■ 論 文 ■

PRESENT AND FUTURE DEVELOPMENTS OF PORTS IN ASIA AND THE PACIFIC*

Dong-Woo HA
(Economic Affairs Officer Transport and Tourism Division)

목 차

Key Words : container shipping and port network, hub port, feeder port, intermodal integration and logistics

ABSTRACT

The continuing pace of technological change and the trend toward larger and faster ships is evident as shipping lines compete in seeking economies of scale in the global market and ports become increasingly reliant on sophisticated equipment. Across the Asia and Pacific region some of the worlds most modern container ships are calling at an extensive network of mainline and feeder ports.

This paper shows that during the period from 1999 to 2011, Asian container trade is expected to continue to increase more rapidly than the world average, i.e., 7.2 per cent per annum compared with the world average of 6.3 per cent. It is forecast that the total volumes of international containers handled at the ports in Asia and the Pacific will increase at an average growth rate of 7.2 per cent per annum.

In order to handle the anticipated port container traffic in 2011, new container berths are required in nearly every country in the Asia and the Pacific region. This will entail very significant capital investment requirements.

If countries in the UNESCAP region are to position their ports to meet the challenges of the next decade, there is an urgent need to implement more robust strategies to address important issues including prioritisation of port development projects, promotion of private sector participation in ports, emphasis on productivity and preparation for intermodal integration and logistics growth.

* This paper is based on the UNESCAP study on "Regional Shipping and Port Development Strategies under a Changing Maritime Environment". Full text of the study is available on the UNESCAP website (http://www.unescap.org/tctd/pubs/files/mppm_nov2001_escap2153.pdf.

Ⅰ. INTRODUCTION

Globalization has brought changes in the structure of the world economy and the shipping and port industries have responded to the challenges and opportunities that have arisen as a result of the structural changes.

Container shipping lines, faced with intensified competition in the liner market over the last two decades, have had to adopt innovative and cost-cutting strategies. Seeking further economies of scale, shipping lines continue to rationalize services, deploying larger ships to call at a limited number of efficient ports with extensive, integrated feeder networks connected to regional hinterlands. Ports, if they aspire to hub status owing to the intense port competition, are required to provide the necessary facilities and services for trans-shipment and logistics.

In view of the size of the investments being made by global shipping lines and major ports, it is an increasing challenge for developing economies in the region to maintain competitiveness in the area of providing maritime services. For countries that are reliant on using maritime services provided by foreign fleets, maintaining a competitive environment is of paramount importance.

To provide member countries with a planning context for the development of shipping and port development strategies, the ESCAP secretariat has recently undertaken a study utilizing the maritime policy planning model (MPPM) developed by ESCAP to forecast trade flows, port container throughputs and shipping and port capacity requirements through to the year 2011.

This paper is based on the study results and provides a background for discussions on the future prospects for container shipping and port development in Asia and the Pacific.

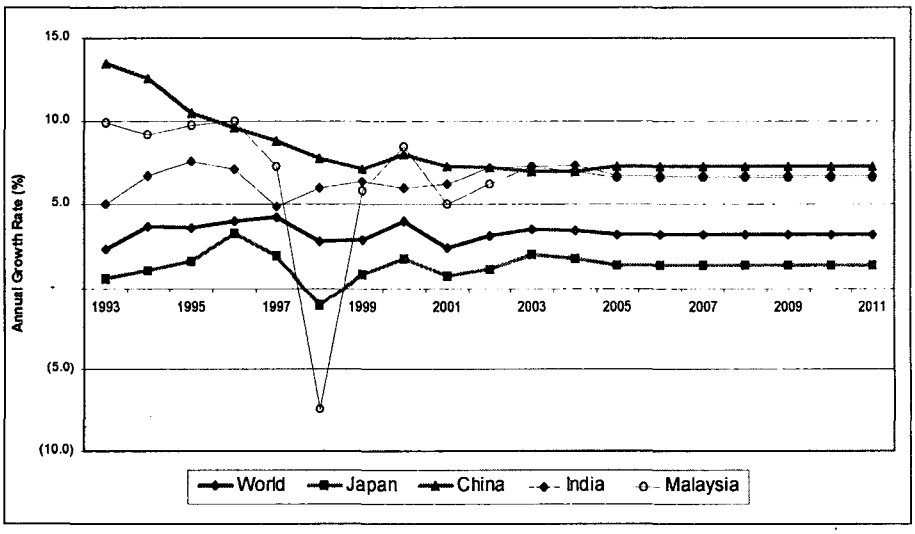
Ⅱ. FORECAST OF ASIAN CONTAINER TRADES

2.1 Economic Growth Assumption

Growth in the container trade is ultimately driven by economic growth. An underlying assumption of the study is that, for the next decade at least, the structural relationships between the growth in container trade and economic growth will remain basically

unchanged.

