The Study on Impacts of Mega Container ships on Ports

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Abstract

Ships are getting bigger in size and mega ships are the new generation of container ships. Good signal of market, economic and commercial advantages offered by mega ships outweigh its limitations that liner operators make a lot of effort to overcome.

As each alliance has placed orders for large vessels, it has placed pressure on others to follow to ensure unit cost parity. Seeing port calls increasingly rationalised by alliance members, ports face the probability of squeezed margins for the business that they retain as alliances look to joint bargaining to secure volume-related discounts.

Mega container ships had brought about cost savings for carriers, decreased maritime transport costs and as such facilitated global trade in the past. However, larger ships require somewhat adaptations of port infrastructure, container handling equipment and cause larger peaks in container traffic in ports, with wide ranging impacts. Both developments in the liner shipping market have a major impact on the ports and terminal operations.

Therefore, this paper will discuss the overview of container ship development, the reasons for the strong development of the ship size for the last period and important commercial and technical challenge as its limitation. Moreover, the paper will focus on the strategies for liner operators and how to deal with mega ships. And this report assesses if the benefits of the current mega container ships still outweigh their costs to the whole transport chain.

Keywords : mega container ship, shipping alliance, port, terminal, container

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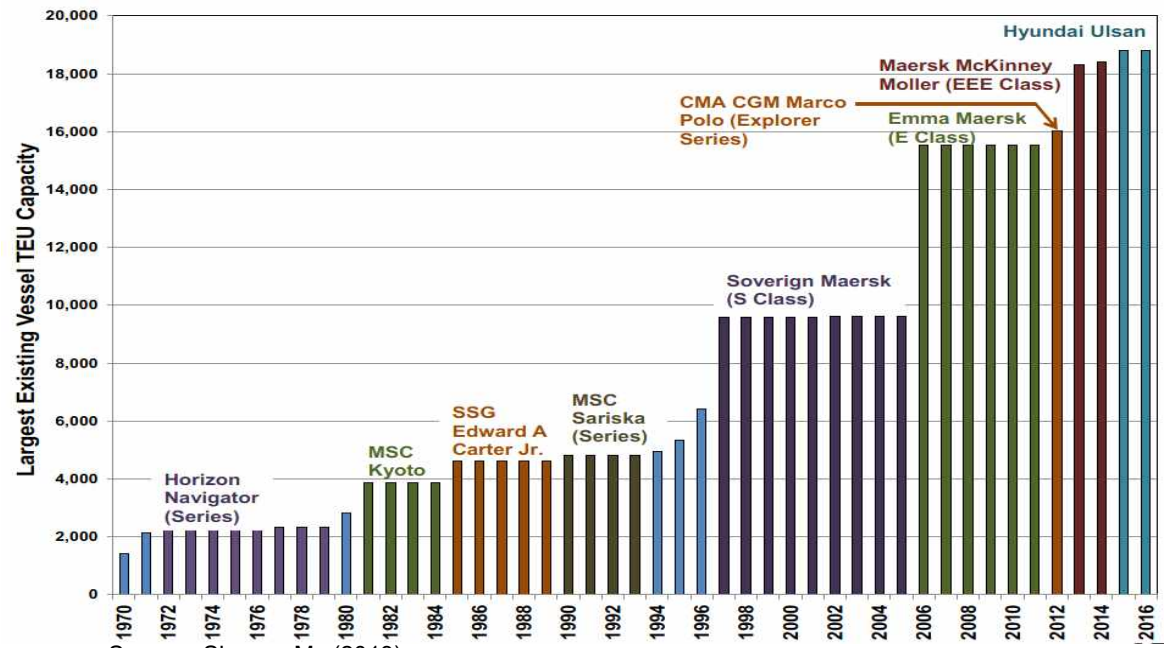
1. Introduction

Container ships are the accelerators of the globalized economy. Although their share of total world fleet represent only one eighth they are essential for the transport of containerized consumer goods around the world. Container ships had been grown bigger at a rapid pace over the last decades, faster than any other ship type.



Source: Sisson, M. (2013).

<Figure 1> Largest container ship size over time

The largest container ship at this moment can carry 19,200 containers(TEUs) but mega ships with capacity of more than 21,000 containers have been ordered and will be delivered after 2017. Larger container ships have enabled carriers to save operation costs, decreased maritime transport costs and as such facilitated global trade in the past. However, larger ships require adaptations of port and hinterland infrastructure, equipments and cause peaks in container traffic in ports.

The world container shipping industry has struggled in recent years due to a decline in the container volume growth rate and the continuous delivery of newly built vessels. These two factors had contributed to an imbalance of supply and demand in major trade routes and gave rise to deficit of every container line's performance results. In order to overcome these issues, world container shipping industries have sought to gain scale merit through mergers and acquisitions and/or strategic alliances consequently the structure of the industry is changing through consolidation.

Notably as with other modes of transport, the container shipping industry is especially

cyclical. The 2008 financial crisis gave rise to over-capacity and a resulting sharp decrease in container shipping rates. At the same time, average containership size has steadily increased over the last decade and will continue to grow in near future. The next generation of container ships - already on order by carriers - will have a nominal capacity of 20,500 TEU class. The latest mega container ships boast improved fuel consumption and environmental performance which can help better respond to economic pressures. And, larger vessels pose new challenges in terms of the adequacy of port infrastructure.

Larger ships are being deployed, and they require more modern and more automated handling processes, whilst at the same time the vessels call at fewer ports, which means competition between hubs becomes greater. Ports have long struggled to adjust to the mega container ships that container lines have deployed over the years. It's quite easy for a container line CEO to sign an order for a new ship than for a port to deepen its draft so that bigger ships can enter or leave fully loaded.

