CONTAINER SHIPPING TRENDS AND THEIR IMPACT ON PORT DEVELOPMENT AND COMPETITIVENESS

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ABSTRACT
Purpose: Container ports play a critical role by enabling seaborne trade to occur in a reliable, secure, cost efficient and environmentally sustainable manner. The competitive position of a container port is determined by its competitive offering to the host of shippers and shipping lines to which the port serves. This paper examines key trends and developments in the container port industry from the perspective of the market structure of a container port.

Design/methodology/approach: This paper uses market structure analysis with case studies drawn from the development experience of the port of Singapore, which is the world's largest container transhipment hub and second busiest container port.

Findings: The paper uncovers major trends that have impacted the nature of demand and supply in the container port industry. It analyses how container ports can capitalise on these developments to bring about port development and enhanced competitiveness to the benefit of their respective communities.

Practical Implications: Container ports increasingly face the challenges of limitations to physical expansion while attempting to capitalise on growing demand and needs posed by larger container shipping lines. Case studies will be drawn from how these challenges can be addressed to ensure that the container port community continues to thrive and grow.

Originality/Value: Port planners will be able to make use of the analyses on container port competitiveness and port development based on empirical evidences drawn from the industry.

Keywords: port competitiveness, container shipping, container ports, port of Singapore

Introduction

In 2012, the busiest container port in the world handled 32.6 million TEUs (World Shipping Council, 2013). In 1990, container throughput was only 5.2 million TEUs. The 2012 rankings revealed that throughput of the 11 busiest ports surpassed 10 million TEUs each. Of these, cargo traffic handled by the four busiest ports exceeded 20 million TEUs. Container ports face tremendous challenges as they strive to maintain competitiveness and accommodate the growth in traffic. Ports that are able to attain these objectives are likely to become focal points for key arteries of the containerised cargo trade. As components of value-driven logistics systems that intersect between hinterlands, efficiency gains generated by competitive ports can impact directly on the competitive advantage of their users. Ports that are supported by the provision of competitive and reliable services can increase the amount of welfare benefits that extend beyond the port community and transport users to the whole of society.

The importance of container ports as primary confluences for market forces in the container shipping industry makes it necessary to investigate the developments and challenges presented to this sector. The paper provides an overview of demand and supply forces that impact on the container port industry and examines the implications for the development and competitiveness of container ports.

Demand for Seaborne Containerised Transport Services

Seaborne trade in containerised cargoes and container throughput handled by ports grew in tandem reaching 1.4 billion tonnes and 573 million TEUs respectively in 2011 (UNCTAD, 2012). Demand by shippers set the broad overtone for container traffic movements. This demand is dependent on the performance of the global economy, types of commodities involved, average haul of cargoes, political events, and transport costs (Stopford, 2009). An environment created by a booming world economy where containerised cargoes are being shipped over longer distances and where transport costs are

declining will generate greater demand for seaborne container transport. Higher penetration achieved by containerisation will also boost demand. These factors ultimately determine the types of goods to be transported as well as seasonality, spread and direction of the containerised trade.

Besides shippers, demand faced by container ports also comes from shipping lines. Containers transported by shipping lines are used for transhipment or direct service (i.e. from port-of-origin to destination port). Shipping lines will try to optimise their logistics networks by rationalising coverage of ports, shipping routes and transit time in order to achieve economies of scale and scope (Mourão et al., 2002; Lirn et al., 2004). Notteboom (2006) noted that the determinants of demand includes the pattern and distribution of freight movement over a particular port's hinterland, cargo volume and cargo-generating potential of the port, maritime access, and quality of service. Other determinants include the ability to compete with other transport modes (Trujillo and Tovar, 2007), adequate feeder networks and efficient hinterland connections (Aversa et al., 2005). Lu et al. (2005) added that requirements by end-customers for high quality logistics services mean that demand for transporting containers by sea is linked ultimately to logistics goals. Logistics is thus seen as a strategic source of competitive advantage in a global environment which is orientated towards increased sharing of global production, shorter product life cycles, and intensification of global competition.