The study estimates of economic growth for some Asian countries and world average are shown in Figure-1.[1] They embody a view of future economic growth that is reasonably optimistic. After these forecasts were prepared in the first half of 2001, the world economy further deteriorated, and now it appears that short-term world GDP growth forecasts the study made may be optimistic.[2] However, in 2003 and onwards, the momentum of recovery is expected to push the world GDP growth back to its long-run path of annual growth of about 3 per cent.[3]



Source: Estimated by ESCAP based on LINK projection

〈Figure 1〉 Economic growth estimates underlying container forecasts

1) The study has relied as far as possible on the projections of the LINK project an ongoing joint research program between the UN and several universities. Since the LINK model projections extend only to 2004, the average growth rate for the period during which the LINK project provided explicit forecasts was applied for the remainder of the forecast period.

2) LINK project recently revised its world GDP growth forecasts for 2001 and 2002 downward from 2.4 per cent and 3.1 per cent (April 2001) to 1.4 per cent and 1.8 per cent (April 2002).

3) United Nations, Global Economic Outlook, prepared for Project LINK Meeting, 24-26 April 2002, p.1.

2.2 Forecast of Regional Container Trade Growth

During the 1980s and 1990s, international container trade continued to increase at a rate far exceeding that of maritime trade as a whole. A large portion of the growth can be attributed to several factors including liberalization of international trade, globalization, containerization and the emergence of China as a major new container market.

None of these trends have yet run their course, and the study forecasts the total number of full containers shipped internationally around the world to grow to 122.7 million TEU by 2011, compared with an estimated 59.0 million in 1999, but at a slower rate of 6.3 per cent per annum compared to 8.4 per cent per annum that characterized the 1990s. These comparisons are summarized in Table 1.

〈Table 1〉 Estimated and forecast growth rates for container trade (19802011)

Year	Container volumes (million TEU)	Compound average growth rate over previous period
1980	13.5	-
1990	28.5	7.8%
1999	59.0	8.4%
2006	91.7	6.5%
2011	122.7	6.0%

Asian container trade is expected to increase more rapidly than the world average during the period from 1999 to 2011, i.e., 7.2 per cent per annum compared with the world average of 6.3 per cent. Asia's share of world containerized exports will rise from 46 per cent in 1999 to 52 per cent in 2011, the share of containerized imports rising from 40 per cent to 44 per cent. Rapid expansion of container traffic is expected as a result of further economic development across the region, particularly in China and in the countries of Indo-China and the Indian subcontinent owing to the substantial potential for further container penetration.

Asia - North America

It is expected that the transpacific trade will show the weakest growth among the three major Asian trades (namely, Asia-North America, Asia-Europe, and Intra-Asia) over the

next decade. This is partly because the growth prospects for Asian trade with North America are likely to be comparatively subdued as the long boom in the United States ends and the full impact of NAFTA is felt.

Since the Asian crisis trade growth has been very unbalanced, with strong growth in the eastbound trade coinciding with a deep and protracted slump in westbound volumes. The recent slowdown in the US economy has seen a drop in eastbound volumes. However, the longer-term forecasts suggest that the current trade imbalance is likely to persist. An average growth rate of 5.1 per cent per annum over the next decade is forecast for the westbound trade, compared with a growth rate of 5.7 per cent per annum in the eastbound trade.

Asia - Europe

The prospects for the growth of Asia-Europe trade seem somewhat stronger. It should be noted that these growth rates covers the whole of the Asia-Europe trade, including some very mature markets such as Northern Europe- Japan, which are expected to grow only slowly. Some other components — for instance, trade between East Asia and the Mediterranean, and between India and all parts of Europe — are expected to grow more rapidly.

Like the transpacific trade, this trade has become seriously unbalanced since the 1997 currency crises. Once again, the study forecasts little improvement in this imbalance. Eastbound volumes are expected to increase at an average of 7.7 per cent per annum over the forecast period while the estimated rate of growth for westbound volumes is 7.6 per cent.

Intra-Asia

The intra-Asian trade is set for sustained solid growth, with a compound average growth rate of 7.6 per cent per annum over the period.

The rapid development of Indian container trades from a very low base is likely to lead to very high growth rates of container traffic to and from South Asia. Continued rapid economic growth and increasing containerization in China will also support robust growth in trades involving East Asia. However, growth of trade between North Asia and

South-East Asia is likely to be slow, with an expected growth rate of around 4.8 per cent per annum over the coming decade, which is somewhat below the global average.

