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Asian Hub/Feeder Nets: The
Dynamics of Restructuring

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ABSTRACT: In less than 25 years containerisation has restructured the way in which regional Asia handles its manufactured and break-bulk cargoes. In 1972 the commissioning of the purpose-built container terminals in Hong Kong and Singapore focused container shipping services, and particularly the trans-Pacific and the traditional Far-East/Europe services, into hub/Feeder networks in which the two ports were the undisputed first order centres. Somewhat later, Kaohsiung and to a lesser extent Pusan, developed as important hubs. But now, in the mid 1990's, earlier and simpler structures of hub/feeder networks are being quickly transformed into much more complex patterns.

Continuing high growth rates of containerised cargo, an increased number of ports with relatively high throughputs and the simple proliferation of ports - particularly but not only in China - have been important factors; but the reorganisation of global liner shipping into a small number of alliances capable of operating larger ships, more complex service patterns and with exceptional market power has been critical. The new shipping networks will be hierarchically organised with high cost-high efficiency first order ports serving high cost-high efficiency shipping services and lower cost-lower efficiency ports serving appropriately segmented shipping markets. In the longer term former feeder ports may be linked into direct call networks; but in practice hub/feeder operations will continue over a long period of time.

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Over the last two decades, and in effect from 1972 when the ports of Singapore and Hong Kong both established purpose-built container terminals, that shipping market focused on Southeast and East Asia - the more or less traditional Far Eastern shipping range - has emerged as an exceptional generator of container traffic¹. In 1994 trans-Pacific container volumes were estimated at 6.7 or 6.8 million TEUs, an increase of 13 percent over the previous year²; Europe/Asia volumes were estimated to be somewhat smaller at about 4.25 million TEUs³; and trans-Atlantic volumes were estimated at about 4.4 million TEUs⁴.

This intense concentration of traffic, remarkable enough per se, was of further significance in that it had spawned a complex web of hub/feeder shipping networks structured about a hierarchy of ports -in which Hong Kong and Singapore were clearly first order ports.

More recently, and partly as a result of the devolution of manufacturing investments from Japan and the Newly Industrialising Economies (NIEs) of the region into offshore and lower cost locations and the globalisation of manufacturing more generally, the region is now further characterised by the exceptional growth of end-to-end, intra-regional shipping services and trade volumes. Again in 1994, estimates of these volumes were set at 4.6 million TEUs; but the figure excluded movements of China traffic and the more likely volumes were probably of the order of 5.5 million TEUs. By the turn of the century intra-Asian container volumes are likely to reach at least 7 to 8 million TEUs - creating a region with the highest intensity of liner shipping operations in the world⁵.

Change has been the only constant in the region; and in the late 1990s it is likely that the cumulative effects of a number of earlier trends as well as the effects of a range of new conditions are likely to effectively restructure existing patterns. This paper is concerned with this restructuring process, with the mechanisms involved and with the likely outcomes.

¹ For a background note see Robinson, R (1985), 'Containerisation in ports in Third World Asia: an overview of present patterns and the direction of future growth', *Maritime Policy and Management*, Vol 12, No 4, pp78-91 and Robinson, R (1989) 'Regional ports: development and change since the 1970s' in Leinbach, TR and Chia, LS (1989), *South-East Asian Transport, Issues in Development*, Oxford University Press, Singapore, pp133-167.

² See *Containerisation International*, July 1995, p51; and October 1995, p63.

³ *Containerisation International*, August 1995, pp39-42; March 1994, pp39-41; and personal communication.

⁴ *Containerisation International*, September 1995, pp59-63; and personal communication.

⁵ *Containerisation International*, July 1995, pp51-54.

1. DYNAMIC DISEQUILIBRIUM: THE ENVIRONMENT OF CHANGE..

Continuing high rates of economic growth have characterised leading regional economies; but fluctuations in exchange rates, variability in external trade demand and in trade policies have created a regional environment characterised by short run instability as well as by rapid adjustments to change. The intra-regional shipping market has reflected and responded to these pressures - so that rapid fleet expansion and extension of services, market opportunism, fierce competition, overcapacity and price instability have tended to be persistent characteristics.

It is unlikely that in the immediate short run these characteristics will be very much changed. But it is arguable that we are seeing in the mid 1990s an outworking of a number of trends and policies which will in fact adjust and reshape existing port and shipping networks. The extensive restructuring of global liner shipping set in place from 1996 will further trigger and underwrite new regional patterns and orientations.

In this section we look briefly at those factors which are prompting change.

1.1 The region as an articulation point in a shipping network; and as a system of shipping networks.

The region centred on the traditional shipping range might be conceptualised as a *point* in a global liner shipping network; as an *articulation point*⁶ in what is increasingly an east-west or west-east corridor. Figure 1 implies the notion of the region as a hub - and as one of the three global market concentrations of high value manufactures linked by high value, high efficiency global container operators, some of whom are properly referred to as logistics megacarriers; and north-south trades, traditionally 'thin' and unbalanced trades, 'hang off' these major concentrations.

At another level, the region is effectively a *system of shipping networks* in which individual ports are linked into intricate patterns of dependency in hub/feeder relationships as well as into end-to-end shipping linkages that reflect the increasing trade dependencies between regional economies.

Table 1 indicates for ten regional countries the volumes of containers which moved on end-to-end intra-Asian services in 1994. In terms of total volumes Japan, Hong Kong and Taiwan are key players with 57 percent of total container volumes. Note, however, some marked imbalances of trade among regional countries with South Korea and Taiwan having proportionately larger export than import flows; and the dominance of imports in Hong Kong's movements. Note also that China traffic is not included in the table and may add nearly one million TEUs to the total movements.

⁶ The term is borrowed from graph theory in which an articulation point, Pa, of graph G may be defined as a point of G such that all the points of G can be divided into two sets having only Pa in common. The notion of a port as an articulation point - as a conjunction of two linked modal networks - is particularly useful.