Supply of Seaborne Containerised Transport Services

Supply of containerised transport comes mainly from fully cellular vessels deployed in container shipping services. Carriers contend with many variables when operating such services. We examine four factors: cargo carried, trade route, cost conditions and industry dynamics. Collectively, these factors determine the kind of container shipping services to run if the decision to operate is taken.

Factors specific to cargo carried include requirements by shippers, availability of cargo, types of cargoes to be transported, freight rates and trade imbalances. The types of cargoes can be differentiated by those transported in standard containers and those that require specialised equipment such as reefers, ISO tanks and open-top containers. There are also considerations of freight rates earned and severity of trade imbalances as empty containers have to be repositioned at minimal cost to the shipping line.

Factors specific to the trade route include distance, geography and infrastructure conditions for container shipping services. For route geography, navigational hazards can impose restrictions on vessel operations whereas distance and type of route involved can influence the types of vessel to deploy. Infrastructure provided by ports-of-call can determine efficiency of port operations, cargo base and vessel turnaround time for the voyage. The importance of this factor has persuaded some of the major carriers to invest in dedicated facilities at strategic locations along key trades to enhance their competitive service offerings. Other conditions specific to the route include state of weather, risk of pirate attacks, regulatory requirements of passage (e.g. conventions enforced by coastal state and port state controls), and political conditions in littoral states.

Factors that relate to costs incurred as a result of the voyage include bunker and supplies that have to be consumed, insurance and port charges, among others. Carriers have to bear these charges upfront even though they can be covered to a certain extent by surcharges such as bunker adjustment factor and congestion surcharges.

The fourth set of factors pertains to inter-firm dynamics on the trade routes. Carriers will weigh the benefits offered from potential market entry and opportunities for cooperation with other carriers against the costs of competition with incumbents and potential entrants. The extensity of competition and cooperation can spread to embrace other routes and shipping networks.

These considerations are manifested in the network structure of liner services where shipping lines aim to optimise network design. This can be achieved by routing cargo via transhipment hubs or amalgamating with other shipment flows. Hence, carriers have to accommodate shippers' preferences and account for behavioural aspects of industry players while attempting to minimise network costs that are linked to its shipping and landside operations. They must fulfil the transport requirements of a globalised economy through organic growth, M&A or engage in various forms of horizontal and vertical cooperation to generate greater customer value vis-à-vis competing logistics networks. Successful carriers will be able to generate greater economic value and cargo volume for the ports where they

hub although the same development will increase their desire for greater control over the logistics flows and work processes at those ports (Yap, 2009).

Implications for Port Development and Competitiveness

Taking together, demand and supply factors witnessed by the liner shipping industry in the recent decade corresponded to the unprecedented increase in containerised traffic which presents many challenges to container ports. The most significant challenges relate to capacity utilisation and expansion as ports strive to:

- Cater to short-term variations in cargo volumes and vessel traffic without compromising schedule reliability of liner services and normal functioning of other port activities
- Cater to increasing size of container ships operated by mainline operators without compromising service levels for operators of smaller vessels
- Deal with demands required by the entire logistics chain
- Address increasing power wielded by large industry entities in dictating cargo routings and container-handling operations
- Compete with a wider range of ports as hinterlands expand and increasingly overlap

Short-term variations in cargo volumes and vessel traffic

Table 1 shows the container throughput and vessel capacity for the ten busiest container ports in 2012. Shanghai port experienced 3.1 times the amount of vessel capacity for every TEU handled. Shenzhen and Ningbo-Zhoushan ports saw this figure exceed four times for their corresponding amount of containers handled. Higher cargo and vessel traffic without adequate facilities to accommodate them lead to delays in berthing, departure, loading and discharge of cargoes and other forms of unexpected waiting time. Notteboom (2006) found that 86.1% of schedule unreliability on the Asia-Europe trade route was attributed to such events. This was an affront to the liner shipping industry which traditionally prides itself with high degree of schedule reliability.