Ⅲ. ASIAN CONTAINER SHIPPING SERVICE NETWORK

3.1 Evolution of Asian Container Shipping and Port Networks

During the last three decades, the successive waves of Asian economic development have brought with them significant changes in structure of container shipping networks in the inter-continental trades to and from Asia as well as intra-Asian trades.[4)]

In the early 1970s, Asian shipping networks concentrated largely on the Japan; Hong Kong, China; and Singapore in structuring the Europe/Far East and the transpacific (both East and West Coasts of the United States of America, with East Coast services transiting the Panama Canal) mainline services. The Europe/Far East services terminated in Japan and the Far East/US services hubbed over the ports of Hong Kong and Singapore. Since containerization of trades within Asia lagged behind the containerization of inter-continental trades, the volume of local traffic on these early services was therefore modest.

As economies of the Republic of Korea and Taiwan Province of China grew, an increasing number of lines began providing shipping services to these locations, initially in conjunction with services to Japan and later with additional dedicated services. Somewhat later, Kaohsiung and Busan were developed as regional hubs. Significant volumes of regional cargoes also began to emerge on short-sea routes linking these new centers to Japanese main hubs.

With rapid economic development in South-East Asia during 1980s, increasingly complex feeder services were introduced to link the regional ports to key hub ports of Hong Kong, Singapore and Kaohsiung. Shipping lines began to experiment with additional calls at South-East Asian ports including Port Klang and Bangkok. Local routes were also developed linking Japan and Far East initially to Singapore, then to other South-East Asian ports.

---

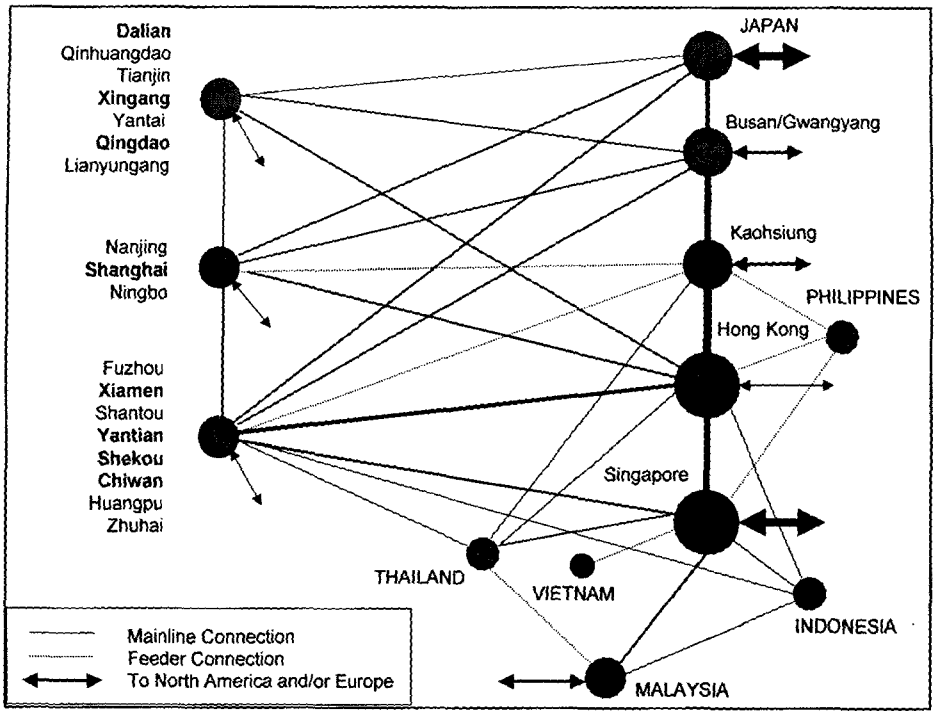
4) A historical review of transformation of Asian container shipping networks is found in Ross Robinson, Asian hub/feeder nets: the dynamics of restructuring, *Maritime Policy and Management*, vol. 25, no. 1, January-march 1998, pp.35-38.

In the 1990s, with the rapid growth of Chinese container trades, Chinese ports were included into new feeder shipping networks, adding further complexity to the Asian shipping system. Intense networks were developed between Pearl River delta ports and Hong Kong port. Busan and Japanese ports increased feeder links with Shanghai and the central and the northern regions of China. Chinese cargoes bound for Japan, the Republic of Korea and Hong Kong, China mixed with feeder cargoes destined for trans-shipment at these locations. A number of shipping services between South-East Asian ports and Chinese ports were also developed.

With further growth in South-East Asia, a new strategy for serving the East Coast of the United States was introduced, with vessels proceeding from Asia via the Suez Canal. This route has proved to be attractive for cargoes from Taiwan Province of China and Hong Kong China as well as from South-East Asia.