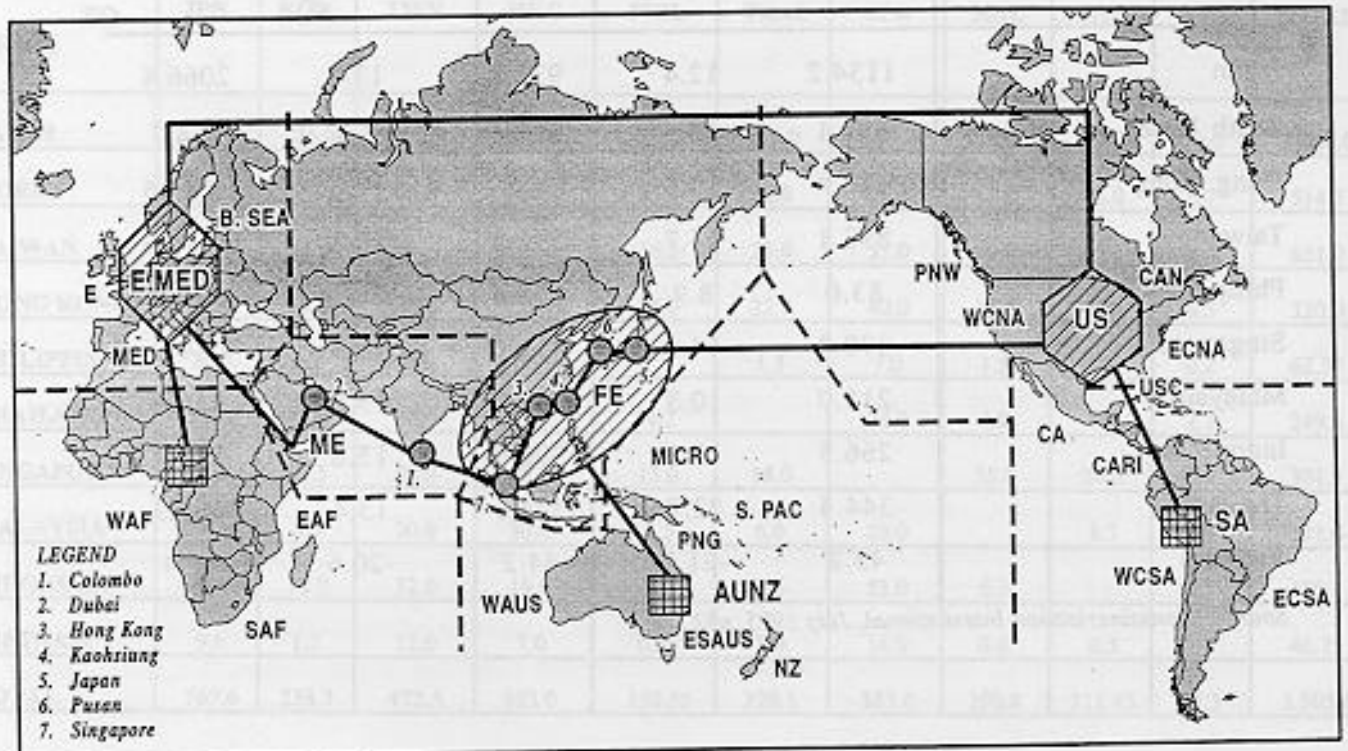


Figure 1: Elements of global liner shipping

TABLE 1: CONTAINER TRAFFIC BETWEEN SELECTED EAST AND SOUTHEAST ASIAN COUNTRIES, 1994 (000's TEUs)

Country	Exports	% change	Imports	% change	Total
Japan	1134.2	12.4	932.2	13.4	2066.4
South Korea	652.1	15.5	332.6	3.3	984.7
Hong Kong	456.4	10.9	1091.1	17.6	1547.5
Taiwan	893.1	15.7	591.5	10.1	1484.6
Philippines	83.0	8.9	175.4	33.1	258.4
Singapore	370.3	14.2	419.6	16.6	789.9
Malaysia	215.0	10.3	240.0	19.8	455.0
Indonesia	266.5	17.1	306.9	13.8	573.4
Thailand	344.4	23.7	324.5	15.4	668.9
Vietnam	43.2	-21.7	44.2	-20.6	87.4

Source: *Containerisation International*, July 1995, p52.

TABLE 2: INTRA -ASIA CONTAINER MOVEMENTS (OOO's TEUs), 1992

TO FROM	JPN	KOR	TWN	HKG	PHIL	THAI	SPR	MAL	IND	VTN	TOTAL
JAPAN		126.0	204.0	220.0	39.0	130.0	140.0	79.0	60.0	10.0	1,008.0
KOREA	180.0		46.0	144.0	25.0	24.0	25.0	11.0	53.0	6.7	514.7
TAIWAN	150.0	25.0		300.0	16.5	23.0	51.0	40.0	35.5	10.0	651.0
HONG KONG	90.0	34.0	60.0		25.0	22.0	40.0	18.5	24.0	6.5	320.0
PHILIPPINES	26.0	4.7	8.5	13.0		1.5	7.0	1.5	0.95	0.2	63.35
THAILAND	137.0	10.0	30.0	32.0	4.2		24.0	4.9	4.8	2.7	249.6
SINGAPORE	76.0	12.5	50.0	58.0	13.0	18.0		35.0	24.0	15.0	301.5
MALAYSIA	54.0	8.4	30.0	30.0	3.5	6.0	29.0		8.7	2.0	171.6
INDONESIA	45.0	16.0	32.0	19.0	4.0	3.6	53.0	6.3		0.2	179.1
VIETNAM	9.6	1.7	12.0	7.0	0.35	1.0	14.0	0.6	0.5		46.75
TOTAL	767.6	238.3	472.5	823.0	130.55	229.1	383.0	196.8	211.45	53.3	3,505.6

Source: NYK

Table 3: CONTAINER THROUGHPUT, EAST AND SOUTHEAST ASIAN PORTS,

Table 2 clarifies inter-regional linkages though it relates to 1992 movements. Japan dominates both import and export movements to and from most regional economies though Taiwan has strongest export links with Hong Kong and Indonesia with Vietnam and Singapore.

In the context of this paper the important point is that container movements and shipping linkages and networks at both scales are intricately linked and what happens at one scale impacts on the structure and operations of the other. This raises the issue of what the likely impact of the new global alliances is likely to be and it is one which will be addressed in the body of the paper.

1.2 The emergence of the several Chinas.

In the late 1970s the China State Council had authorised the establishment of four special economic zones (SEZs) in Fujian and Guangdong provinces; and by the end of 1980 special areas in the cities of Shenzhen, Zhuhai, Shantou and a fourth SEZ near Xiamen in Fujian province had been established. Somewhat later, in 1984, foreign investment incentives were granted to 14 'coastal cities' as a stimulus for economic growth and trade development; and in 1988 the State Council established further 'open areas' in the coastal region and proposed that Hainan Island be established as a province with potential to become China's largest special economic zone⁷

In effect these policy initiatives have underlined an inherently strong regionalisation of China and, in liner and container shipping terms, has focused trade volumes into three distinct regional nodes. The Pearl River delta and the SEZs in Guangdong have generated very large volumes of container traffic, until recently almost exclusively oriented to the handling facilities in the port of Hong Kong - either at the major terminals or overside handling in the stream. Xiamen, further to the north and relatively close to the major ports of Taiwan, has also been closely aligned to the port of Hong Kong.

In central China Shanghai has played a key role in trade development and, together with Nantong and Ningbo, was designated among the 'coastal cities' as a site for further foreign investment and trade development. But inadequate facilities, shallow draft and congestion necessitated major new infrastructure development. It was not until the early 1990s, and with the provision of upgraded and new facilities under funding from the World Bank, that Shanghai could exploit its potential for the generation of container traffic. Now, and with new terminal developments at Ningbo, the potential for development of new container shipping linkages is considerable.

⁷ See 'An evaluation of the special economic zones in China with special reference to the Shenzhen zone' in United Nations (1985), *An Evaluation of Export Processing Zones in Selected Asian Countries*, ESCAP/UNCTC Publication Series B, No 8, Bangkok, Thailand, pp114-142; Yue-man Yeung (1993), 'Infrastructure development- the southern China experience', Paper presented at the Workshop on Growth Triangles, ADB, Manila, February 1993; and Chu, DKY (1991), 'Containerisation of Hong Kong and Pearl River Delta - opportunities and constraints', Paper presented at Transportation and Urban Development in the Pacific Rim Conference, Vancouver, October .