Port	Container Throughput (million TEUs)	Vessel Capacity (million TEUs)	Throughput / Vessel Capacity (%)	Vessel Capacity/ Throughput
Shanghai	32.6	100.4	32.5	3.1
Singapore	31.7	81.2	39.0	2.6
Hong Kong	23.1	85.8	26.9	3.7
Shenzhen	22.9	95.9	23.9	4.2
Busan	17.0	63.2	26.9	3.7
Ningbo-Zhoushan	16.8	79.7	21.1	4.7
Guangzhou	14.7	21.6	68.1	1.5
Qingdao	14.5	36.4	39.8	2.5
Jebel Ali	13.3	32.0	41.6	2.4
Tianjin	12.3	27.6	44.6	2.2

Source: Informa UK Ltd (2012) and World Shipping Council (2013)

Table 1: Comparison of container throughput and vessel capacity for the top ten container ports

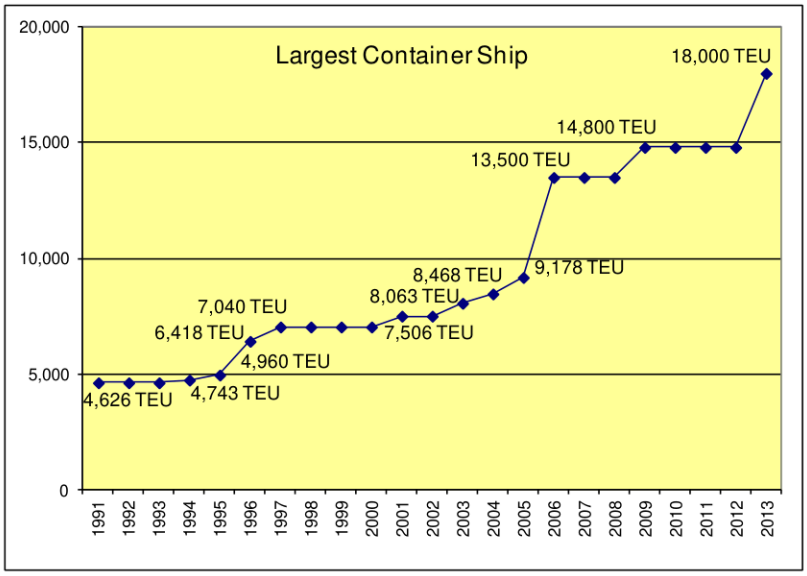
Ports typically develop new facilities ahead of demand to avoid the capacity crunch. However, the cost of development does not come cheap. In the case of Shanghai, the development cost for a 300-metre berth at Yangshan Phase 3B in 2009 amounted to US$288 million (HKTDC, 2009). This was almost double the cost incurred for a similar berth for Phase 1 (Hong Kong Standard, 2005). On the other hand, misreading demand to be overly optimistic can result in underutilisation of very expensive infrastructure and represent a hefty opportunity cost for society.

The key challenge for container ports is to structure their facilities to achieve optimal balance between accommodating frequent short-term variations in demand and achieve gainful employment of terminal resources on a sustainable basis. Container ports need to also consider the long-term investment horizon associated with these resources. For instance, demand and supply conditions faced by a container terminal operator at the beginning of a 30-year lease period are likely to be very different compared to conditions at the end of the period. Diseconomies from increasing volume of inter-terminal haulage, hinterland traffic congestion and larger economies of scale required to generate acceptable returns to shareholders may render existing facilities obsolete. This may require an entire

system of container terminals to be redeveloped with the latest terminal design and technology aimed at achieving higher levels of productivity as well as addressing concerns of an increasingly demanding stakeholder community with regards to spatial and environmental quality of the vicinity.

Increasing size of container ships

Figure 1 shows that the largest container ships deployed in the early 1990s remained below 5,000 TEUs while maximum ship size increased to 7,040 TEUs by the end of the decade. In 2003, the 8,000-TEU record was broken. Two years later, the 9,000-TEU record was broken by the MSC Pamela. In 2006, there was a significant structural break when the 13,500-TEU Emma Maersk entered service, leading to an order-rush for ships exceeding 10,000 TEUs in size. In 2013, another break occurred when the 18,000 TEU McKinsey Moller-Maersk entered service.



