Implications posed by Mega ships to terminals

Nov 5th, 2015

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1. Background of the rapid growth in container ship sizes and the formation of alliance

- The financial crisis of 2008 followed by the downturn in the shipping market coupled with the high bunker price have turned the cost-cutting into a core competency of container lines.

- Much can be accomplished through the deployment of mega ships as it enables container lines to reduce unit costs spent for maritime transportation of containers.

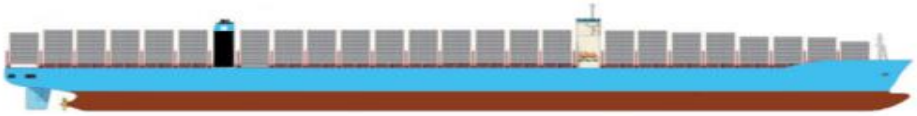
- Container ship capacity has doubled over the last 10 years, rapidly reducing the unit cost for maritime transportation of containers down to one third of the previous cost.

- As a breakthrough to overcome the severe downturn of container shipping market , liners seek to realize economies of scale through the formation of mega alliance.

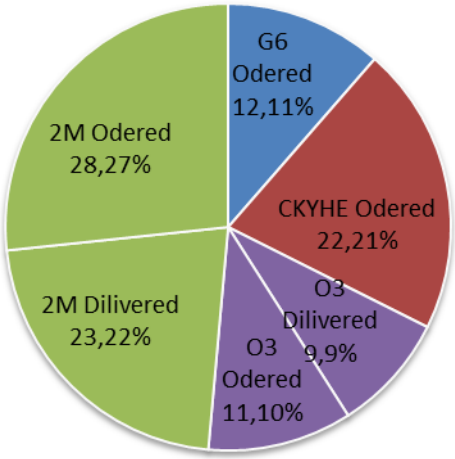
- Despite the failed P3 Network, the formation of mega alliance is the predominant trend enabling carriers to achieve economies of scale, as evidenced by 2M, O3, G6, CKYHE.

2. Evolution of mega ships

❑ Recent Mega ships and Newbuildings

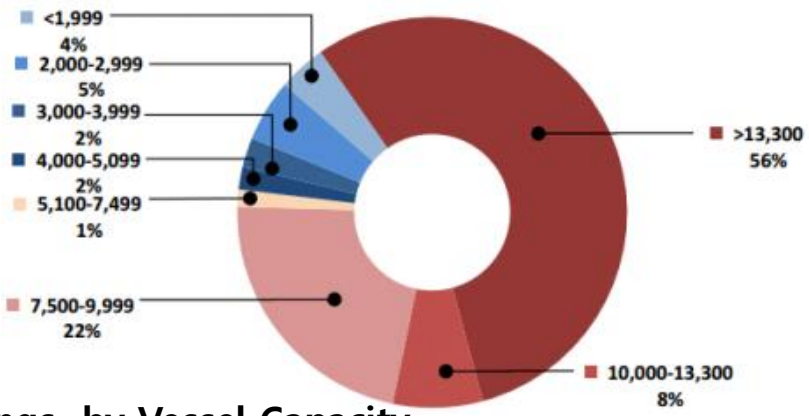
		TEU (declared) tdw	LOA m	Breath m	Draft m
BARZAN 6 units in series from Apr 2015		18,800 teu 199,744 tdw	400.0	58.6	16.0 UASC Hyundai Samho/Hyundai H.I.
MSC OSCAR 12 units in series from Jan 2015		19,224 teu 197,362 tdw	395.4	58.6	16.0 MSC Daewoo (DSME)
Maersk 'EEE' 20 units in series from Jun 2013		18,340 teu 194,153 tdw	399.2	59.0	16.0 Maersk Daewoo (DSME)

Source : ALPHALINER



Newbuildings by Alliance
(Proportion by the number of vessels)