Since the mid of 1990s, there have been two conflicting forces at work in shaping the inter-continental container shipping networks. On the one hand, economies of scale are encouraging the use of larger vessels, which places increased emphasis on minimizing time spent in port and concentrating mainline vessel calls on the limited number of key hub ports with massive volumes of cargoes and very high productivity. On the other hand, increasing container volumes at secondary ports, combined with ability of global shipping alliances to offer multiple string services on key routes, encourage the proliferation of direct calls at these ports. As a result, increasing number of the ports in South-East Asia and China in all three regional locations, i.e., southern, central and northern China, are served by direct calls, while at the same time feeder services to and from major hubs including the ports of Hong Kong, Singapore and Busan still continue.

<Figure 2> shows the current complex patterns of mainline and feeder networks in the Asian region.



Source: Modified from Ross Robinson, Asian hub/feeder nets: the dynamics of restructuring, Maritime Policy and Management, vol. 25, no. 1, January-March 1998, pp.35-38.

〈Figure 2〉 Asias hub and feeder network

3.2 Two Scenarios on Future Container Shipping Service Network

It has become increasingly clear that there are no insurmountable technical barriers to the future increase in ship size. However, there is a significant divergence of views amongst competent and experienced analysts as to how large containerships will grow, and how rapid the increase in size is likely to be over the next decade, and the issue of container ship size has become one of the most hotly debated topics in the container shipping world at the present time.[5)]

Some analysts take the view that the search for economies of scale is inexorable, and

5) Pessimistic and optimistic views as to size economies of containerships are reviewed in Alfred J. Baird, Container vessels in the new millennium: Implications for seaports, *Singapore Maritime and Port Journal 2001*, pp.162-181.

will drive vessel sizes up through 12,000 TEU and even beyond within the next decade, despite the challenges in terminal handling that will need to be overcome. According to this view, the move to larger and larger ships, driven by an inexorable search for economies of scale, will continue and, if anything, accelerate. The need to maximize the utilization of these large vessel will in turn drive a radical reduction on the number of port calls on major routes, and feed the development of global mega-ports served by fully integrated global networks.

Others point out that the gains from each increment in size grow smaller as vessels grow larger, and argue that we have already reached or surpassed the point at which additional feedering and inventory costs would outweigh any further savings in slot costs on main line vessels. According to this view, although vessel size will continue to increase, it will do so at a slower rate, as shipping lines try to balance the slot cost reductions available from larger vessels with the cost and marketing advantages of maintaining a wide network of direct port calls. Other pressures notably environmental opposition to dredging and resistance to ever-increasing concentration of containers on the land transport system will also tend to limit ship size growth.

In order to explore the implications of the ship size increase for the region, the ESCAP study developed two scenarios on the future network of liner shipping. The "base case" explores a relatively conservative hypothesis, in which the growing demand for the carriage of containerized cargoes will be met by a continuation of the slow 'creep' in ship size, allowing for an increase in scale of the largest vessels in service, up to 8,000 TEU in 2006 and 12,000 TEU in 2011. This is combined with an increase in the number of 'strings' that are operated in each of the major trades. The number of ports included on each string is similar to the number included on the major services of today.

The "big ships" scenario starts from a different assumption, i.e., that the major carriers will attempt to achieve further economies of scale and deploy vessels of 10,000-12,000 TEU class on the major trade lanes. In line with current thinking of how shipping patterns will evolve if these very large vessels come to dominate, it begins with the assumption that these ships will operate on radically simplified routes, calling at only one or two ports in Asia.

Some of these radically streamlined routes appear to have the biggest potential in the Europe-Far East trade. Although post-Panamax container ships were first introduced on the transpacific route, it was on the Far East-Europe route that they first became the norm for

leading consortia, and it is still the route on which most post-Panamax vessels are deployed. The study results suggest that this will also be the case for the largest vessels in the future.

The other route where the deployment of very large ships on a streamlined limited call services will be a suitable option is a combined service from Asia via a Mediterranean hub port to Europe and onto the US East Coast. The long sailing distance, combined with the very large volumes made available by jointly serving these two major markets, provide ideal conditions for the deployment of vessels at the top end of the size range.

In contrast, the transpacific route appears less promising for streamlined large ship service. Generally, services connecting the major hubs on each side of the Pacific will be well served by vessels of around 6,000 TEU and the study results suggest that there will still be a great deal of scope for vessels of around 4,000 TEU direct services connecting secondary Asian ports to the key American destinations.

