HOW MEGA-SHIPS ARE AFFECTING TERMINALS

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"Mega Ship" is a terminology coined sometime around 2013 when Maersk line introduces the Triple E series of ships that can carry 18,340 TEUs. The term "Mega Ships" has since been used synonymously with the term "Ultra Large Container Vessel" (ULCVs). Mega ships came about in the drive by the shipping lines to pursue economies of scale and cost savings to offset the decreasing rates in depressed freight markets. When deciding upon the deployment of mega ships, considerations of route, nautical distance and volume are crucial. Based on these criteria, mega ships are mainly deployed on the Far East-North Europe trade lane where the route covers the longest nautical distance and presents adequate cargo imports and exports. This ensures that the ship will be earning sufficiently from freight carried while saving on operational costs. Cost savings is required for a carrier to achieve an edge in the container shipping industry, where price competition is one of the main drivers.

PRICE IMPACT

The impact of mega-ship on freight prices and operational cost has been thoroughly analyzed. The introduction of mega ships has injected huge capacity into the market leading to the container shipping industry becoming structurally over-capacitated. With pressure building to fill up the ship for maximum utilization of the slots, freight prices naturally fall as excess capacities put a downward pressure on prices. While some shipping lines have postponed their new ship orders or taking delivery of new ships on order, the trend is reversed only with the restructuring of the alliances coupled with the demise of Hanjin shipping that caused some equipment shortages which naturally caused sudden rate spikes. On the cost side, the doubling of the maximum container ship size has reduced total vessel costs per transported container by roughly a third over the last decade.

INSTALLATION COSTS

Nevertheless, these cost savings are not expected to continue at the same rate in the future. From the perspective of lifecycle costing in the supply chain, any further increase in container ship size could potentially raise vessel transport costs. To illustrate, operators of ports with insufficient depth may engage in dredging to deepen their waters before they can receive the mega ships. New cranes need to be installed to reach across larger vessels. The cost of installation will be further escalated when some sections of one pier will need to be reinforced to handle the heavier weight of the cranes. On the landside, some ports may not possess adequate capacity to handle the increased volume of cargo that arrive at the same time from larger ships. Even though a port may have sufficient acreage across its multiple terminals, acreage for storing containers (i.e. container yard) within some terminals may be inadequate for handling increased container volumes. When terminal operators seek to increase terminal capacity by stacking containers higher, it will be more time-consuming and costly to sort through when a trucker arrives for pick up. Moving beyond the ports, aging roadways impedes cargo movement in a door-to-door delivery particularly where freight rail, trucks, and other road users converge at congested crossings and intersections.

SHARING CAPACITY

The problem of rising vessel transport cost due to increasing vessel sizes can be improved by optimizing cost on a system-wide basis. In our opinion, capacity sharing among neighboring terminals offer a promising means to meet increasing demand for cargo-handling from mega ships without incurring hefty capital investment. By capacity sharing, vessels that are scheduled to arrive at a busy terminal are to be transferred to another terminal with free capacity, and proceed with the discharging and loading of containers with minimal delay. To evaluate the gains of this proposed management practice, a simulation model is constructed to survey the capacity requirement planning of major resources, such as quay cranes, storage space, and gate, in multi-terminal port operations where the logistics process of a container port can be seen as a typical batch process in production planning as containers arrived vessel-by-vessel and demands for the port resources are time-dependent.

Capacity requirements on the resources are estimated in the form of workload distributions on resources over time spanning across the peak and non-peak periods. The effects on workload requirement, arising from multi-terminal cooperation, are subsequently examined in consideration of different container flows among terminals characterised by varying transferring rates among the terminals and volume of transshipment cargo volume relative the gateway traffic.

INTER-TERMINAL COOPERATION

Experimental results suggest that higher transferring rate between terminals will reduce the quay crane and storage space requirements but aggravate the gate congestion as represented by the queue length of truck at the yard. Variabilities in the quay cranes and storage space requirements also increase as containers stay in the port for shorter time durations but with more frequent changes in container inventory at the yard. The interaction effect between transferring and transshipment rates further shows that the average resource requirements for a terminal can be greatly reduced when the inter-terminal transferring of containers contributes positively to a more even workload redistribution across terminals. The most significant improvement for quay cranes requirement is observed when transshipment rate and transferring rate are moderately high at 85% and 75%, respectively. Meanwhile, use of storage capacity across terminals is best optimized when there is a very high transshipment rate (i.e, 90%) coupled with low transferring rate (i.e., 60%). The gate resource benefits most in this arrangement of resource sharing between terminals when the transshipment and transferring rates are both moderate (i.e., transshipment rate is 80% and transferring rate is 75%).

We highlight that inter-terminal cooperation also brings about other benefits such as higher bargaining power as a single port entity against other regional competing ports via the provision of large capacity in container handling service. The need for intelligent capacity requirement planning for multi-terminal operations is likely to be more critical for transshipment hub ports, as the ability to provide prompt and adequate handling services for large shipping lines is strongly associated with revenue.

However, we need to caution that the operations in the collaborating terminals inevitably become more complicated when a container terminal collaborates with its neighboring terminals within a port or across ports in the form of resource sharing. Resource sharing practices among terminals present operational challenges for handling strategies in berth scheduling, storage space allocation, inter-terminal process planning. When a container terminal shares its resources with others, the container flows among the terminals rely on berth schedules that indicate arrival plans of vessels. These inter-terminal flows involve a subset of transshipment containers discharged from a vessel at a terminal but required to be loaded onto another vessel berthing at another terminal. In order to realize the gains from such collaborations, an operations management system that has the ability to make use of the available resources efficiently and effectively needs to be in place.

ABOUT THE AUTHORS

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