Over 18,000 Teu vessels totals 105 units



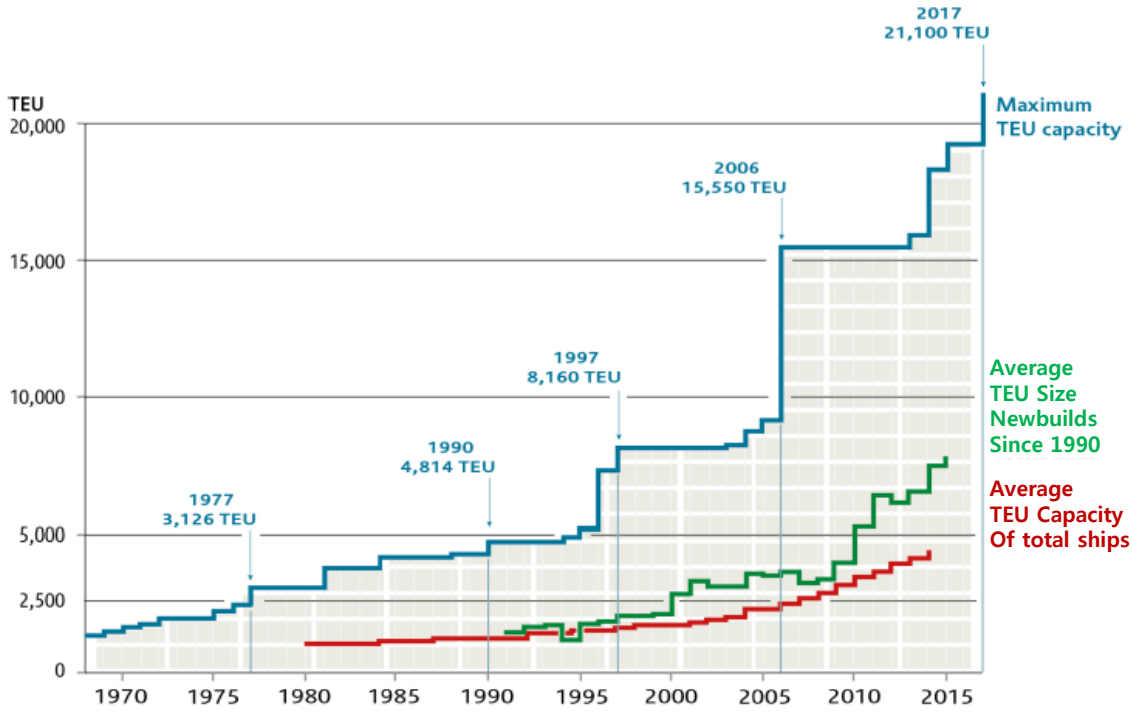
Newbuildings by Vessel Capacity

2. Evolution of mega ships

❑ Evolution of mega ships

- Unlike other merchant ship types, the capacity of container ships have dramatically increased after year 2000.

- For the past 10 years, the average TEU capacity of container ships have doubled and the most recent mega ship delivered reaches to 19,200 TEU.