3.3 Forecast of Container Fleet Requirements

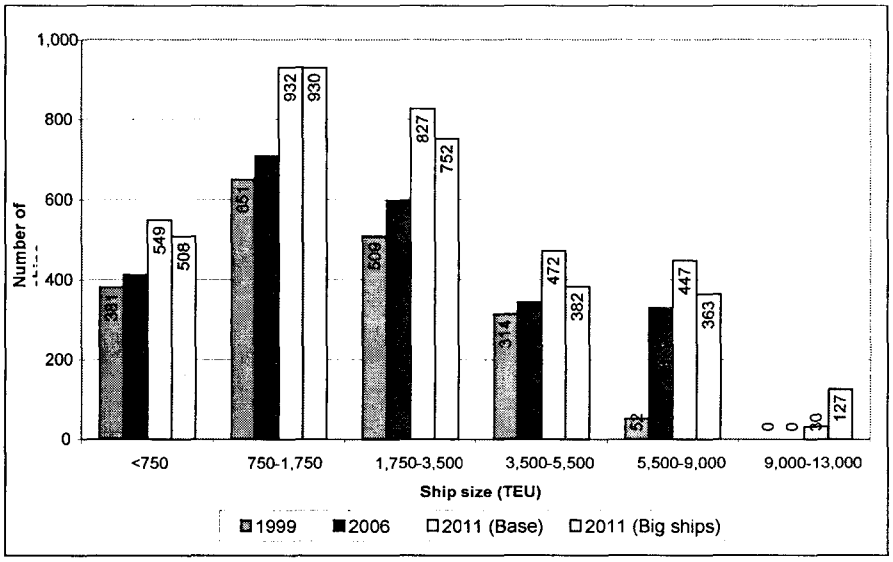
The Liner Shipping Network Module (LSNM) of the MPPM suite was used to obtain an estimate of the number of vessels required to service the trade task in the year 2006 and in 2011.[6)]

Figure 3 compares the fleet required in 2011 under the "big ships" scenario with that required in the "base case". Under the "base case" scenario, by 2011 there will be a need for around 950 vessels with a capacity of more than 3,500 TEU on the trans-Pacific, Far East-Europe and North American Atlantic Coast services. Of this, only 30 ships would be in the range of 9,000-13,000 TEU capacity.

In the "big ships" scenario, 'express' services with minimal port calls become a major feature of the Asian trades by the end of decade. This encourages the use of even larger vessels on highly streamlined routes between key hub ports, and the domination of the key trade routes will be even greater. Under this "big ships" scenario, around 870 vessels with

6) The estimation procedure in the LSMN is experimental and leads to a definition of the future shipping system which is internally consistent, compatible with estimated market demand, in line with known developments in the liner shipping world and reflective of many of the other, less readily quantified forces that shape the global liner shipping system. It does not, however, lead to a uniquely probable or optimal shipping network. For details, see ESCAP, Regional Shipping and Port Development Strategies under a Changing Maritime Environment, 2001, pp.37-38.

a capacity of more than 3,500 TEU will be in service by 2011, including 127 ships of 9,000-13,000 TEU capacity. This implies that some of the intercontinental services in the base case operated by vessels with 3,500-9,000 TEU capacity would be replaced by the streamlined East-West services deploying the bigger ships.



〈Figure 3〉 Required number of container ships by size

Ⅳ. FORECAST OF CONTAINER PORT THROUGHPUT

4.1 Trans-shipment

Table 2 shows the MPPM's estimates for trans-shipment volumes at each of the ports within the ESCAP region. It is estimated that under the "base case" scenario the total volume of containers trans-shipped within the ESCAP region will increase from an estimated 26 million TEU in 1999 to 64 million TEU in 2011. The share of trans-shipment in total port volume is expected to increase from 28 to 30 per cent during the period.

It is expected that the new ports of Gwangyang (Republic of Korea) and Tanjung Pelepas (Malaysia) and the trans-shipment hub emerging in Shanghai will all capture

substantial trans-shipment volumes. The traditional port centres of Singapore, Kaohsiung and Hong Kong are expected to retain their importance throughout the period.

If the "big ships" scenario does eventuate, it will have implications for both total trans-shipment volumes and the distribution of trans-shipment opportunities between ports. Since the "big ships" scenario depends to a greater degree on hubbing at key trans-shipment centres, the regional trans-shipment volume would be 4.5 per cent higher than the "base case" scenario by a total of around 3 million TEU per annum. The major beneficiary from the streamlining of routes is Singapore, as shipping lines operating very large vessels would be forced to concentrate their calls on the port with the most extensive shipping network. Shanghai also appears likely to benefit from this consolidation. It would appear that Colombo could also gain in this scenario, consolidating its position as the gateway to the subcontinent.