Ships are growing at an accelerating, rate as carriers become focused on reducing operating costs as the key to profitability. That's pushed ahead up pressure on terminals to perform, because carriers can't realize the potential cost savings of their mega ships if they are always playing catch-up to stay on schedule because of port delays. The consequences of being late are increasing because, as mega-ships take up more time at port, punctual berthing order are harder to find.

Many vessels which currently serve major routes will be replaced by mega ships and ULCSs. They will be next deployed to other routes. Consequently, an average size of container vessel in world container trade will significantly increase. The world container markets are currently preparing for a significant structural change which will occur when a larger number of mega container ships are deployed. Container lines, ports and terminals already make preparations and investments in anticipation of this development. This will be some kind of a chain reaction or change. Ports, terminals, stevedores and many other entities must adjust for this development.

2. Literature Review

Theo Notteboom(2016), examined how container ports located upstream on rivers use processes of adaptive capacity building in an attempt to remain competitive in port systems. The case study on Antwerp and Hamburg showed that the discussion on the future of these upstream seaports cannot be detached from broader public policy and stakeholder management concerns and the influences of retention mechanisms, power, politics and collective action by the port community.

Noel Hacegaba(2014) found his paper assessed the effects that mega containerships and related alliances may have on the port authorities. He tried to seek to identify the role of the port authority and address the fiscal and political factors that should be considered as part of the decision-making process.

Paul J. Birnbaum(2016) presented that JOC forecasts growth of 5.5% in 2016 and 6.5% in 2017 for US containerized import volume and JOC forecasts growth of 4.1% in 2016 and 5.8% in 2017 for US containerized import volume, down from previous forecasts. Ultra large container vessel deliveries will accelerate in 2017, with more than 50 units. Vessel supply and size both continue to grow, further widening the capacity gap. The supply/demand imbalance and overcapacity are resulting in downward pressure on carrier rates with another 5% decline projected in 2016. Carrier alliances' structures and members are expected to change in the next year or so in response to challenging supply/demand dynamics.

John Bockrath(2016) studied that there are some signs that alliances may be utilizing market power but this evidence is not consistent enough to warrant significant regulatory action. As liner shipping is the dominant form of global transport chain this shift in market structure could have a substantial impact of the global trading system. A legal analysis of liner shipping regulation history supports this conclusion by casting doubt on the effectiveness of the current liner shipping regulatory structure.

Francesco Munari(2012) explained that in a consortium, pooled vessels are normally identical, and cross-slot charters are executed with a view to reserving for each member of the consortium a fixed portion of the capacity of all vessels used in the service. Port terminals used by the members are clearly the same, and often also other equipment is pooled.

Olaf Merk(OECD, 2013)said that ports and cities are historically strongly linked. However, the link between port and city growth has become weaker. There are various sorts of port-cities, with their own particular challenges ; so much depends on local circumstances.

Jean-Paul Rodrigue(2016), explained container shipping benefits from the application of economies of scale since they have a direct impact on operating costs. The larger the containership, the more cargo it can carry, and as such the lower the transport cost per unit of cargo. There has thus been a push to deploy larger ships, which were put on high volume trade routes, such as between Asia and Europe and across the Pacific. Diseconomies of scale are a common economic concept stating that after a specific level of output the input costs per unit of output are starting to rise. There are therefore no incentives to increase the output of the particular unit beyond a threshold.

Hans G. Payer(2001) said economy of scale had driven the development of container shipping from its beginning. The trend towards "larger ships has accelerated in recent years and can be observed with the increasing size of long haul as well as cascading feeder vessels'. This mega ships tendency is supported by a continuing healthy growth in container volume on east-west world major trade routes. Looking into the future the limits for container ships from a technological point of view are seen at a ship size carrying 22,000, or 25,000 TEU.

Liyenita Widjaja(2012) found that mega container ships have positive impacts to the port both in short term and long term. In addition, the port is very competitive, and it has a great potential of attracting mega ships to come by having the supporting assets necessary.

Yvo Saanen(2013) argued that larger vessels are maybe the right way to go for the lines,

but they are not for the terminals. In order to keep the operational costs at the same levels, the rates need to increase by 3 – 17 percent depending on the increase in vessel size. In the current economic climate, this is not a message that would be appreciated by the lines, which are coping with overcapacity. Container lines and terminals have to come to terms with this matter, only then can the savings on the liner side be turned into productivity improvements at terminals.

K. Eloot1, J. Verwilligen and M. Vantorre(2010) The paper describes two main research studies executed to fill in the gap of knowledge about the manoeuvring behaviour of container ships in shallow and confined water: the accessibility of Ultra Large Container Ships with a maximum capacity of 14,000 TEU to the Western Scheldt and the accessibility of the Berendrecht Lock and Delwaide Dock located on the right bank of the port of Antwerp.

A Rum Park(2014) found the shipping alliances give rise to most important change in the maritime industry. Shipping alliances will have a huge impact on the terminal operation because the three major consortium of container lines account for the majority of the world container trade routes. She tried to measure the efficiency of each terminal in Busan Port, the data envelopment analysis (DEA) is used. A results shows how efficiently Busan Port has been operated based on the concession contracts.