Source : Clarkson Research Services

2. Evolution of mega ships

❑ Specifications of the largest container ships

Source : MEGA-SHIP READY

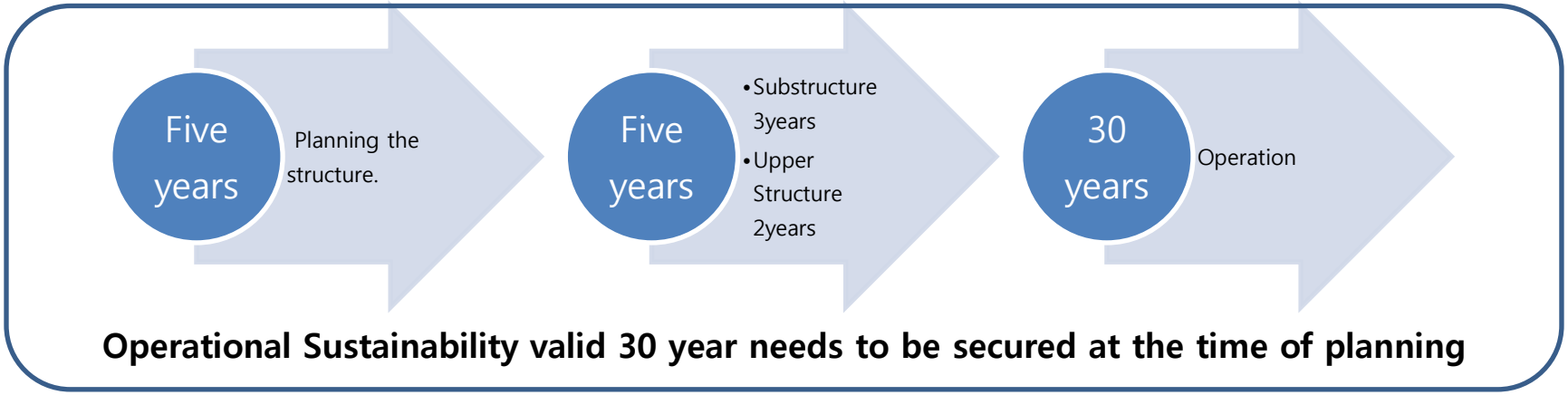
Year	CAPACITY (TEU)	LOA (M)	BEAM (M)	Draft (M)	Tier (H/D)	GROWTH	
						LOA	BEAM
1974	2400	239	30.0	10.5	8/6	-	-
1981	3600	267	32.3	12.5	8/6	12%	8%
1988	4800	294	32.3	13.0	8/6	10%	0%
1995	6,600	318	42.9	14.5	9/6	8%	33%
2001	8,724	352	42.9	14.5	9/7	11%	0%
2006	15,500	397	56.5	16	11/9	13%	32%
2013	18,000	400	59.0	16	11/10	1%	4%
2020	24,000	456	63.9	16	12/11	14%	8%

- Carriers struggling to achieve ‘economies of scale’ have continuously enlarged the vessel size at a rapid pace.

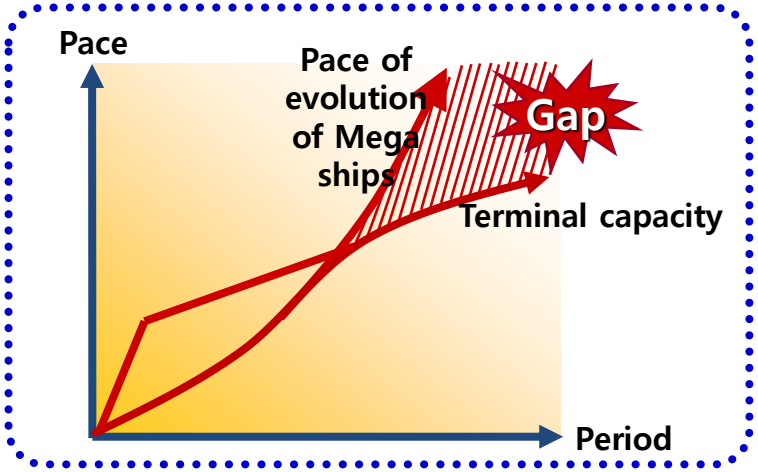
3. Implications of mega ships on container terminals