〈Table 2〉 Estimated trans-shipment shares, 2011

(Thousands of TEU, percentages)

	Base case			Big ships		
	Total	T/S	Share	Total	T/S	Share
Colombo	5 372	4 051	75.4%	6 879	5 559	80.8%
Singapore	30 940	23 145	74.8%	33 145	25 351	76.5%
Port Klang	7 598	4 228	55.6%	7 459	4 089	54.8%
Tanjung Pelepas	4 472	3 720	83.2%	3 817	3 065	80.3%
Hong Kong	25 322	5 272	20.8%	25 317	5 267	20.8%
Kaohsiung	12 780	5 691	44.5%	12 702	5 613	44.2%
Shanghai	19 040	7 768	40.8%	19 622	8 350	42.6%
Busan	12 488	4 859	38.9%	11 913	4 284	36.0%
Gwangyang	8 876	4 155	46.8%	8 796	4 075	46.3%
Tokyo/Yokohama	6 554	561	8.6%	6 634	641	9.7%
Kobe/Osaka	4 957	486	9.8%	4 974	503	10.1%
Total	138 400	63 938	46.2%	141 258	66 797	47.3%

4.2 Container port volumes

It is forecast that the total volumes of international containers handled in the ports of the ESCAP region will increase from 94 million TEU in 1999 to over 155 million TEU by the year 2006. By the end of the forecast period in 2011, the total volumes will grow to

around 216 million TEU. This implies an average growth rate of 7.2 per cent per annum.

A forecast of port container throughputs of individual economies in the region is provided in Table 3. The most striking feature of the table is the increasing dominance of China, which is expected to be clearly Asia's largest generator of containerized cargo by 2006. It is estimated that the container throughput in the Chinese ports will increase at an annual rate of 12 per cent through the year 2011. China, when combined with Taiwan Province of China and Hong Kong, China, will account for 40 per cent of the total container throughput of the ESCAP region. Among the East Asian economies, the Republic of Korea is also expected to experience rapid container growth, particularly owing to the emergence of the port of Gwangyang as a trans-shipment hub.

〈Table 3〉 Forecast of port container throughputs by economy (2011, base case)*

(Thousand TEU)

Economies	1999 (CIY**/other sources)	2011 (ESCAP MPPM)
Bangladesh	392	1,151
Brunei Darussalam	62	300
Cambodia	n.a.	103
China	12,004	46,219
Democratic Peoples Republic of Korea	n.a.	614
Hong Kong, China	16,211	25,322
India	2,186	6,410
Indonesia	2,784	6,145
Japan***	11,503	18,953
Malaysia	3,775	14,556
Myanmar	118	270
Pakistan	697	1,323
Philippines	1,696	3,761
Republic of Korea	7,473	22,772
Singapore	15,945	30,940
Sri Lanka	1,704	5,372
Taiwan Province of China	9,758	16,874
Thailand	2,892	5,808
Viet Nam	653	1,701

* Domestic coastal traffic is excluded.
** Containerisation International Yearbook.
*** Based on an official forecast made by the Japanese Government through to 2010.
**** Figure includes statistics from the ports of Mersin and Izmir only.

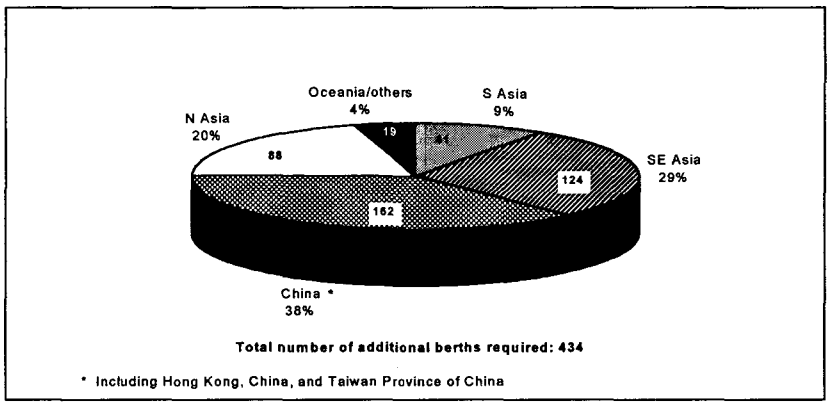
Another notable feature is the rapid increase in container handling in the ports of Malaysia, mainly due to expansion of the trans-shipment business. It is estimated that Malaysian port international container throughput will increase at an annual average rate of 12 per cent from 3.8 million TEU in 1999 to 14.6 million TEU in 2011, of which trans-shipment will account for 7.9 million TEU or 55 per cent. In the South-East Asia subregion, high annual container growth is expected in Viet Nam (8.3 per cent) and Brunei Darussalam (14.0 per cent) from the current low level of container penetration.