Sources: various including A.P. Moller-Maersk Group (2013)

Figure 1: Increasing size of container ships (1991-2013)

To cope with increasing vessel size, container ports are boosting handling capacity by reconfiguring cargo operations through the deployment of more equipment, restructuring of terminal design for greater efficiency, or developing capacity in entirely new locations. In Singapore, container berths at Pasir Panjang Terminal Phase 1, which began operations in March 1999, were designed with 360 metres per berth. The terminal was equipped with state-of-the-art automated overhead bridge cranes and berths that could handle the largest container vessel then on the orderbook (i.e. 8,063-TEU OOCL Shenzhen with LOA of 323 metres). When Phase 2 began operations in June 2005, the longest berth had a length of 418 metres which could handle the 13,500-TEU Emma Maersk (PSA International, 2006). When Phases 3 and 4 become operational, they will be capable of handling the Triple-E megaships (A.P. Moller-Maersk Group, 2013).

Demands required by the entire logistics chain

Robinson (2002) noted that port competition had shifted to competition between value-driven logistics systems. Container ports become part of these systems that connect the entire flow of cargoes from origin to destination. As a result, the value delivered by the entire chain becomes fundamentally important to customers rather than its individual components. Lam and Van de Voorde (2011) showed that features of the logistics chain go beyond physical aspects to include considerations from the customer service, inventory setting, transport requirement and order processing angles. They suggested that while it was important to attain local optimum with respect to each individual activity, the supply chain community should focus on the overall service quality that is presented as a collective whole to the customer. As such, container ports have to position themselves to complement specific requirements of individual logistics chains that utilise their services (Lam and Yap, 2011a). In Singapore's case, container shipping can count on the efficiency of transhipment operations for hub-and-spoke, interlining and relay containers. This allows the port to serve markets across Asia to as far as Europe, Australasia, Africa and North America. In effect, the port has to deal with logistics requirements on a global scale spanning several time zones, companies, work cultures and

operational concerns. Above all, the container port industry in Singapore must be able to perceive, anticipate and act on user demands from key decision makers along the entire logistics chain.

Increasing power wielded by industry entities
The spate of M&A activities in the liner industry resulted in the top twenty carriers controlling 85% of the world's container vessel capacity in 2013 (Alphaliner, 2013). By comparison, market share of the top twenty carriers in 1992 was only 37%. Shipping lines constantly pursue strategies to establish superior positions against other players in the logistics chain. With the increase in bargaining power, ports that are less flexible in accommodating the requirements of major carriers can be bypassed. However, the costs of re-routing traffic to another port can be costly for shipping lines as well. For example, they may have to contend with the loss of key customers.

There is a growing trend of collaboration between pure stevedores and major container shipping lines for terminal investments. Table 2 shows projects involving a consortium of pure stevedores and major shipping lines. Pure stevedores desire some level of certainty and the involvement of shipping lines in the project can provide the base throughput for the terminal. Engaging prominent local partners who are major shippers or companies involved in the hinterland transport business can also enhance the viability of the project and, not to mention, improve the chances of winning the concession.

Project	Parties Involved	Nature of Business	Shareholding (%)
Shanghai Yangshan Phase 3A	PSA International	Pure stevedore	30
	China Shipping	Shipping line	30
	Shanghai International Port Group	Pure stevedore	20
	COSCO Group	Shipping line	10
	CMA-CGM	Shipping line	10
Antwerp Gateway Terminal	DP World	Pure stevedore	42.5
	COSCO Pacific	Stevedore related to a carrier	20
	Zim	Shipping line	20
	CMA-CGM	Shipping line	10
	Duisport	Logistics centre	7.5
Rotterdam World Gateway	DP World	Pure stevedore	20
	Mitsui OSK Lines	Shipping line	20
	Hyundai Merchant Marine	Shipping line	20
	APL	Shipping line	20
	CMA-CGM	Shipping line	20

Sources: various including Reuters (2013)

Table 2: Selected terminal investments involving stevedores and major carriers

Global terminal operators and shipping lines equipped with the relevant financial, technological and managerial expertise can help ports to overcome their deficiencies and sustain their competitive edge. However, access to competitive assets does not automatically translate into port competitiveness as efficiency gains generated can be monopolised in anti-competitive settings. The container handling sector in Singapore is dominated by PSA International with a market share of almost 100%. While this seems to present PSA with the advantages of a monopoly, the fact that 85% of containers handled are transhipment in nature makes this business liable to move to alternative locations if competing offers are better (PSA Singapore, 2013). Between 1999 and 2002, four of the largest container shipping lines relocated their transhipment operations to neighbouring Port Klang and Tanjung Pelepas citing more favourable terms. Ports that are able to attract internationally competitive global terminal operators and anchor major mainline operators may be in a better position to sustain their hub status and realise the stipulated economic and social benefits for their communities.