Renée Kidson et el.(2015) analysed the recent time series of wharfside and land-side indicators published in Waterline. They found that during 2013 semester 2 there was a sharp upturn in the number of very large vessels making their first call to Australia's major container ports. They examined slot utilisation for trucks transporting containers from and to ports, and show that while the number of slots has been increased to handle increased throughput,

3. Pros and Cons of Impacts of mega Containerships

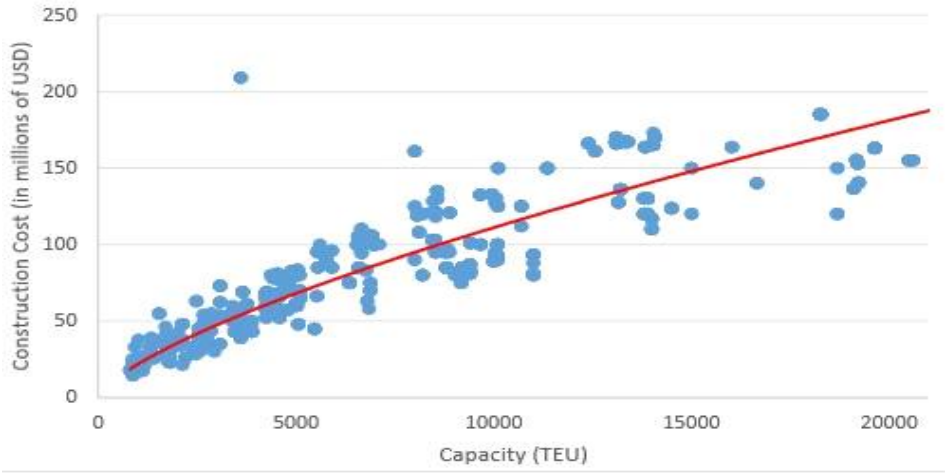
3.1. Pros of Impacts of mega Containerships

3.1.1 Economy of scale

The main trunk route from Asia to Europe and to Transpacific has required bigger ships to meet the demand and to take advantage economic of scale. Economy of scales at sea is the greatest advantage of mega container vessels. Theoretically, the operation cost advantages can be achieved by expanding the capacity of the ship. The unit cost(per TEU) will be decreased when the vessel capacity increases.

Therefore, when calculated the economy of scale of a Malacca-max would offer 30% reduction of a unit cost compared with that of a Panamax. The economics of scale with its implications mostly come from capital and fuel cost while the carrying capacity of mega ships increases respectably. As container shipping is very capital intensive and fuel cost accounts

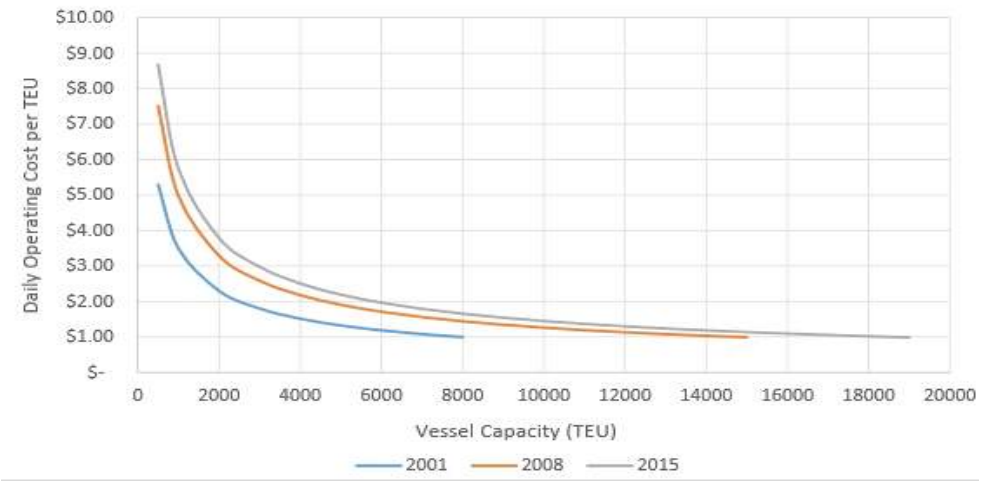
60% of operating cost, so it always had the most concern of ship owner. The new container ship building price is higher than smaller one but in term of investment per TEU, the bigger container ship is less cost than the smaller container ship. It is generally supposed that vessel costs per TEU decrease with size, whereas handling costs per TEU increase.



Source: Midshipman William Murray(2015).

<Figure 2> Nominal Costs of Construction

Cost savings of bigger vessels are crucially dependent on the extent to which the ships are being filled. However, the difference in utilization corresponding to a given slot cost is not very large between different vessel size classes. Shipping lines have difficulties attaining such high utilization rates. In practice most ships are loaded with lower rates. E.g. the monthly ship utilization rates on the Asia to North Europe route have fluctuated between 65% and 103%, which is relatively high compared to other trade routes that generally have lower ship utilization rates.



<Figure 3> Daily Operating Costs

Source: Midshipman William Murray(2015).

However, economics of scale will be affected by those factors as time spending at port stay, time handling cargo, process after discharge cargo from mega ship to hinterland connections with logistic chain, all those can be trade off factor with the cost advantages and productivity of ship size.

3.1.2 Consolidation among Shipping Lines

Recently, the severe competitive container shipping markets are forcing ocean carriers in general and container carriers in particular lower cost and higher quality of service which they are offering. The container shipping lines want to be bigger in the size of company as well as the size of the ship to overcome the situation of high competitive market. They have tried to merge, acquisition in horizontal or vertical. Shipping alliances have become more important as the global shipping industry has been faced with volume slowdowns and overcapacity. Partners under an alliances can share port calls, networks, and ships so that they can cut costs. This can add up to millions of dollars in savings each year. Three major strategic alliances(2M+HMM, The Ocean Alliance, The Alliance) are formed and have an effects on container market. This kind of alliance(consolidation) are pros factors for the ship size increase, as when the company becomes bigger and has more recourses, strong financial condition, it can easily invest in bigger ship.