❑ Implications on newly developed terminals

■ Features of Container terminal development



■ Challenges posed to the existing container terminals



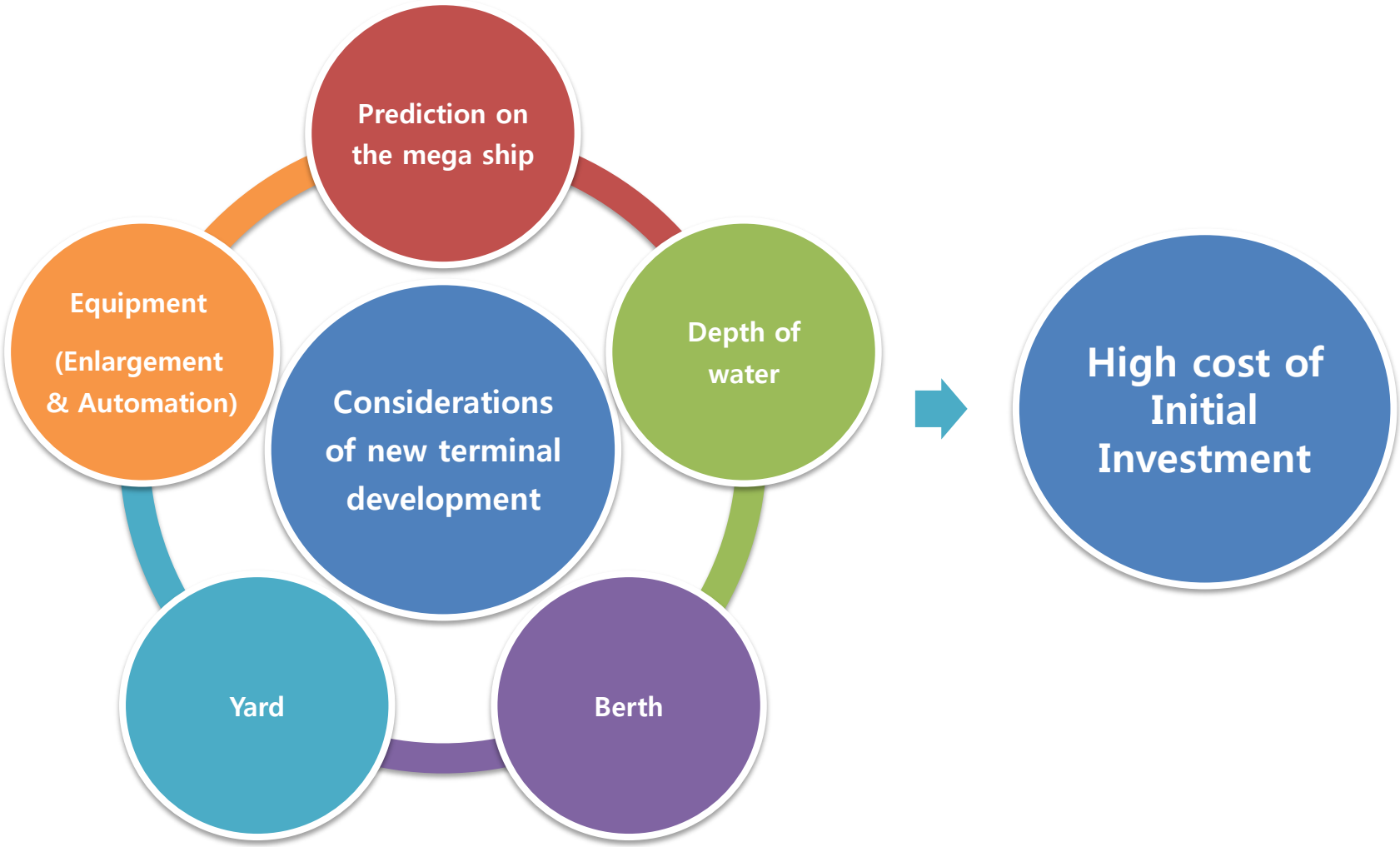
Rapid growth of container ship size makes an ever widening gap with the capacity of the existing container terminals.

→ The development of container terminals taking more than 10 years is not structured to catch up with the growth of the ship size.

→ Appearance of mega ships poses an overwhelming challenges onto the existing terminals.

