		
Textiles, Yarn etc. (Cotton,	82.50	96.94
Metal and Metal Products	16.44	25.02
Spices	0.0	75.00
Hosiery, etc.	76.85	96.34
Machinery, Instruments,	70.48	73.10
Drugs and Medicines	85.71	91.84
Marine Products	100.00	100.00
Dry Fruits	100.00	100.00
Jute and its Products	100.00	100.00
All Commodities	74.44	76.81
Unloaded		
Chemicals	85.40	93.86
Plastic & its Products	85.11	100.00
Textiles, Yarn, etc.	92.37	100.00
Paper, Newsprint, etc.	94.79	100.00
Drugs & Medicines	100.00	100.0
Hair & Wool	100.00	100.0
All Commodities	76.82	72.98

Source: *Basic Port Statistics of India (2005-06), Transport Research Wing, Ministry of Shipping, Road Transport and Highways, Govt. of India.*

Under NMDP, Indian ports are gearing up to match the projected trade growth. Development of all the components of supply chain is to take place in such a way as to synchronize with the trade growth. In order to sustain the projected double digit growth of 15.71 per cent per annum 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, legislation in line with world practices in multimodal transportation, etc. The ports handling containerised cargo need to see to it that they are well equipped with the latest technology so as to handle them effectively. As such, ports – container handling ports, to be precise, would be our focus of discussion in the succeeding chapter.

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