In northern China, Dalian, Qinhuangdao, Tianjin, Yantai, Qingdao and Lianyungang were all nominated among the 'coastal cities'; and subsequent and in some cases continuing major infrastructure projects under World Bank (Tianjin, for example) and Overseas Economic Cooperation Fund (OECE) funding (Qinhuangdao, for example) have created a major concentration of container traffic.

Since the late 1980s and in the early 1990s new development initiatives, including joint venturing and new management strategies for ports in China, have continued to enhance the potential for the development of new shipping linkages and networks. In effect, after a somewhat protracted but intensive period of infrastructure development of high priority projects in major ports, there is now a trend towards developing container operations in much smaller regional ports - as for example in Rhizao south of Qingdao - and streamlining and integrating operations in the larger ports in the much more complex task of achieving high levels of efficiency.

1.3 The loosening of regulatory frameworks.

Most of the regional economies, for long constrained by regulation in trade, in ports and in national and international shipping operations, have exposed themselves - to a greater or lesser degree - to the demands of economic rationalism; so that over the last decade there has been a loosening of the regulatory frameworks, a reorientation of the interventionist roles of Government and a more liberal view of the role of the market. In Malaysia, for example, Klang Port Authority - in what was then seen to be a brave experiment - privatised its container terminal in March 1986; and the remaining operational services in South Port and North Port in December 1992; and most recently, in September 1994, privatised the new Westport development.

Deregulatory policies in the maritime sector have become more widespread; and in the mid 1990s new moves will further influence the emergence of new port/shipping networks.

In February 1994 the US lifted its trade embargo on Vietnam. Though economic reforms under the 'doi moi' program began in 1988 the embargo has led to considerable increase in the number of shipping services operating to and from Vietnam. Container volumes have increased rapidly to about 280000 TEUs in 1994 from the three main container handling areas in the Ho Chi Minh City port complex (Ben Nghe, Saigon and Tan Can) ⁸and further development is continuing. Importantly, too, for the progressive inclusion of Vietnam into regional container shipping networks, are the moves to establish a major new port and container handling facility at Vung Tau with the assistance of a Singapore-based consortium Tredia Vung Tau Port Development. ⁹

In the Philippines Executive Order 185 in June 1994 went some way to deregulating inter-island shipping operations, allowing the entry of new Philippines-registered lines though not foreign

⁸ *Containerisation International*, March 1995, p91; see also *Containerisation International*, February 1990, pp40-44.

⁹ *Containerisation International*, April 1995, p35. Initial contracts were signed in March 1995.

owned carriers. Foreign ownership remains limited to minority shareholding in joint venture partnerships with local companies. By early 1996 the largest inter-island operator (William Lines) had moved to take over its two competitors (Aboitiz Shipping Corporation and Carlos A Gothong Lines) and secure an estimated 51 percent market share in the inter-island freight and passenger market.¹⁰

In Korea, too, the deregulation of the nation's short sea trades by abolition of the 'Waiver System' (which reserved cargo for Korean flag vessels) in 1995 has created a new and more competitive environment.¹¹ In particular, services have been intensified between Pusan and major Japanese ports and Busan and smaller regional ports in southern Japan.¹²

Taiwan's port sector, despite its exceptional growth and recent moves to privatise stevedoring and warehousing activities, continues to be constrained by - or at least perceived to be constrained by - public sector ownership - ' For Taiwan to develop into a viable transshipment centre, it would have to get the port authority out of the port business...and transfer responsibility to shipping lines or any licensed operator' .¹³

It is the external framework - the political realities of the China/Taiwan relationship - that will determine the extent to which Kaohsiung, particularly, will play a critical role in the further development o mainline/feeder shipping networks in the next decade.

In August 1988 Taiwan established a policy of indirect trade and shipping with China - in which all trade moved via a third port. More recently, in May 1995, the Taiwanese Government authorised the use of Kaohsiung as a transshipment hub for mainland China cargo. China's view that the cross-straits trade represents a regional domestic trade will impose conditions on the development of Kaohsiung - at least in the immediate short run.¹⁴

1.4 Change in the relative status of Japanese ports.

The dampening of growth in the Japanese economy through the early 1990s, the appreciation of the yen against the US dollar and regional currencies, continuing rigidities in the waterfront labour market, despite recent changes, and in the somewhat shorter term the dislocation to trade caused by the Kobe earthquake in January 1995 have impacted on the relative status of Japanese ports. Variable growth rates - and in some cases low and even negative rates in the 1990s - have underlined changes.

Certainly the high costs incurred in some of the major ports have encouraged at least one major Japanese liner operator to hub offshore; and high inland haulage costs, combined with the

¹⁰ *Containerisation International*, January 1996, p47.

¹¹ *Containerisation International*, March 1995, p61.

¹² *Containerisation International*, September 1995, p17.

¹³ *Containerisation International*, January 1995,pxi. The view was expressed by a senior official of one of Taiwan's major liner operators.

¹⁴ See Lu, FHF (1996), ' Liberalisation of shipping trade between China and Taiwan; prospects and impact on China, Taiwan and Hong Kong' , Paper presented at Singaport 96, Singapore, March. (Dr Lu is President of Yangming Marine Transport Corporation, Taipei). See also *Containerisation International*, June 1995, p9.

aggressive shipping policies of some Korean lines following deregulation, have meant that some Japanese cargo is being routed direct to smaller regional ports in southern Japan and fed for transshipment over Pusan rather than hauled to Tokyo or Yokohama for direct export shipment.¹⁵

The point here is not that Japanese ports are no longer important; simply that new options available to shippers and shipowners will continue to further underline changes in container shipping networks.

1.5 The realignment of the global majors in liner shipping.

Through 1996 at least ten of the major container lines will be realigned into three alliances¹⁶; and although grouping of lines and consortia formation have been a characteristic of container shipping organisation since their beginning, the new alliances represent a significant reordering of market power and concentration. Particularly, the geographic scale over which the alliances can operate, their ability to integrate landside and blue water operations, the proposed duration of the alliances - up to ten years - and the scale of their asset base underline the potential for change.

The Maersk/Sea-Land alliance, for example, was estimated to control at least 81 vessels larger than 2000 TEUs, with 20 vessels of over 3660 TEUs on order in mid 1995; the P&O/NYK/Hapag Lloyd and NOL grouping had 94 vessels with 13 or 14 vessels on order, all over 4000 TEUs; and the APL/OOCL/MOL/Nedlloyd and MISC alliance (the original so called 'global alliance') controlled 71 vessels with 15 vessels on order¹⁷. 28 or 29 of those vessels on order (almost 60 percent) exceeded 4800 TEUs and 17 or 18 (or 37 percent) were between 5500 and 6000 TEU capacity.

The market power represented by the alliances and the emergence in the market place of the 5000 and 6000 TEU container vessel suggest that the new alliances will have exceptional ability:

- to rationalise existing shipping services and links with it
- to rationalise and/or develop port terminals and mega terminals
- to segment the market place, with high cost/high efficiency networks emerging from a range of lower cost/lower efficiency networks and niche patterns of other liner operators and
- to integrate mainline and feeder networks as well as to extend the scale of feeder networks to secure the large volumes and hence economies of scale required for the viability of the large container vessel operations.

The global majors and the new alliances will have a significant impact on the further reorganisation of regional port and shipping networks.

¹⁵ *Containerisation International*, March 1995, p61.