3. Implications of mega ships on container terminals

❑ Implications on newly developed terminals

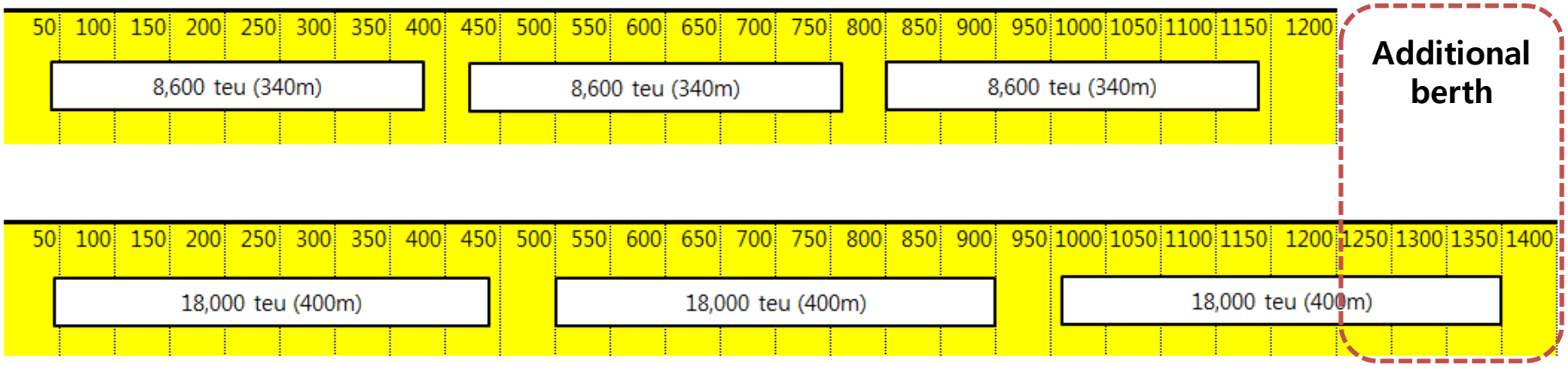


3. Implications of mega ships on container terminals

❑ Implications on the existing container terminals

- Premise : ① 3 berths totaling 1.2km
  ② 12 super post panamax Q/C
  ③ 38 yard cranes
  ④ 55,000 TEU yard capacity

■ Berth



- Reinforcement of berthing facilities (draft, fender and bollard, etc) is prerequisite.

3. Implications of mega ships on container terminals

■ Yard

▶ Moves by container ship size in terminals

Category	Ship Size	Container Moves		Remark
		VAN	TEU	
Actual	8,600TEU	3,144	4,936	- TEU Factor 1.57
	13,000TEU	5,523	8,671	
Future	18,000TEU	8,226	12,915	
	20,000TEU	9,307	14,612	

▶ Index in Yard by container ship size

Category	Estimated Yard Stock TEU at Peak	Estimated Occupancy Ratio at Peak	Tiers at peak	Productivity Drop Ratio	Remark
13,000TEU	38,500	70%	3.7	-	- Based on the terminal handling 2.4 mil. TEU per year
18,000TEU	42,744	77%	4.1	-9.5%	
20,000TEU	44,441	81%	4.3	-12.8%	