Countries in the South Asia subregion are also expected to experience high increase rates of port container throughputs during the period from 1999 to 2011, i.e. 10.0 per cent in Sri Lanka and 9.4 per cent in Bangladesh and in India.

V. FUTURE DEVELOPMENT OF CONTAINER PORTS IN ASIA

5.1 Regional requirements for additional container births

In order to handle the anticipated port container traffic in 2011, it is estimated that a total of 434 new container berths will be required. The largest number is accounted for by China (including Hong Kong, China and Taiwan Province of China), which will require over 160 new berths by the end of the decade. South-East Asia's requirements are 124 berths, of which Singapore alone will require around 43 berths. North Asia (excluding China) and South Asia will require 88 and 41 new berths, respectively.



〈Figure 4〉 Port capacity requirements in 2011

This will entail very significant capital expenditure and precise investment requirements will depend on the particular conditions that prevail at each new development site. Based on typical costs to develop new infrastructure and procure the handling equipment required to allow the terminal to operate at a satisfactory level of efficiency, the total capital required has been estimated at approximately US$ 27 billion. However, substantial additional investment will also be required to secure adequate access to the terminals by road, rail and inland waterways, which will be essential for the effective distribution of containers to expanded port hinterlands. The additional costs of dredging, the provision of breakwaters and the establishment of land transport links and intermodal interchanges could easily double this total. It is also noted that MPPM covers only port-to-port trades. It does not, therefore, provide a basis for assessing capacity and investment requirements for hinterland linkages.

5.2 Capacity and performance requirements

Hub ports

Trans-shipment cargoes offer port authorities and terminal operators an opportunity to develop their businesses at a faster rate than the development of their economic hinterlands would permit. It is therefore not surprising that the competition for this business is fierce. As the recent decision of Maersk Line to move its South-East Asian hub from Singapore to Tanjung Pelepas has shown, it can also be very volatile.

A potential hub port's ability to attract trans-shipment traffic will depend on a number of factors, including geographic location, port facilities and performance. However, there are two great advantages that are difficult or impossible to duplicate: a location that is directly on a major sea lane; and a dense network of established services that allows cargoes to be moved between a wide variety of origins and destinations ensuring a high frequency of sailings to and from feeder ports.

Most established hub ports possess both of these advantages. For example, Singapore is considered the central location of the transport network of South-East Asia and is located en route to and from Europe and North America. Singapore is a major hub port where 250 shipping lines provide connections to 600 ports in 123 countries, including daily sailings to every major port in the world.

Obviously, there is a need at such hub ports for sufficient port facilities to be available to accept post-Panamax container ships. This includes the depth of water in approach channels as well as at berths, and adequate availability of quay cranes and handling equipment to ensure efficient handling of the large volume of containers.

Many of the region's hub ports have recently made significant productivity gains. The port of Singapore achieved a breakthrough vessel rate of 280 moves per vessel hour in February 2001. The first vessel productivity record above 200 moves per hour was achieved in July 1995 when a vessel discharged and loaded a total of 1,375 containers during its 6-hour stay handling average 229 containers per hour. The record was surpassed twice in 2000, i.e., 234 moves per hour in January and 243 moves per hour in April.[7)]

However, the productivity improvement achieved may not be sufficient to prepare for being a future hub port. It is suggested that for the new mega-ship of 8,000 TEU capacity, a port has to be capable of an effective handling speed of about 330 moves per hour.[8)] The record vessel productivity of 280 moves per hour is still 50 moves per hour short of the high efficiency level needed for economic operation of the mega-ships.

To keep pace with the development of the larger container vessels, needed are new ideas and concept to increase speed for the crane movements, including double trolley cranes or even triple trolley cranes and possibly servicing the mega-ships from both sides in an indented berth. The indented berth will allow a minimum of 300 moves per hour with up to ten cranes working both sides of the ship.[9)]

Other important requirements for hub ports to attract trans-shipment traffics also include availability of management information services, simple procedure for the trans-shipment cargoes passing through the port, competitive level of port charges, and so on. A large amount of back-up land should be available for stacking areas, container freight stations, cold stores and other specialized facilities as required.

Feeder ports

While these are remarkable achievements in increasing capacity and improving productivity at many ports in the region, the other ports must also reach sufficient capacity

7) PSA Corporation, *Port View*, various issues.

8) H. G. Payer, Feasibility and practical implications of container ships of 8000, 10000 or even 15000 TEU.

9) UNCTAD, *Review of Maritime Transport 2000.*

and satisfactory levels of productivity to assure the smooth functioning of the worldwide transport network. This is true for all ports whether they are global hubs, regional hubs or feeder ports.