Wider range of ports
Improving transport networks and expanding markets result in hinterlands that increasingly overlap. Improvements in intermodal technology and organisation are also prompting shipping lines and shippers to frequently review service schedules, traffic routings, and assets utilised to exploit changing traffic density and achieve greater economies. As a single node in global value-driven logistics systems, container ports continuously strive to entrench and enlarge their captive hinterlands, while at the same time, erode those of competitors. A principal consideration is the total transport cost

associated with including the port in the particular logistics chain given that cargo flows are continuously seeking routes that offer the best value for comparative service levels.

Analyses of container port competition for various container-handling regions in the world show that ports do not only compete with their immediate neighbours but also with other ports located in the region. Competition was found to be more intense between major load centres located within a region (Lam and Yap, 2006). The impact of competition on the container port industry in Singapore is severe. Prior to 1999, Singapore was the uncontested container hub in Southeast Asia. However, the share of transhipment containers handled by the port fell from almost 100% in 1998 to 71% within a decade. The largest decline was registered between 1999 and 2002 where the port's transhipment market share declined by more than 20 percentage points. This was attributed to the presence of professional global terminal operators such as Hutchison Port Holdings in Port Klang (The Sun, 2001) and APM Terminals in Tanjung Pelepas (Singapore Business Times, 2000). These developments improved terminal productivity, marketing effectiveness and ability to provide better services at competitive price levels. As a result, four major mainline operators which had based their transhipment operations in Singapore decided to relocate their hubs to Port Klang and Tanjung Pelepas.

Container ports can complement and sustain each other's competitive advantage to boost performance. This is underscored by the fact that a port needs another port. First, the direction of trade can be used to determine the degree of complementarity that exists in container traffic flow between origin and destination ports. Second, complementary relationships can exist in hub-and-spoke networks where hub performance is complemented by positive developments at various spokes to which the hub is connected. However, the positive effects of this relationship can be reversed if the spoke become large enough to compete for direct calls with the hub. Analyses of relationships between container ports are usually conducted at the aggregated level. Lam and Yap (2011b) pointed out that every market served by each port involves different decision makers, geographical regions, trades routes and shipping lines. It is unlikely for a port to compete with another over the whole spectrum of market segments. Therefore, an essential element in identifying inter-container port competition and complementarity is to identify the specific markets where these relationships exist.