3.1.3 Efficiency of fuel and gas emission

The efficiencies of the mega container ships are good for individual shippers, and for the global environment. They consume as little as 50% of the fuel per container moved as older ships, while also more than halving insurance and staffing costs. A mega ship requires the same 20-odd crew as a smaller ship but can carry three times the cargo. New mega container ship designs allow for more fuel-efficient operations. For example, the Triple E class, which stands for energy, efficiency, and environmental improvements, can carry up to 18,000 TEUs.

There is an ongoing trend in the shipping industry to focus on sustainability and environmental issues that affect the supply and demand. Carriers have to follow new regulations and adjust their ships accordingly. The new generation of ultra efficient mega ships is credited with lowering greenhouse gas emissions. The Triple-E class ship enables these largest container ships to produce 20 percent less CO2 per container moved, compared to Emma Maersk and 50 percent less than the industry average on the Asia-Europe trade lane.

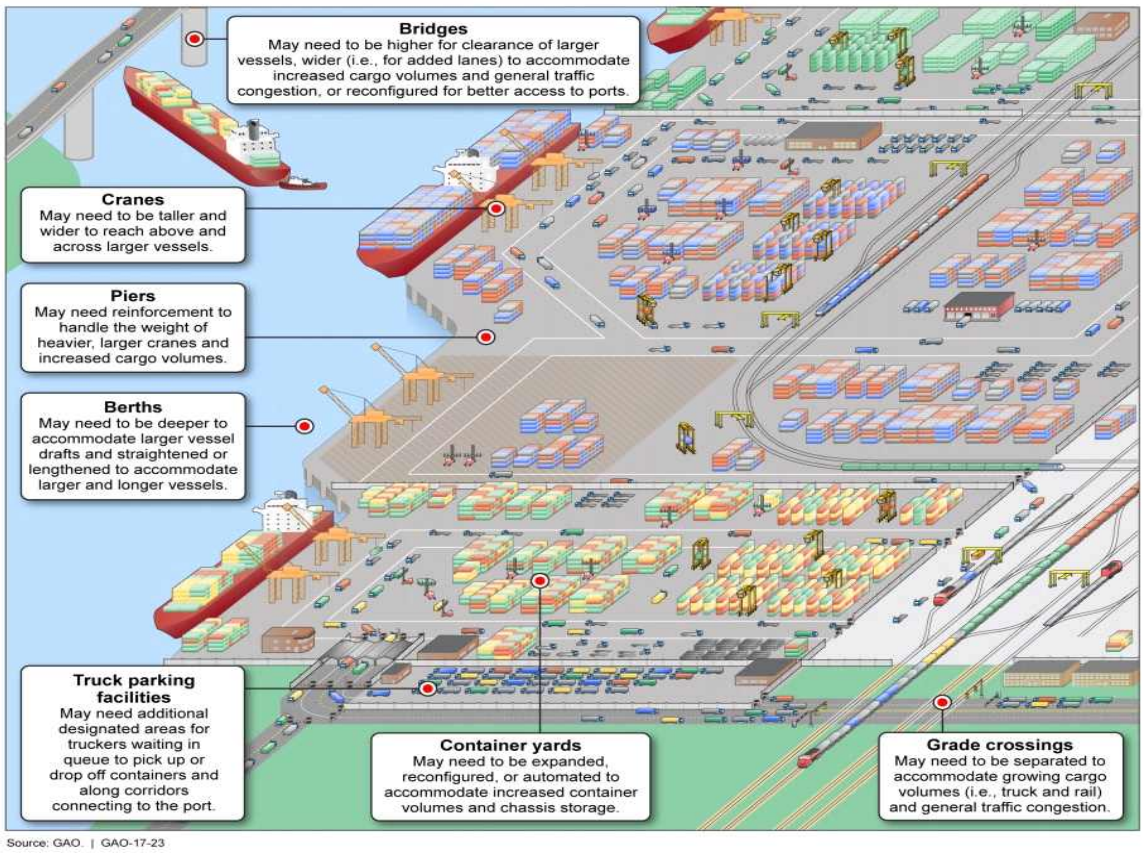
3.2. Cons of Impacts of mega Containerships

3.2.1 Port Problems

Mega container ships pose big challenges for container ports and require adaptations. There are four types of major problem on port facilities when mega container ship enters to port.

Firstly, the draft limitation is most common problem because most mega hub ports do not have enough draft which mega container ship can berth easily without any draft limitation. Dredging and maintaining the access channel and fairway can be the effective solution for entering mega container ship. However, high cost of dredging will contribute to the total cost and dredging would be postponed considerable time.

Secondly, new larger and higher crane or crane enlargement can be another factor escalating the lack of port facilities. Mega ships pose challenges to cranes in terms of outreach width and height. In the past, if you want to increase loading or unloading productivity of a container vessel, it is not difficult to raise the loading speed by adding one or two gantry cranes. However nowadays, with the wide crane outreach and crane height for mega container ship, crane can no longer be added. Therefore, it will be the challenge to handle an effective operation with such mega container ships at port.