¹⁶ A fourth alliance may emerge comprising the Tricon group (DSR Senator Line and Cho Yang) and Hanjin Shipping. See *Containerisation International*, July 1995, p59.

¹⁷ *ibid.* See also *Containerisation International*, June 1995, pp51-52 and *Containerisation International*, January 1996, pp51-53.

2. REGIONAL GROWTH AND NETWORK MODIFICATION: THE DIMENSIONS OF CHANGE.

Sustained high levels of regional economic growth have given rise to increasing functional and operational complexities in ports, in port-linked inland transport networks, in shipping and in the related institutional frameworks.

Larger container volumes through ports have triggered development programs that have increased the infrastructure and asset base and, for the most part, have led to economies of scale and higher levels of operating efficiency. In so doing these changes provide new opportunities for integration into mainline nets or into higher order feeder nets. For shipping, increased cargo availability has triggered changes in vessel type and size, in service patterns, in schedules and in the structure of the industry itself. Ancillary transport support networks and operations and the institutional arrangements which support the new logistics also become more complex.

In this section we focus on the details of these changes.

2.1 Changes in shipping operations and corporate shipping strategies.

2.1.1 End-to-end intra-Asian shipping: ‘Wafer thin margins’, overtonnaging, depressed rate levels and unstable pricing regimes and severe container volume or box imbalances have characterised some, but not all, regional end-to-end trades.¹⁸ The market is, however, characterised by a number of large regional operators with significant market power and a large number of much smaller players - so that there exists a considerable range of efficiencies and costs, high levels of competition on major routes and ‘sweeper’ services able to meet niche and opportunistic demands. Market leaders include Singapore-based Pacific International Line (PIL) and Regional Container Lines (RCL); Heung-A Shipping and Dongnama Shipping in South Korea; and Wan Hai Line, Uniglory Marine and Cheng Lie Navigation in Taiwan. Tokyo Senpaku Kaisha (TSK), an affiliate of Japan’s NYK Line, MISC in Malaysia, PT Pul International and Samudera Indonesia in Indonesia are somewhat smaller but are also important players.¹⁹

Not surprisingly, given increasing volumes of end-to-end cargo the mid-1990s have seen an upgrading of ship size on a range of services as well as increased service and route complexity, often through joint service partner arrangements. For example, in 1995:

¹⁸ See *Containerisation International*, March 1995, p61. The description is especially characteristic of the Korea/Japan short sea trades in the mid 1990s. See also Drewry Shipping Consultants (1993), *Feeder and Short Sea Container Shipping: Regional Market Structures, Modal Competition and Economics*, London, Section 3, pp81-104.

¹⁹ See Drewry Shipping Consultants (1993), *op. cit.*, Table 3.13, p94 for the relative importance of these players in 1992.

- The Taiwan-based carrier Yangming Line upgraded its weekly service Japan/South Korea/Philippines/Indonesia by replacing vessels of 600-700 TEU capacity with vessels of 1000 TEUs;²⁰
- Wan Hai Lines, also based in Taiwan, launched a new South Korea/Indonesia service in July 1995 in a joint venture with Hyundai Merchant Marine. The new service is based on four vessels of 1000-1200 TEUs;²¹
- Hanjin Shipping, in a slot charter arrangement with Dongnama Shipping, extended its links to include Vietnam in a weekly service using four vessels of 480-577 TEUs in April 1995;²² and
- Singapore-based Regional Container Lines (RCL) already operating a shuttle service Xiamen/Hong Kong extended the service to include Yantian; and established a new service Shanghai/Singapore in late 1995.²³

2.1.2 Mainline/feeder services: In a shipping market characterised by rapid change - as is the case in regional Asia- ephemeral and short term changes may mask longer term, fundamental and structural changes; but in the mid 1990s there are at least three sets of conditions that will mark fundamental reorientations in the mainline/feeder networks which have emerged to date.

First, the new ‘global alliances’ in container shipping - effective from the beginning of 1996- will implement new service structures with increased frequencies and new service strings, new patterns of rotation and port calls and new feeder networks. The introduction of new 5000 and 6000 TEU vessels into these restructured patterns will have significant implications for network structures.

It will take some time for these changes to work themselves out but early indications are that lines will increase service frequencies on major routes - in the Asia/Europe corridor, for example, Sea-Land may increase its service from twice to four times a week; Hapag Lloyd/NYK/NOL may do the same; and on the Trans-Pacific routes P&O and MOL, for example, will have new or additional services.²⁴

Not all new mainline operations will occur, within the new global alliances. Other major lines constantly reassess options- in May 1995, for example, Evergreen Line introduced a fourth service string into its Trans-Pacific operations (with fixed day weekly calls at Singapore/Hong Kong/ Los Angeles/San Francisco (later Oakland)/Keelung/Singapore); and the competitive environment in 1996 and beyond is likely to prompt further reassessments.²⁵

Second, the integration of selected China ports into mainline corridors in 1995 represents a critical threshold stage in the development of containerised trade to and from China.

²⁰ *Containerisation International*, September 1995, p9.

²¹ *Containerisation International*, July 1995, p11.

²² *Containerisation International*, May 1995, p5.

²³ *Containerisation International*, September 1995, pp67-69.

²⁴ *Containerisation International*, July 1995, p60 and January 1996, p51.

²⁵ *Containerisation International*, April 1995, p11.

In early 1995 APL and OOCL rerouted a fixed day weekly Trans-Pacific service (the Straits Indonesian Express) to make direct calls westbound at Yantian and eastbound at Chiwan.²⁶ Somewhat later, in September, the two lines planned to extend another Trans-Pacific service (the Pacific Island Express) to include direct calls at Shanghai.²⁷ In early 1996 the two lines, as part of the new alliance service, were evaluating direct calls at northern ports in China - including Qingdao, Qinhuangdao and Tianjin.²⁸

Increasingly, ports in southern, central and northern China will be linked into mainline nets by 'alliance' operators as well as by other operators- in early 1995 Sinotrans (the China National Foreign Trade Transportation Corporation) and the South Korean line Hanjin Shipping established a new northern Europe/China service, including direct calls at Qingdao.²⁹

Third, as well as the integration of some China ports into mainline networks there has been, through 1995, a rapid growth in the number of feeder networks to include China ports. These have included, for example,

- Japan/China links - with services to and from Ningbo and southern Japanese ports (including Yokohama, Kobe, Osaka, Moji);³⁰
- Thailand/China links - with an extension of a Bangkok/Hong Kong shuttle operated by RCL to include Shekou;³¹
- Hong Kong/ central China links - with an extension of an Evergreen shuttle service Hong Kong/Shanghai to include Ningbo.³² High intensity shuttle operations have linked southern China and Pearl River delta ports with Hong Kong for some time. Xiamen and Yantian, for example, are heavily serviced.
- Singapore/China links - the development of a new service by RCL between Singapore and Shanghai.³³

The integration of China into both mainline and feeder networks will intensify and serve to modify existing networks.

2.2 Changes in ports and port development strategies.

There is an exceptional concentration of container traffic through regional ports with the ports of Hong Kong and Singapore handling more than one million TEUs per month in 1995. Moreover, for the port of Hong Kong projections suggest that the port will handle 23.5 million TEUs in 2011 and 39.2 million in 2016;³⁴ and by the year 2009 the port of Singapore will have

²⁶ *Containerisation International*, February 1995, p8.