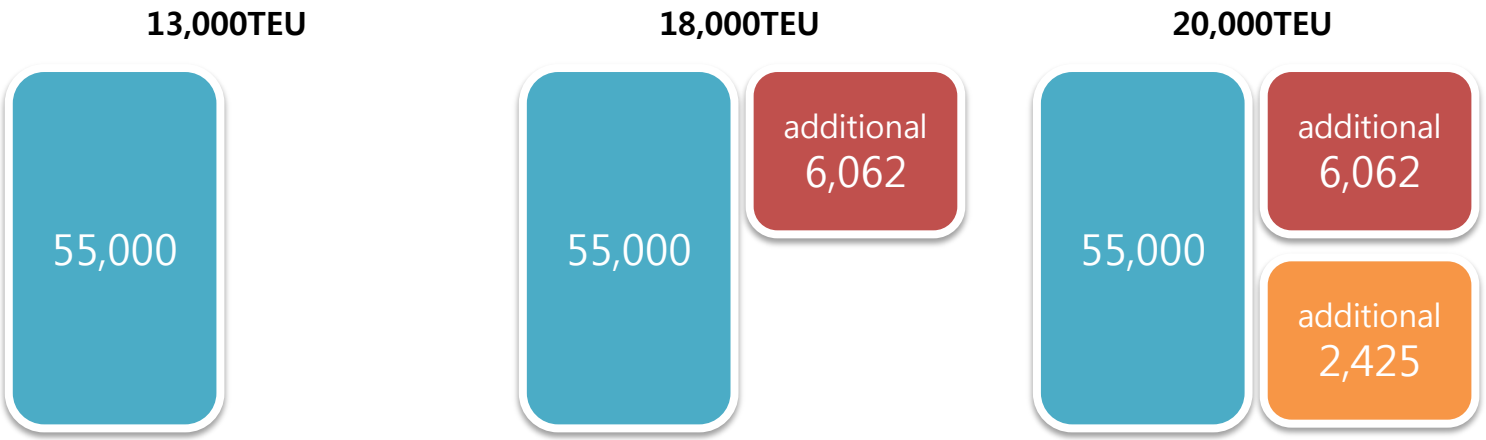
- Productivity is seriously affected by the yard congestion caused by mega ships.

3. Implications of mega ships on container terminals

■ Yard

▶ Solutions to cope with yard congestion

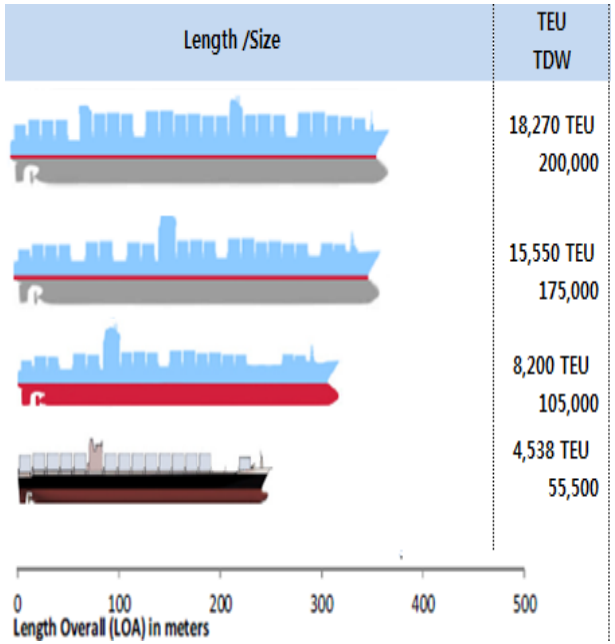
Category	Yard Capacity	Increase	Difference	Ratio
13,000TEU	55,000	-	-	
18,000TEU	61,062	6,062	+ 11.0%	
20,000TEU	63,487	8,487	+ 15.4%	