Source: Better Supply Chain Information Could Improve DOT's Freight Efforts(2016)

<Figure 4> Types of Potential Waterside, Terminal, and Inland Infrastructure Constraints on Cargo Movement at Major West Coast Ports

Thirdly, the limited berth size is other cons for mega container ship. In many ports, quay walls need to be heightened, strengthened and lengthened for mega ships to have the capacity to accommodate the largest ships and the forces they exercise when these are berthing and moored. Because the mega ships are also less flexible in port area, they have limited choice to come along side berth with their side, so it may result in longer time stay in port and also will negatively affect economies of scale. Nonetheless, it has limit ports that vessel can call. Mega container ships have to choose hubs and spoke system and it inevitably leads to the feeder and transshipment costs for ship owner.

Fourthly, the limitations of ports and land-side operations inhibit the cost-savings of mega container ships. Big ship carriers often expect that terminals should be able to completely unload mega ships within a day. This imposes challenges on ports and stress the whole logistics chain has to bear. The increased demand on turnaround time has to be satisfied by ports. Mega container ships introduce new levels of congestion and activity and require more land, and more labor or higher port automation.

Finally, large size hinterland facilities and hinterland infrastructure are needed for mega container ships in port. Hinterland is the area of land behind or around harbour, it has various types of facilities related to operate container including container yard, warehouse, and road/railway for land transportation. Therefore, hinterland connections influences to the container operation directly. If hinterland connections facilities cannot adapt with the growth of mega container ships, it will give rise to the port congestion problem. For the container shipping line, reliability of service is very important factor, and port congestion is one of factors which make the container line become unreliable. In fact, it takes some time and needs a lot of investment for the port and hinterland to be able to offer high quality service to maximize the utilization rate and minimize time in port where diseconomies of scale happen.

3.2.2 The Imbalance of Trade volume and Uncertainty of Global Economy

Due to the strong growth rate of economy in China, and the some emerging of Asian countries, the trade imbalance is still maintained in the major east/west and north/south trade routes. Almost 50% of containers were leaving North America and 20% in Europe were empty according to ISL(Institute of Shipping Economics and Logistics). It leads to the cost of container shipping line. In addition, if the increase of fuel oil prise, it will have negative impact on the variable shipping and the total costs of the ships(investment, fuel etc.) were doubtful, many shipping lines have decided to reduce speed and find other solutions to reduce fuel consumption. Moreover, the uncertainty of world economy is a problem, the weakening of the US economy may reduce consumer demand.

3.2.3 The Larger Risks and Environment Impact

The bigger the ship is, the larger the risk is. The value of goods transported by container

is getting higher and higher, therefore in the event of accident, the loss of huge amount of cargo will be the lost for container ship owner, cargo owner and insurance company. The loss of the MSC Napoli that carried 4,500 TEU box was a third of the size of the largest vessels in that time and is already the second most costly maritime insurance casualty after the Exxon Valdez. Therefore “the larger the ship, the more costly it is to insure, and then there is the matter of ship safety and security risks, Furthermore, the environment will be threatened by a possible huge the oil spill because the quantity of fuel oil of mega container ship is equal to that of a small tanker.

3.3. Implications on Ports of Impacts of Mega Container Ships

3.3.1. Size of Ports and Terminals

Growth of container ship size affects to size growth of ports and terminals. The most important factors for ports of mega container ships are ship’s draft and length. Dredging of berths and channels and construction of quay walls give rise to a vast investment costs, not to mention planning and environmental hurdles. Wider beams of mega container ship are easier to deal with, but longer outreaches gantry cranes had to be installed. Big gantry cranes are somewhat expensive, so they are generally to install in a new berths or deeper water. Even ports like Hamburg and Antwerp with significant draft and tidal restrictions due to long river passages are still very much in the mega-ship game. Hamburg and Antwerp had seen calls by the 15500 - 16,000 TEU class.

3.3.2. Cranes are also getting bigger

The 18,000 TEU ships are getting wider though, so outreach width and height of crane is becoming more critical. The Triple-E vessels are 23 boxes wide, whereas the Maersk E-class is 22 wide and the CMA CGM Marco Polo class is 21 boxes wide. However, most of the major ports on the Asia-Europe route, including wayports in the Mediterranean, Middle East and Indian Subcontinent, have already deployed cranes able to cope with wider rows, or are taking steps to do so. If a gantry cranes in wayport terminal only have outreach for 20 boxes, ships can be stowed to cope with this if necessary. But crane height is also a significant issue, together with outreach, and some hub ports are currently investing in raising the height of some of their existing cranes.

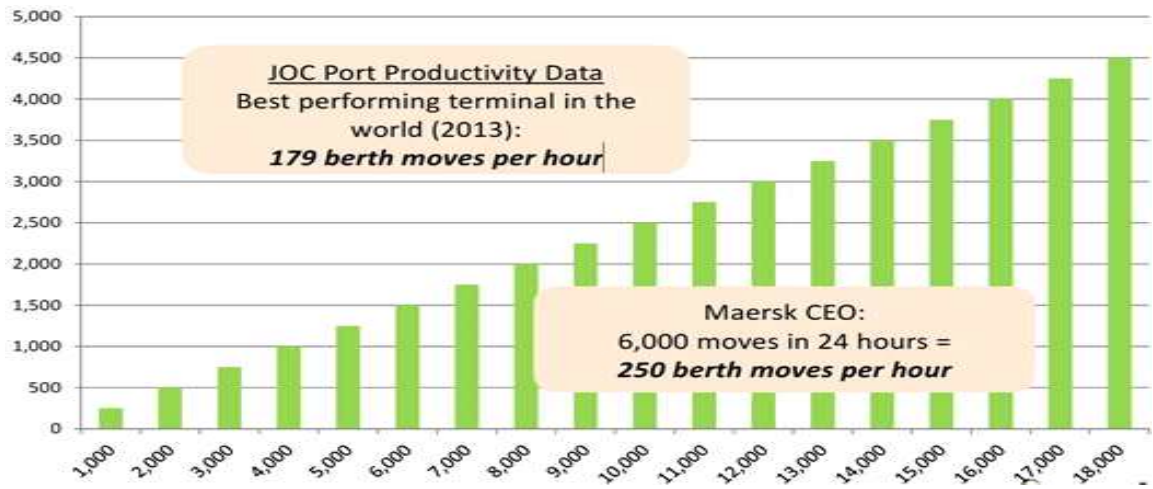
3.3.3. Needs for higher terminal productivity