In relation to non-hub ports at which direct mainline services are also handled, there is a need for sufficient port facilities and high productivity to be available to accept relevant direct calling vessels.

If the port is to be served only by feeder vessels, it is necessary to make realistic assessment of the demand for berths and other facilities of appropriate size. It will depend on the size and type of the feeder vessels.

Performance at small feeder ports can be improved through the application of information and communications technology (ICT). Although smaller ports handle less ships and cargoes thus have smaller information flow, they still have to exchange information with a large number of parties. The use of ICT will reduce information-based problems in ports that have prevented port authorities and operators from pre-arrival planning for operations and caused delay of cargo clearance and delivery. It has been suggested that as many small ports are linked to the Internet, the use of ICT linked to the Internet offers the potential to exchange information electronically provided other members of the port community are also linked.[10)]

Intermodal integration and logistics

The increased volumes of containers moving through the ports, regardless of hub ports or feeder ports, will place great stress on the land transport interface and generate a need for faster and more efficient intermodal connections to the hinterlands.

At the same time, the demand of shippers for 'seamless' logistics is likely to continue and intensify. Modern ports are required to offer a variety of value added logistics services such as warehousing, distribution, packaging, labeling, quality control, documentation, information and communications, and to provide accommodation for the institutional players such as Customs, freight forwarders, shipping agents, banking and insurance, etc.

Some leading ports in the region have already transformed and expanded their functions and business activities to provide port users with value added logistics services. However,

10) Information technology solutions for small ports are suggested in UNCTAD, *Study on the use of information technology in small ports* (UNCTAD/SDTE/TLB/1), 12 January 2001.

other smaller feeder ports in the region also have an important part to play in the total logistics chain, and therefore should be prepared for the logistics growth including restructuring of their facilities to support the logistical need of the users.

VI. CONCLUSION

Within the context of the future prospects described in this paper, there is an urgent need to formulate and implement more robust strategies to address the increased demands for capital investment in container port development.

Prioritization of port development projects will become increasingly necessary to avoid uneconomical investment and to ensure that funds are available for essential port development projects. This will require resisting the temptation to use port development projects as a means of satisfying the political demands of local communities, and ensuring that the funds are applied to projects that will provide the highest social and economic return. Coordinated planning may be necessary in order to avoid wasteful investment in duplicated facilities.

Faced with increased demands for capital investment in other sectors as well as in ports, it is unlikely that governments will be either willing or be able to provide all of the capital required for future port developments. The private sector will need to provide a significant share of the total. While many experiments with private sector investments in the port sector have been resounding successes during the last decades, lack of transparency and continued resistance from labour have been cited as major obstacles to further private sector involvement. It may become more difficult to attract private capital in the future, as private investors become more discriminating in the choice of projects. This will require governments to develop more innovative incentives for private investment. The challenge will be to reconcile this need with the equally compelling need that countries maintain strategic control of their vital international transport links.

It is clear that an increased focus on port productivity can reduce the need to invest significant quantities of new capital in expanding port facilities. Substituting productivity gains for new port development will have the additional advantage of avoiding the conflicts between environmental and economic objectives that will inevitably and increasingly accompany new port development.

In an increasingly competitive and globalized market place, the search for comparative advantage will inevitably focus on the cost and effectiveness of the total logistics chain. There is an urgent need for ports to play a lead role in providing the necessary facilities for logistics growth.

REFERENCE

Ashar, Asaf, "The fourth revelution," *Containerisation International*, December 1999.

Baird, Alfred J., "Container vessels in the new millennium: Implications for seaports," *Singapore Maritime and Port Journal*, 2001.

Containerisation International, various issues.

Containerisation International Yearbook, various issues.

IMF, *World Economic Outlook*, May 2001 and October 2001.

Payer, H. G., "Feasibility and practical implications of container ships of 8000, 10000 or even 15000 TEU."

PSA Corporation, *Port View*, various issues.

Ross Robinson, "Asian hub/feeder nets: the dynamics of restructuring," *Maritime Policy and Management*, vol. 25, no. 1, January-March 1998.

Stopford, Martin, "A new revolution," *Containerisation International*, January 2001.

UNCTAD, *Review of Maritime Transport 2000.*

UNCTAD, *Study on the use of information technology in small ports* (UNCTAD/SDTE/TLB/1), 12 January 2001.

United Nations, *Global Economic Outlook*, prepared for Project LINK Meeting, 24-26 April 2002.

United Nations ESCAP, *Regional Shipping and Port Development Strategies under a Changing Maritime Environment* (ST/ESCAP/2153), 2001.