²⁷ *Containerisation International*, September 1995, p7.

²⁸ *Lloyds List*, 11 March, 1996.

²⁹ *Containerisation International*, April 1995, p11.

³⁰ *Containerisation International*, January 1996, p7.

³¹ *loc. cit.*

³² *ibid.*, p11.

³³ *Containerisation International*, June 1995, p16.

³⁴ Clark, T (1996), 'Coping with regional trends - the way forward for Hong Kong', Paper presented at Singapore 96, Singapore, p13.

added 26 new container berths in the Pasir Panjang terminal to the existing 29 berths in the port in 1995 (20 mainline berths and 9 feeder berths).³⁵

But as important as these individual ports are there is now a relatively large number of ports in the region that have reached a throughput of more than one million TEUs; Kaohsiung and Pusan now exceed 5 million TEUs; and numerous smaller ports handle now, or will soon handle, half a million TEUs (Table 3).

Growth rates are, of course, variable and often relatively large on a small base - container throughput in the port complex in Ho Chi Minh City reached about 280000 TEUs in 1994, a 48.5 percent increase over 1993; Tianjin handled 630000 TEUs in 1994, a 31 percent increase over the previous year; and Qingdao exceeded 430000 TEUs in 1994, an increase of 42 percent over 1993.³⁶

There has emerged, too, a rash of newly developing ports in China notably in the Pearl River delta - including Yantian, Chiwan, Zhuhai and Jiuzhou - and with other ports being developed by or in association with Hong Kong's Hutchison Delta Ports group, including the new port of Zhu Chi and the port of San Shan in central Guangdong Province.³⁷ Elsewhere too - as in Vietnam with the proposed Vung Tau development and the new Tan Can (Newport) development, which commenced operations in 1992 - new terminals are emerging.

Clearly, the rapid growth of some ports provides the necessary cargo threshold conditions for inclusion in new or existing feeder or mainline networks; and new ports provide new options for network development and/or restructuring. But in a competitive regional environment inclusion in shipping networks has underlined the need for efficiency as well as growth; and these conditions have impacted on, and will continue to impact on management and ownership strategies in regional ports.

Multilateral aid agencies such as the World Bank and the Asian Development Bank have been, and continue to be, involved in port development in the region; but through the 1980s and 1990s joint venturing and contractual management arrangements by offshore firms, usually with strong maritime sector interests, have become important strategies for developing ports and terminals and/or ensuring higher levels of efficiency particularly, but not only, in China. P&O management teams have been involved in the port of Shekou for example, Hutchison Whampoa in the port of Yantian and Hutchison Delta Ports in the Pearl River delta and other ports in China.

Not unusually, too, shipping lines have sought control over terminals in order to attempt to control efficiency and/or to serve other corporate operational requirements. Privatisation of one sort or another and corporatisation of ports have also been key strategies in achieving greater

³⁵Port of Singapore Authority (1994), *Annual Report*, Singapore.

³⁶ *Containerisation International*, June 1995, p37.

³⁷ *Containerisation International*, May 1995, p35.

efficiency in regional ports. Malaysia, as earlier noted, moved to privatise container operations and later other port operations from 1986. In 1995, the Port of Singapore Authority announced moves towards corporatisation; and with it an increasing awareness of the need for customer-focused operations and service quality rather than simply a reliance on infrastructure-led efficiency.¹This change in perception will not be lost on other regional ports as they seek a more competitive focus.

¹ *Containerisation International*, October 1995, pp79-81.

Table 3: CONTAINER THROUGHPUT, EAST AND SOUTHEAST ASIAN PORTS, 1993 AND 1994 (000's TEUs)

PORT	1993	1994	PORT	1993	1994
Hong Kong	9,204.2	11,0505.0	Philippines		
			• Cagayan de Oro	118.5	139.7
			• Manila	1,251.3	1,502.0
			• Cebu	205.6	365.6
			• Davao	na	na
Indonesia			Singapore	9,046.1	10,399.4
• Belawan	161.3	176.9			
• Tanjung Perak (Surabaya)	393.6	411.3			
• Tanjung Priok	1,000.1	1,252.2			
• Ujung Pandang	55.6	71.8			
• Semarang	na	na			
Japan			South Korea		
• Kobe	2,696.1	2,915.9	• Pusan	3,070.7	3,212.6
• Nagoya	1,154.9	1,224.4	• Incheon	na	na
• Osaka	679.9	654.8			
• Tokyo	1,537.6	1,805.4			
• Yokohama	2,167.8	2,317.1			
Malaysia			Taiwan		
• Johor	168.3	238.0	• Keelung	1,856.4	2,046.6
• Penang	330.9	366.2	• Kaohsiung	4,635.9	4,898.9
• Port Klang	771.9	943.8	• Taichung	302.7	360.8
Peoples Republic of China			Thailand		
• Shanghai	900.3	1,130.2	• Bangkok	1,273.8	1,394.8
• Dalian	256.2	305.0	• Laem Chabang	218.5	348.5
• Qingdao	264.4	430.0			
• Tianjin	481.9	630.7			
• Chiwan	33.1	45.8	Vietnam		
• Shekou	67.0	84.1	• Ho Chi Minh City	145.0	280.0
• Xiamen	154.5	225.0			
• Zhuhai	198.6	160.5			
• Huangpu	131.1	160.5			
• Fuzhou	-	104.0			
• Zhangjiagang	82.0	95.0			
• Shantou	55.0	83.0			
• Nantong	-	66.0			
• Lianyungang	25.0	50.0			
• Yantai	25.1	35.0			
• Yantian	na	na			

* Source : Containerisation International Yearbook, 1996.

Not unusually, too, shipping lines have sought control over terminals in order to attempt to control efficiency and/or to serve other corporate operational requirements. Privatisation of one sort or another and corporatisation of ports have also been key strategies in achieving greater efficiency in regional ports. Malaysia, as earlier noted, moved to privatise container operations and later other port operations from 1986. In 1995, the Port of Singapore Authority announced moves towards corporatisation; and with it an increasing awareness of the need for customer-focused operations and service quality rather than simply a reliance on infrastructure-led efficiency.² This change in perception will not be lost on other regional ports as they seek a more competitive focus.

2.3 Changes in ancillary transport networks and in institutional frameworks.

Increasing trade volumes have exerted continuing pressures for efficiency, not only in ports and shipping operations but also in ancillary transport networks and in institutional and organisational frameworks that sustain them. Not surprisingly, changes have been slow to emerge but by the mid 1990s there is some evidence that more sophisticated logistics systems are developing.

This is particularly the case in China and, given the importance of this emerging market, we note briefly some of these developments.

2.3.1 The development of intermodal rail services: In December 1994 the first dedicated rail container service in China - a blocktrain service between Zhengzhou in inland Henan province and Hong Kong - began operations. The service, operated jointly by Hong Kong's Kowloon Canton Railway Corporation (KCRC) and China's Ministry of Railways, offered significant time and cost savings over road transport, simplified administrative and liability arrangements (with cargo moving under a Combined Transport Bill of Lading) and streamlined handling arrangements.³

Through 1995 further services were developed, particularly to Wuhan, and other links exist with inland centres.⁴ More recently new intermodal operations to handle international container traffic through other China ports have been evaluated, with a rail terminal at Tianjin likely to be only one of a number of new developments.⁵

2.3.2 The development of trucking operations: Through 1994 and 1995 the moves by Sea-Land, as a major international intermodal operator, have been innovative and important in the further development of container services in China. For some time the company has been involved in trucking operations between southern China locations and Hong Kong; and in 1994 it established a joint venture trucking operation with the Shanghai Port to centralise containers on the port.