To attract large container ships, securing high terminal productivity is critical factor to customer(container lines). If handling productivity is not high enough, mega vessels to call at the terminal takes so much time and resources to process work that the benefit of a mega container ship operations offset or rather worse. As the container terminals grow larger, the

quantity of containers and equipment that must be managed surge and operational complexity rises exponentially. There is a great possibility that productivity decreases down somewhat extent if manage the whole terminal by the existing system or the manpower. The expansion of the terminal facilities and terminals for the mega container ships, therefore, ultimately will have an interest in the terminal automation system more and more.

3.3.4. Handling peak time volume

Bigger ships lead to bigger peaks in container ports. This is the result of reduction of call frequency and higher volume size per call - more containers loaded and unloaded per ship in the same port. This means that the container handling moves per ship increases with larger ships. This causes peaks three different stages of the container handling process - ship to shore handling, yard operations and for the interface between the yard and hinterland transport. For the economies of scale to work, shipping lines either need to reduce the number of port calls or they need to get handled faster by increasing berth productivity. With larger vessels, the importance of fast handling becomes even more important.



Source: Tina Liu(2015)

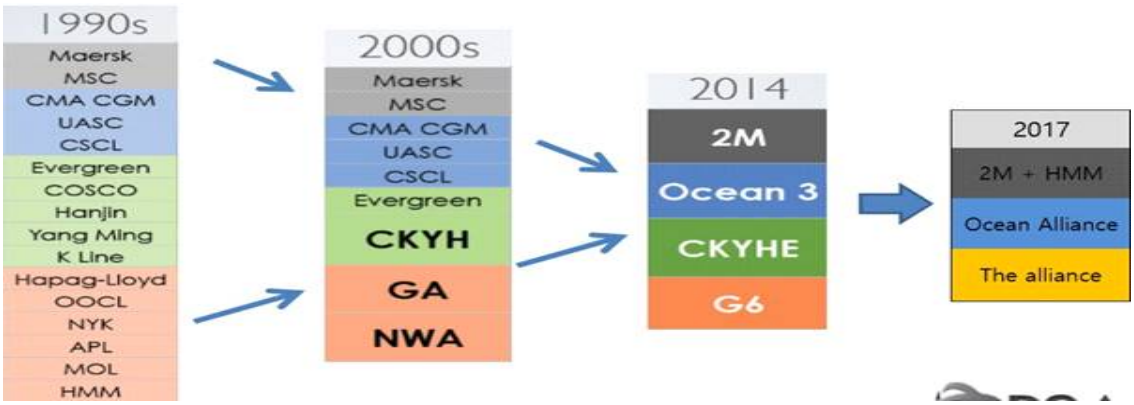
<Figure 5> Vessel call volumes and handling speeds

The average ship turn-around time of world container ports is one days now. The majority of world container ports manages to achieve average ship turn around lower than two days, most ports in Asia even lower than one day. Mega container ships generally suppose to be stayed approximately 20% longer in ports. Mega container ships can be defined as container ships with 150,000DWT at least, which translates roughly in container ships with TEU capacity larger than 13,300 TEU.

3.4. Proliferation of carrier alliances

Ever mega container ships also intensify the pressure for more alliances and cooperation between carriers in order to fill their ship holds with containers, and so ports and terminals are confronted by the challenge of more collection of containers. The Asia-Europe trade route, for example, did have just three main players - Maersk Line, MSC the operating alliance of and the Ocean Alliance(CMA CGM+ APL, China COSCO, Evergreen, OOCL), The Alliance(Hapag Lloyd+UASC+Hamburg Sud, NYK+K Line+MOL).

While there are some of individual carriers within global container market, in terms of ship operations they are joined together. While it is important to note that not all of this containers has to be accommodated in one port or terminal, the increasing concentration of alliances clearly has an serious impact. And the cascading effect of larger vessels onto other East-West and North-South trade routes will inevitably increase the pressure for more alliances, and in turn concentrate volumes for ports and terminals. For example, the each alliance has extended its cooperation to include the Asia-East Coast North America route and emerging latin america route. This will see the top three liner companies, Maersk Line, MSC and CMA-CGM are cooperating operationally on all three East-West routes – Asia-Europe, Transpacific and Transatlantic.



<Figure 6> Shipping Alliance transition over time

More complicated issues still are ports where there is a mix of gateway and transshipment containers. There is several critical factors considered such as availability of terminal capacity, ship size, contractual commitments, terminal share holdings and so on. Then there is disposed to use its related terminal company – Maersk Line tends to be at arm's length to APMT, and CMA CGM closer still to Terminal Link. These are complex issues that will take time to work through and more collaboration between shipping lines will surely follow and with it some degree of rationalization of port and terminal choices.