Engaging the port community for port development and competitiveness

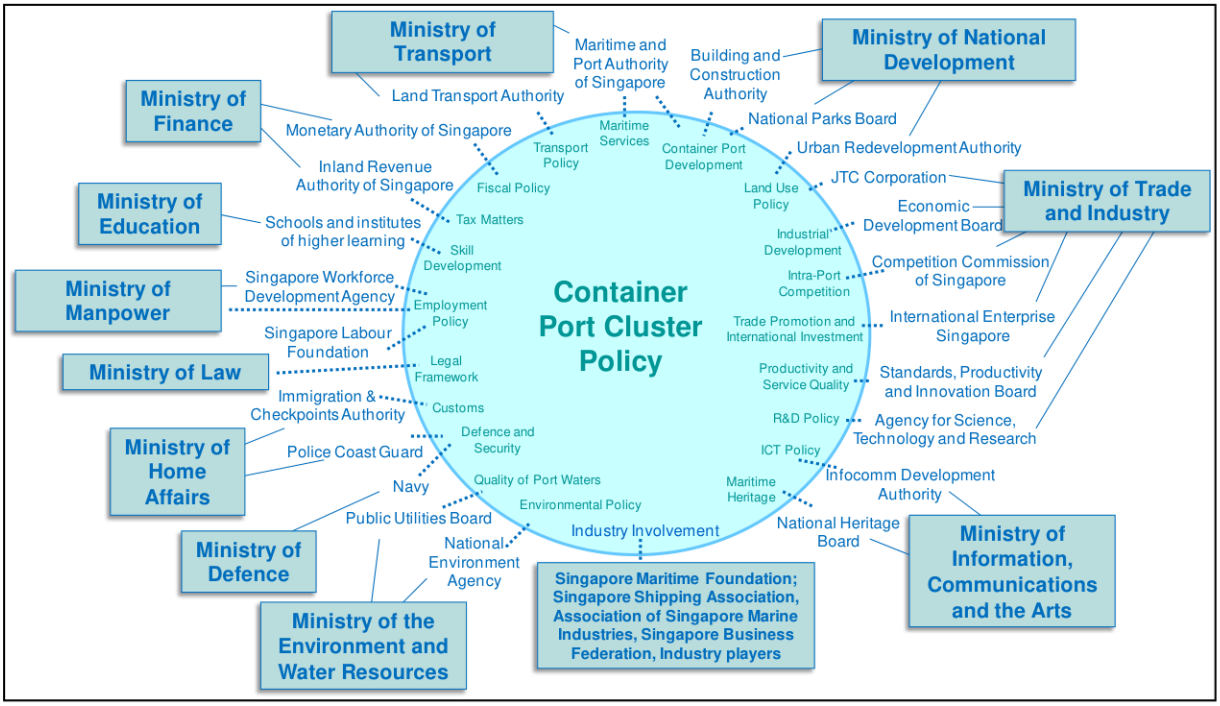
Competition can have positive effects in promoting greater efficiency and innovation, although the distribution of its benefits may be contentious. Negative effects may result as competition can lead to exploitation of resources beyond sustainable levels (Yap et al., 2011). In particular, vigorous competition in the port scene has led some to question its longer-term economic, social and environmental rationale and implications for society. Hence, container ports should be proactive in identifying and engaging relevant stakeholders to address potential flashpoints that may arise. This is most important when the situation involves issues that concern the long-term competitiveness, commercial viability and sustainability of the container-handling business on which the entire container port community is dependent. Otherwise, the interests of the container port may be misrepresented or even worse, misunderstood, and the container port community risks being marginalised.

Figure 2 shows the institutional framework governing operations and development for the container port cluster. The Ministry of Transport directly oversees the operating environment of the container port. Other organisations include those related to industrial development, employment creation, trade promotion, education policy and ICT infrastructure. The figure shows the complexity of relationships and variety of government agencies and private-sector institutions that can affect the overall competitiveness and competitive offering of the container port. The various stakeholders have different interests as well as different sources and avenues of influence. The challenge is to harness the support of these entities to advance the port's competitiveness.

Conclusions and Recommendations

The port is an important node for facilitating the efficient flow of containerised cargo. The main influence exerted by ports would be through improvements to cargo and vessel productivity, providing superior maritime and hinterland access, and ensuring that the pace of capacity expansion is sufficient to meet anticipated demand. Ports that aim to be competitive hubs must strive to become the focal point for main arteries of containerised cargo traffic by serving as collection and distribution points for hinterlands that may extend beyond their national boundaries. Ports that are able to provide an environment where trade in containerised cargo can be conducted in a safe, secure and cost-effective manner relative to competition will ensure that they will be the preferred conduits of container traffic.

The challenge is to balance long-term investment horizons with short-term variations in demand. The challenge is even greater for container ports that rely on transhipment traffic for such cargo are known to be “foot-loose”.



Source: Yap (2009)

Figure 2: Institutional framework for container port cluster development in Singapore

This paper examined the issue of container port development and competitiveness from the perspective of trends and developments brought about by changes to demand and supply forces in the container shipping industry. Given the dynamic nature of developments in these areas, future research can address the role of technology and spatial policies from the perspective of urban development. The paper also introduced the subject of container port cluster from the institutional dimension. Given the diversity of entities involved and roles held, it would be useful to investigate the subject matter from the perspectives of different parties in the cluster to obtain deeper insights for container port development and competitiveness.

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