² *Containerisation International*, October 1995, pp79-81.

³ *Containerisation International*, February 1995, p26.

⁴ *Containerisation International*, August 1995, pp74-75.

⁵ *Containerisation International*, September 1995, pp86-87.

In 1995, however, the company through a wholly owned subsidiary (Guangdong Orient Trucking Limited) was able to commence trucking operations as an independent operator within China - the first foreign-based company to obtain a licence to do so after Government moves towards deregulation of road transport in 1993.⁶

These developments are of considerable significance, not only for the company but also for trade growth more generally. Control over trucking arrangements allows some control over landside movement efficiencies; it facilitates integration with shipping and other services; it has potential for further market capture; and there are potential spinoffs for regional and trade development.

2.3.3 The establishment of storage, warehousing and distribution centres: Foreign capital and joint ventures are playing an important part also in establishing other elements of the distribution system. A number of shipping lines, for example, jointly operate and/or manage container freight stations, depots and distribution centres - RCL, for example, is operating trucking, warehousing and distribution facilities in Xiamen; ⁷COSCO and Evergreen shipping lines are also involved in the development of container depots and handling facilities - the COSCO facility is located near to the port of Shanghai and the Evergreen facility at the port of Ningbo. In both cases Singapore-based firms are also involved.⁸ One of these firms, the Sembawang Corporation is also involved in the development of a distripark facility in Shenyang in northern China.⁹

2.3.4 Expansion of the network of shipping agency offices: Evidence of further maturity in logistics frameworks is the gradual expansion of shipping agency offices throughout China. American President Lines, Sea-Land and Maersk Line have operated agencies as wholly owned foreign enterprises for some time; but only in 1995 - apparently after considerable delay in achieving approval - have the major Japanese shipping lines (NYK, K Line and Mitsui OSK Lines) been able to establish subsidiary companies that allow for greater independence of action.¹⁰

3. NETWORK TRANSFORMATIONS.

What, then, are the implications of these changes for port/shipping networks handling large volumes of containers under conditions of rapid regional growth? Have regional networks responded as we might expect? What principles underlie the restructuring and transformation of port/shipping networks under the particular conditions at work in regional Asia? This section falls into two parts - the first outlines a conceptual framework that sets out how hypothetical port/shipping networks emerge as the outworking of rational economic growth principles and

⁶ *Containerisation International*, August 1995, p25.

⁷ *Containerisation International*, September 1995, p67.

⁸ *Containerisation International*, April 1995, p35.

⁹ *Containerisation International*, October 1995, p41.

¹⁰ *Containerisation International*, March 1995, p7; and April 1995, p13.

relationships; and the second interprets the emergence of networks in the region against these notions of transformation and adjustment.

3.1 The emergence of port/shipping networks: a conceptual note.

Port growth is a function of the production outcomes of firms in the port's adjacent space - or of that space to which it is linked, either in landward space or in areas linked across water or ocean. The inherent capability of that linked space to produce tradeable goods or services will impose significant limits to port growth. But in regional Asia, particularly, rapid growth for numerous ports has been a function of that port's location within often complex port/shipping networks - hub locations that have emerged as the articulation points between networks based on feeder shipping and networks based on mainline, usually longer haul, container shipping. Elsewhere, of course, and notably on the west coast of the US, hub locations have emerged as the articulation points between mainline shipping networks and transcontinental rail nets.

In regional Asia, then, the propensity for container port growth must be interpreted, at least under present circumstances, against how the port itself responds to continuing growth as well as to how shipping services, shipping links and shipping networks respond to such growth.

For ports, increasing volumes of containers through terminals under fixed capacity conditions will trigger increased delays and increased costs; but new investments will increase capacity, create economies of scale and of scope; and increasing container volumes will increase the potential for the port's inclusion into mainline rather than feeder networks as critical volume thresholds are reached.

For shipping lines, increasing volumes of containers will trigger pressures on capacity; and increasing diseconomies of scale will prompt measures to increase capacity in one way or another- with chartered-in vessels, slot agreements and newbuildings, for example; and larger ships with reduced per unit costs will likely be an appropriate outcome.

Given these driving principles, the port/shipping network capacity itself comes under increasing pressure; so that the existing network transforms into new networks that reflect an increasing segmentation of the market place and are **hierarchical** - or **ordered**. Effectively, these networks will differentiate themselves on the basis of cost and efficiency; so that high cost/high efficiency ports will sustain high cost/high efficiency shipping in what might be regarded as first order networks. Lower cost/lower efficiency ports and shipping will sustain second or third or subsequent order networks, depending on market complexity.

Clearly, under these conditions, there may be a hierarchy of hubs; and in the real world it is likely that port/shipping networks will overlap.

Figure 2 illustrates port/shipping network transformation for a hypothetical set of ports and shipping linkages. The process is simplified as a three-stage process though actual stages may be difficult to differentiate and they are not independent or unrelated.

Stage 1: In this initial stage conventional break-bulk liner services link ports in a well-connected network. Small but increasing volumes of containers begin to appear on some links in the network and from selected ports.

Stage 2: Increasingly, purpose-built cellular container vessels replace break-bulk vessels; and the port/shipping network is progressively decomposed into mainline links supported by feeder shipping links. Hub ports become the articulation points between mainline and feeder nets.

Stage 3: Continuing rapid growth in container volumes - with changes in size and complexity of ports and upgraded shipping services and operations - decompose existing networks into a reordered, hierarchical set of networks reflecting differing cost/efficiency levels in the market place. Ports A1 and A2 reach sufficient volumes to sustain high cost/high efficiency shipping in a high density trade corridor and are in fact high cost/high efficiency operators. Conceptually, they might be regarded as megaterminals.

Ports B1, B2 and B3 represent second order cost/efficiency levels and support shipping services that are excluded from first order nets on this basis. Similarly, ports C1, C2, C3 and C4 represent a hypothetical third order level of cost/efficiency and serve shipping excluded from higher costs/higher efficiency nets. Typically, higher order nets will have fewer ports than lower order nets; and time will be a less critical factor the lower the order of network. Note that numerous ports - D1 and D2, for example - will retain feeder status.

In a Stage 4 of the process the degree to which a port's growth is dependent upon either its role as a hub - and hence transshipment traffic - or its inherent ability to generate traffic other than transshipment traffic will be critical in determining its position within the network hierarchy.

To what extent does regional Asia, in the mid to late 1990s, exemplify this conceptual model?