4. Directions for Korean Shipping and Ports of Mega Containership

4.1. Fostering Korean global container lines

The Korean government plans to support every possible efforts to foster Hyundai Merchant Marine, which become the nation's global container carrier due to the bankruptcy of Hanjin Shipping, into one of the world's fifth container shipping companies. New SM(Samra Midas) Shipping would become the second largest container carrier with 110,000 TEU capacity after HMM with 455,000 TEU capacity.

With respect to this, the government plans to leverage its 2.6-trillion-won ship fund and the Korea Ship Co. with a paid-in capital of 1 trillion won to help HMM secure viable ships, aimed at escalating the rank of the company which is now positioned at No. 13 within a short period of time(The Korea Economic Daily, 2016).

Meanwhile, Japan's three major container lines(Nippon Yusen, K Line, and Mitsui O.S.K. Lines), decided to consolidate their container shipping business to establish the world's sixth-largest container line until April in 2018.

To help Korean container shipping lines, including Hyundai and SM, secure new ships, the government decided to double the size of its ship fund from $1.2 billion to $2.4 billion. HMM plans to use the ship fund by the end of 2016 to place orders for ultra-large containerships. As HMM will join the world's largest container shipping alliance - 2M, government proceed the current support plans in order to promote HMM as a global leading container line.

4.2. Korean global container lines had to join major Alliance

Alliances have become increasingly important in the global container shipping industry. Container lines seek to minimize operational costs by partnering and working together in alliance members. Members share ships and terminals, networks, and port calls. This partnerships are the equal of airline alliances in the aviation area. So Korean container lines had to join major alliances.

In practice, sharing vessels allows container ship alliances to operate without having to increase the number of ships. In the 2M alliance, for example, MSC and Maersk can use their partner’s vessel space. Container lines benefit by being able to offer a level of service they simply cannot cover with only their own ships as a single shipping loop can tie up a vessel for weekly service.

With their combined volume, major alliances have power over ports and can pressure them for more favorable conditions and improved services. The size of alliances allows them to negotiate better cargo handling tariffs at ports and push for discounts for volume. In contrast, the smaller, independent lines end up having to pay higher charges. The power of shipping alliances is an incentive for ports to stay competitive, as they have little means to reward loyalty. The smaller lines that reap the greatest benefits without having to increase their fleet, can access to greater geographic coverage. As alliances pool their containers on larger vessels, the savings quickly add up as mega ships are much more fuel-efficient.

Shippers may need to contract across alliances, not carriers, to manage risk. Because

container lines share vessels within their alliances, shipping with two different carriers might not guarantee that you are shipping on two different vessels. And shippers may be able to arrange for additional sailings from his carrier because he have access to other vessel within the alliance.

The extent to which several GTO(global terminal operator) collaborations are being driven by the increasing size of both ships and shipping alliances is not clear, but what is evident is that bigger ships and bigger alliances increase the challenges and risks for GTOs. GTOs, whilst competing strongly with each other in many places, are also increasingly opting to cooperate in selected locations.

The growth in ship size and alliances means less ocean carrier product differentiation as far as shippers are concerned. Container terminals will retain service differentiation by way of factors such as service levels, infrastructure, location and inland connectivity. The physical and commercial consolidation of terminals is another trend to overcome this complicated situation.

4.3. Shipping Lines had to cooperate on land-side operations

Shipping lines had to realize that they need to cooperate more with respect to land-side operations, because this is where more cost savings are to be possible. For example, the Ocean Alliance has five different cargo interests on one vessel, all of which might have different terminal and intermodal interests. When container comes to intermodal yards, the rail lines will need to deal with the additional volumes which they must work with five different shipping lines. We can find the case at US West Coast where the port terminals are mostly in the hands of the shipping lines. Due to the appearance of a few alliances, an important share of the vessels are now shared with alliance partners, but the vessels still call at each individual terminal because of their links with the individual shipping company. For example, in Los Angeles, five of the alliance members have their own terminal assets.

Similar situations exist in ports elsewhere in the world (e.g. Hong Kong). Each carrier has a strong incentive for their vessels on a service to call at their terminal, because terminal costs are not shared, because the approach to terminals can be different and because it would lead to difficult negotiation within the alliance on rates to be charged to alliance partners.

On land-side, alliances split into individual lines with their own terminal agreements, trucking contracts, management, and arrangements. Individually, the lines lose the scale merit. In near future, we can see changes that alliances negotiate and work to overcome operational difficulties and reduce the overall cost for land-side operations. Joint operations of shipping lines on land can be included:

Terminals: Container shipping alliances use several container terminals within the same port. Connecting one operation systems and one management teams, alliances can effectively merge several terminals and operate as if they were one. The end result would be an

increase in efficiency and reduction in turnover times.

Rail: Working together on intermodal rail transport, alliances can benefit from improved logistics flow and supply chains. It also allows them to manage rail freight volumes through a single intermodal company instead of having to rely on different agreements with each shipping line.

Trucking: The combined volumes gives alliances the advantage of lower trucking rates. Through a more centralized truck planning and dispatching management, transport costs and times can be reduced.

	Berths	Operator	Ownership
1	100	China Shipping (CS)	CSCL
2	121 - 131	Yang Ming (YM)	Yang Ming
3	135 - 139	TraPac (TP)	MOL
4	206 - 209	Port of LA (POLA)	Port of LA
5	212 - 225	Yusen (YTI)	N Y K Line
6	226 - 236	Seaside (STS)	Evergreen
7	302 - 305	Eagle Marine Services	APL
8	401 - 404	APM Terminals (APM)	Maersk
9	405 - 406	California United (CUT)	Hyundai
10	T130 - 140	Total Terminals (TT)	Hanjin
11	G226 - 236	International Terminal (ITS)	K Line
12	F6 - 10	Long Beach (LBCT)	OOCL
13	Piers J,A,C[1]	SSA Terminals (SSAT)	Carrix

Source : Drewry research, McKinsey & Co(2015)

<Figure 7> Alliance Members operate Their Own Terminals(Los Angeles Port)

More cooperation of shipping lines on land operations could take various forms, possibly in the form of equity stakes in port terminals and ports. So Korean container shipping lines had to be active in developing hinterland transport operations, they might do this more jointly with their alliance partners. It could be in the interest of supply chains that shipping lines internalize the costs that they cause by ordering mega ships.

4.4. Cooperation between terminal operators

Bigger container ships are resulting in much greater peaks in container terminal activity, which together with the large combined volumes of bigger alliances, demands fewer, larger terminals in each port. The knock-on effects of bigger ships and alliances are already becoming apparent. Terminal operators had to react by consolidating terminal layouts and ownership and by working more closely together.

The effects of terminal cooperation and consolidation will differ from place to place, and general guidelines are not straight forward. A reasonable extent of competition between port

terminals is clearly in the public interest, also because competition between ports is in many places limited because of their natural gateway functions that cannot easily be replaced by other ports. In coopetition the ports focus on their individual strengths and weaknesses and segment their service offerings in order to attract new customers. An underlying threat is that one of the cooperating ports is strengthened on cost of the other without sharing revenues. In contrast a big opportunity is to generate competitive advantage against other rival ports.

At the same time, mega ships would sometimes suggest the consolidation of certain terminals, for example, in order to create the required berth lengths or yard space. Sometimes, port related laws are restrictive in the terminal extensions. The alternative is relocation of part of the port, which could be disadvantageous to incumbent port terminal operators, considering that they are frequently excluded from bidding for reasons of competition. In some countries with terminal fragmentation, port laws would need to be evaluated in order to assess if the legislation is “mega ship ready”.

Busan Port Authority(BPA), for example, will continue to exert all efforts to strengthen marketing activities for alliances, to integrate fragmented container terminal operations for flexible inter-terminal transportation, to carry out efficient incentives, and to attract containers from Asian countries’ transhipment cargo.

4.5. Coordination of port development and investment

The power balance between shipping lines and ports has shifted towards shipping lines. This is partly related to the container shipping alliances, which has taken place at a much faster pace than consolidation of ports, which remains exception rather than common practice. While ports have to attract three major alliances, the carriers have a wide choice of ports where they could call. In many cases, shipping lines seem to keep certain direct calls to smaller ports going in order to keep their options of possible ports to call large enough. Many ports are quite focused on one or major shipping line or alliance. If a large volume carrier or alliance would stop to call the port, this would result in a large decline in port volume. This gives the shipping line strong bargaining power vis-à-vis ports, only enforced by the fact that carriers have movable assets, whereas the assets of ports are highly fixed.

Ports that wish to accommodate mega carriers have to adapt to their huge dimensions. The harbour basins have to be wide and deep enough for a mega carrier to turn without any problems. The container gantry cranes also have to have sufficient outreach to load and discharge a container ship across the entire width. The larger the vessel, the higher the costs for the ports – for infrastructure (approach and entrance, turning basins, mooring basins, quay walls) and for super structure. As a result, ports grow into mega ports with terminals growing in size, channels being deepened to accommodate mega ships, and multi-modal transportation options being added.

Higher productivity is a much greater take-up of terminal automation, particularly yard automation. Automated terminals are over 50 in the industry, and most automated terminals

are really only semi-automated. Most automated terminals that are under development worldwide are focused on ASC(automated stacking crane) designs. These allow for not only the cranes to be automated, but also the horizontal transport. Container terminals automation is needed for fast and concise container handling operation of peak volume within a day. Robotically operated yard equipment is the highest profile aspect of terminal automation investment.

5. Conclusion

The container shipping market is saturated but mega ships are running major container routes and this affects ports and terminal operators. While container lines squeeze out on profit margins and fiercely compete on price, the leading terminal operators also feel an increased pressure on performing better, faster and cheaper than their competitors.

Mega ships bring more infrastructure costs as ports have to adapt. Yet investors are the ones bearing these costs. Mega carriers exert a huge power over ports as they can threaten to shift their cargo elsewhere if they don’t receive favorable rates and conditions. Some lines assume that advantages and disadvantages of mega ships will calibrate themselves with the next generation of 24,000 TEU vessels.

Close collaboration between ports and shipping lines begins and ends with good communication. To end up in a win-win situation, ports and shipping lines need visibility and close alignment of each other’s operations. One way to achieve this is to rely on joint planning – i.e. optimising cargo flows from end-to-end. Smart joint planning could improve reliability, on-time performance, and cut transportation costs.

Aiming to drive down unit costs and improve profitability, ship lines have been giving an impetus to a rapid increase in the size of container vessels ordered since 2009. But according to Drewry’s latest study, while these larger ships help carriers reduce voyage costs, savings are increasingly offset by higher port and land-side costs, meaning that total system cost savings are small and declining.

Some ports had to cooperate between terminal operators in order to collectively fund projects and increase terminal capacity needed to gain business from mega-ships. Port investments and improved productivity are necessary to carry future growth. And hinterland infrastructure has to be developed simultaneously to avoid port congestion and peak demand problems.

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