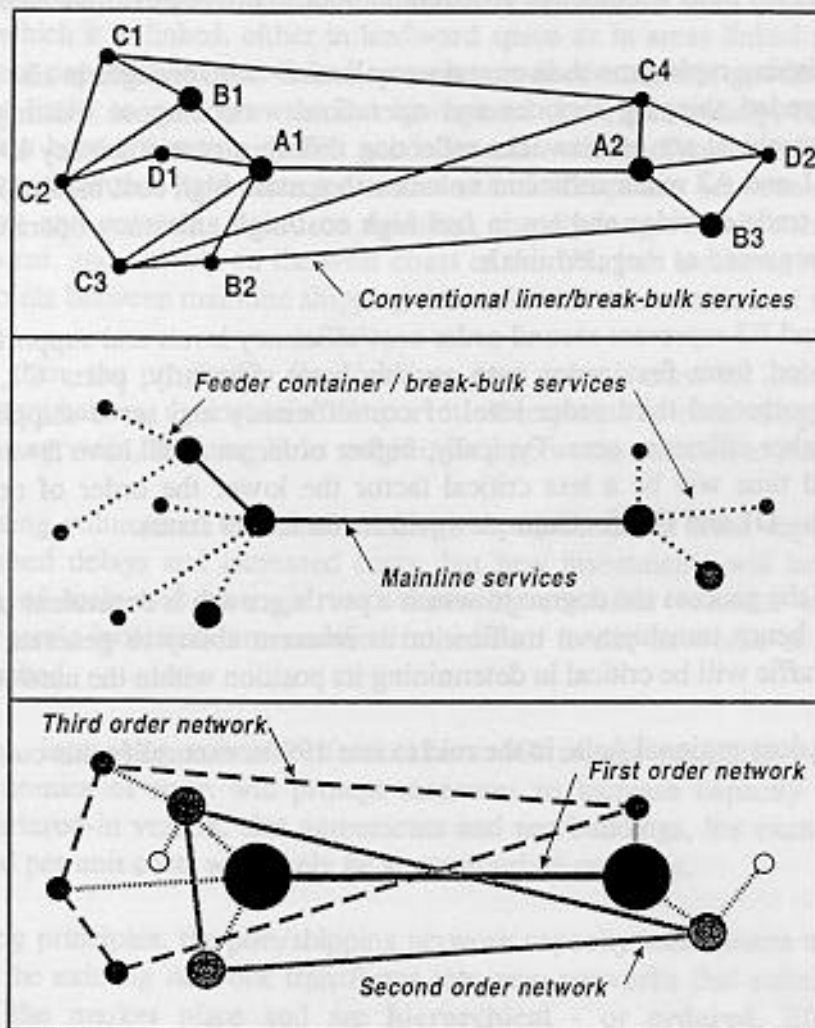


Figure 2: The emergence of hierarchical port/shipping networks handling containerised cargo under conditions of rapid growth

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3.2 The transformation of container port/shipping networks in regional Asia from the early 1970s.

It was Japan that had moved quickly, in the late 1960s, to establish container shipping operations following the introduction of Matson's US West Coast/Japan service in 1967 - in 1968 Japanese shipping lines began a US West Coast service, in 1969 a US East Coast service and an Australian service and in 1970 a Japan/Europe service.

But the commissioning of purpose-built container terminals in Hong Kong and Singapore by mid 1972 marked the effective beginning of container developments in regional Asia. Shortly after, in August 1973, Port Kelang received mainline calls in the Europe/Far East service; in October 1975 Bangkok's East Quay terminal was able to handle containers; and in 1978 and 1979 respectively Tanjung Priok and Manila commissioned new terminals. By 1980, then, Japan, Korea, Taiwan, Hong Kong and the ASEAN countries had developed container handling operations and provided the focus for container shipping networks.¹¹

By the year 2000 containerisation will have impacted upon, and transformed, the ports and shipping networks of regional Asia in little more than three decades; and although adaptation has been constant in the face of continuing high growth rates it has been argued in this paper that particular and convergent circumstances in the early and mid 1990s are triggering new directions of change. In this section these new directions are seen against the earlier phases of development.

Figure 3 provides a framework for assessing change in port/shipping networks in the region. Three broad phases are recognised and, for ease of reference and simplicity, the time periods for each phase have been loosely defined.

Phase 1-From 1970 to the mid 1980s: This initial period reflects the importance of:

- the Europe/Far East and the Far East/US or trans-Pacific services in structuring a mainline corridor in which the Europe/Far East services terminated in Japan and the Far East/US services hubbed, initially over Hong Kong and shortly thereafter on Singapore. The Japanese ports, Hong Kong and Singapore were key hubs with Kaohsiung and Pusan developing somewhat later in the period. Port Kelang was an important waypoint in the Europe/Far East trade; and
- an increasingly complex set of feeder shipping services linking into these hubs. In particular, Thai cargo was fed into Singapore and Hong Kong particularly, with smaller amounts to Kaohsiung and Japanese ports - though for these ports end-to-end services were important. Cargo to and from the Philippines was hubbed over Hong Kong and somewhat later Singapore and Kaohsiung; and some was handled in Japanese ports. Indonesian cargo was increasingly handled over Singapore though it was not until the introduction of major deregulation measures

¹¹ See Robinson, R (1985) and (1989) *op. cit.*

- Presidential Instruction Number 4 (Inpres 4/1985) and Paket November 21 or Paknov/1988 - that transshipment cargo volumes boomed.¹²

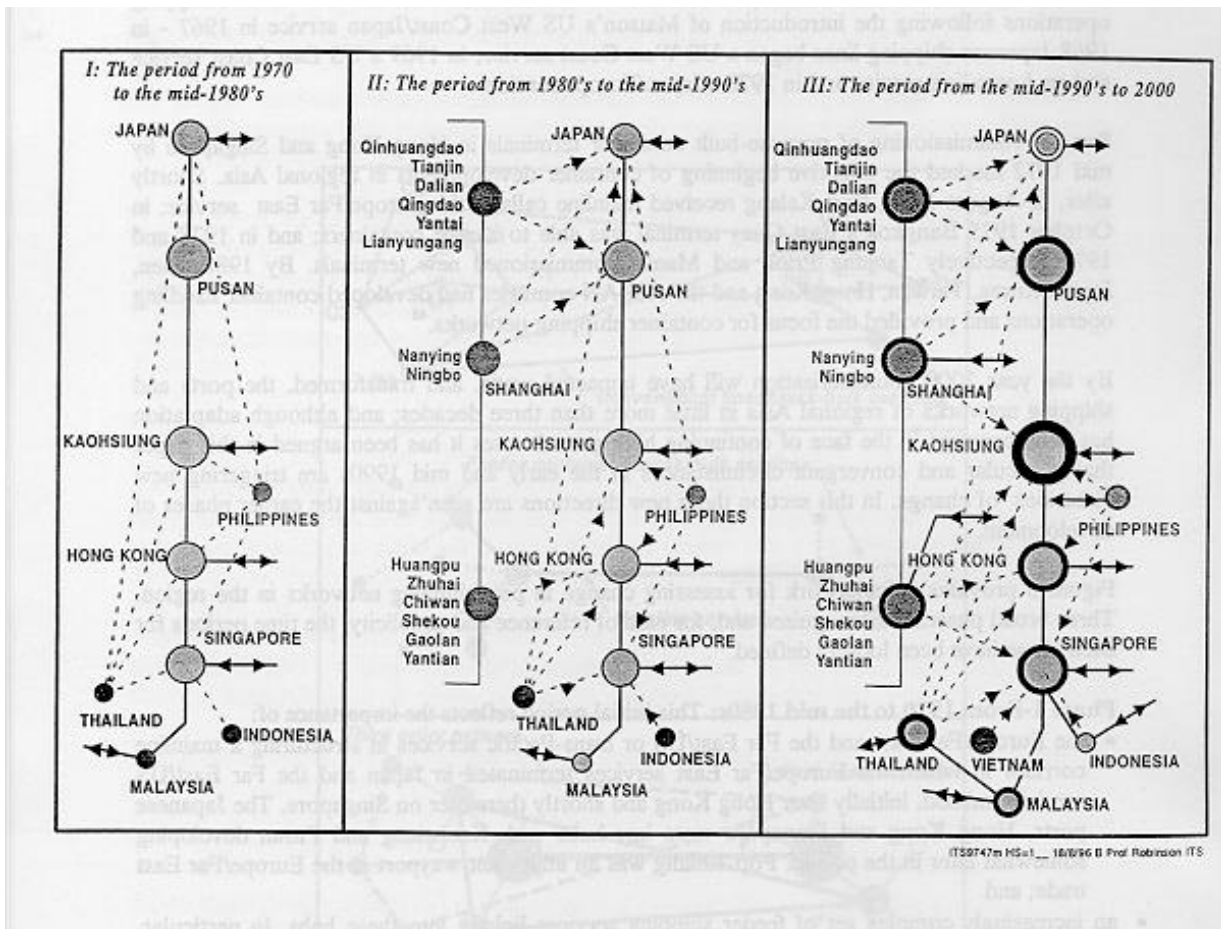


Figure 3: Development phase in Asia's hub/feeder networks 1970 - 2000

¹² See Robinson, R and Dick, H (1990), *Assessment of Deregulation within the Indonesian Maritime Sector*, Report prepared for the World Bank, Centre for Transport Policy Analysis, University of Wollongong.

Phase 2: From the mid 1980s to the mid 1990s: Continuing high growth rates in most years and for many of the region's ports added further complexity to this earlier pattern; though the emergence of Round-the World services intensified the role of the existing hubs and particularly of Kaohsiung. The emergence of 'new' regional ports throughout this period was particularly important - though Figure 3 does not indicate the increasing complexity of these new feeder links.

In Indonesia, Tanjung Priok continued to grow; but Surabaya (Tanjung Perak), Belawan, Semarang and Ujung Pandang all began to develop new feeder services, essentially - though not only - to Singapore. In the Philippines Manila, though experiencing difficult years reflecting deep political changes, continued to grow over the longer period; but regional ports, particularly Cebu and Davao, also developed new feeder links and smaller ports have developed some container traffic. In Thailand, Laem Chabang emerged with potential to operate as a mainline port; and in Malaysia Penang and Johor - and at the end of the period, in 1994, the new Westport terminal - have added to feeder services. Vietnam, particularly since the lifting of the US trade embargo in 1994, has emerged as a new node in feeder shipping networks with strong links to Singapore.

But it has been the growth of container traffic in China's ports and the inclusion of these ports into new feeder shipping networks that defines this period. Initially, the development of a plethora of ports in the Pearl River delta focused traffic through Hong Kong and was largely responsible for the explosive growth of the port. But significant investment from the multilateral aid agencies - the Asian Development Bank and the World Bank - as well as from the Chinese Government itself and from private foreign investment in southern, central and northern regions of China has meant that by the mid 1990s the initial period of construction, development and low growth has finished.

Shipping linkages between the Pearl River delta ports and Hong Kong are intense; and feeder links from Shanghai and central region ports and from the northern ports focus on Pusan and Japanese ports. Notably, despite its adjacent location to southern and central China ports but reflecting current political realities, Kaohsiung is excluded from China-oriented shipping networks.

Phase 3: From the mid 1990s to 2000: Two sets of events define this period - the beginning of direct calls to selected China ports in both the Europe/Far East and in the trans-Pacific trades; and the emergence of the major new shipping alliances, with effective new organisation and schedules from the beginning of 1996. But note that these events are taking place against a background of continuing high growth rates in the region's ports - which has meant that a whole new set of regional ports has reached volume thresholds that make direct calls rather than feeder calls economically attractive - or at least, that lines find it imperative to achieve some market penetration and capture market share now rather than later.

Figure 3 shows, that ports have grown in volume terms though Japanese ports will decline in relative share terms; and that China ports in all three regional locations are supporting direct

calls. Feeder services to other major hubs - Hong Kong, Singapore and Pusan will continue; and the diagram suggests that, given changes in the political climate, Cashing could operate as a hub for container cargoes from both central and southern China.

The diagram implies new direct call networks, somewhat different from the earlier and simpler Japan/Singapore corridor. In effect, increased volumes, the emergence of China and other regional ports and the new alliance structure in shipping with the ability to sustain new service strings using a range of vessel types of varying size and speed have effectively segmented the market place. New, overlapping and hierarchically organised networks are emerging and will emerge through the period.

Hong Kong and Singapore are high cost/high efficiency terminals; they will support high cost/high efficiency vessels and services - ideally 5000-6000 TEU vessels and support first order networks. Kaohsiung and Pusan are lower cost and perhaps lower efficiency ports; they might conceivably be included in first order nets - or they may be key hubs in second order networks.

Other regional ports will distribute themselves along the cost/efficiency continuum; and will be integrated into networks that serve the needs of the new alliances - and of operators outside the alliances. Thus Laem Chabang, Port Kelang/Westport, Yantian, Qingdao, Ningbo and Shanghai, Manila - and in due course Tanjung Priok (or its substitute) - and a number of other ports will be integrated into direct call, mainline networks of varying order.

For regional Asia, the simple mainline/feeder networks of the 1970s and 1980s are being transformed into more complex patterns of hierarchical networks that will reflect very closely costs, efficiency and the corporate strategies of very large operators. Smaller operators will find niches; or resort to coping strategies; or will disappear in the not-so-medium term.

4. A FINAL NOTE.

In less than twenty five years - from the commissioning of purpose-built container terminals in Hong Kong and Singapore in 1972 to the inclusion of some China ports into direct call networks in 1995 - containerisation has reshaped the way in which regional Asia handles its relatively high valued manufacturing and break-bulk cargoes. But now, in the mid 1990s, earlier and simpler structures of port/shipping networks are being transformed into more complex patterns.

The Japan/Singapore liner shipping corridor - oriented about the service strings of operators in the traditional Far East/Europe and Far East/US trans-Pacific trades - was focused into hub/feeder patterns in which Hong Kong and Singapore were the undisputed first order ports, Kaohsiung and Pusan played a somewhat lesser but nonetheless crucial role and the earlier dominance of Japanese ports - particularly Tokyo, Yokohama and Kobe - gradually eroded.

But continuing high growth rates of containerised cargo, the proliferation of ports - as well as the increasing number of ports with relatively high container throughputs - and significant changes in the operation and organisation of global container shipping are restructuring these

earlier patterns. The new shipping networks will be hierarchically organised and are likely to be overlapping - with high order nets including, conceptually if not in practice, high cost/high efficiency hubs and lower order nets including a mix of hub and direct-call ports. Conceptually, again, we might expect the hub function to progressively degrade as former feeder ports are linked into direct-call networks; but in practice hub/feeder operations will continue over a long period of time.