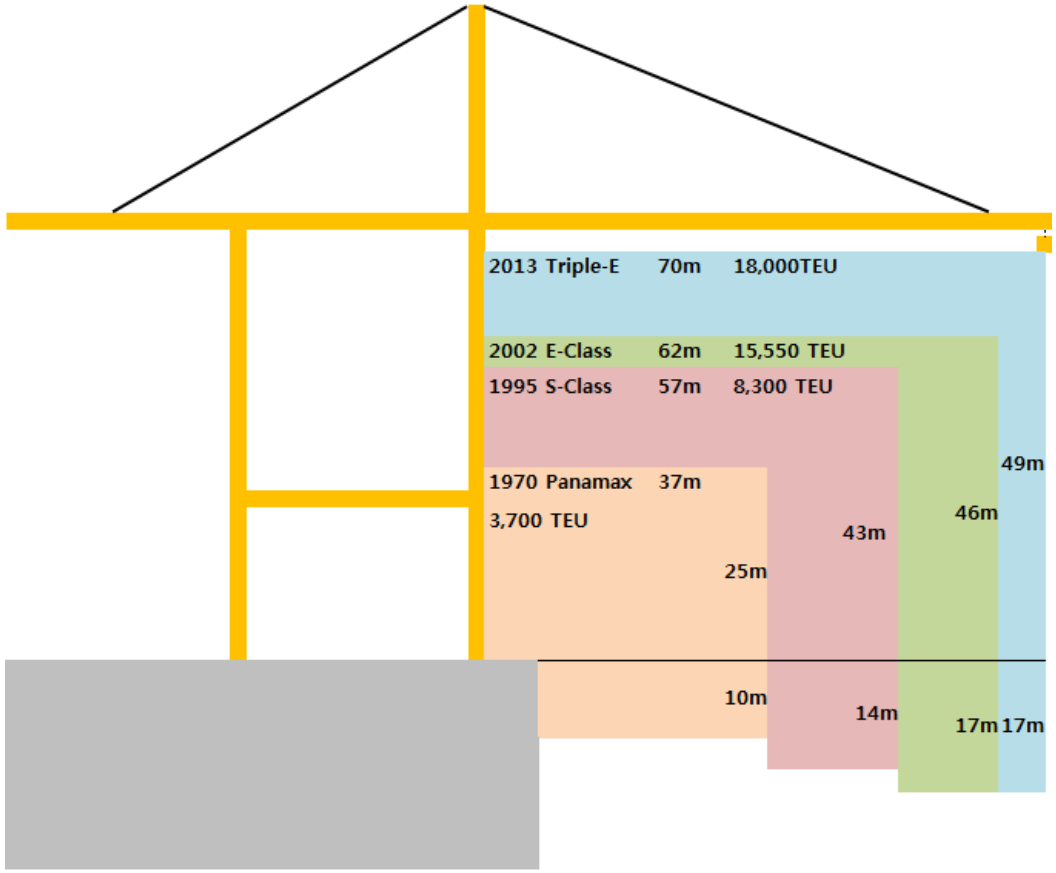


3. Implications of mega ships on container terminals

■ Equipment

▶ Bigger Cranes are a must





- The growth in ship size inevitably leads to the equipment enlargement on berth. The most modern type of quay crane is the super post panamax crane with the outreach that can handle 24 container rows.

3. Implications of mega ships on container terminals

■ Equipment

▶ Deteriorating productivity

Ship(teu)	LOA(m)	Breadth(m)	Row	Hold tiers	Deck tiers	Productivity Drop Ratio	Remarks
20,000	400	60	23	12	11	-9.7%	
18,000	400	60	23	11	10	-7.6%	
13,000	370	48	19	11	9	-	
10,000	350	45	18	11	7	-	
8,000	340	46	18	9	7	-	

- Vessels below 13,000TEU capacity has similar specifications in terms of beam and container rows on deck, which experiences a dramatic change upward from 18,000 TEU vessel resulting in the seriously deteriorated productivity.

3. Implications of mega ships on container terminals

■ Equipment

▶ Additional equipment

(3berths, same productivity)

Category		13,000TEU	18,000TEU	20,000TEU	Note
QC	Required	12	12.9	13.2	
	Difference (addition)	-	0.9	1.2	
Yard Crane	Required	38	42.0	43.6	
	Difference (addition)	-	4.0	5.6	

- To maintain a similar productivity for the mega ships, additional quay cranes and yard cranes are needed.

3. Implications of mega ships on container terminals

■ Summary

Category	Berth Length Additionally Required	Yard Capacity	Equipments additionally needed		Remarks
			QC	Yard Crane	
13,000TEU	-	-	-	-	
18,000TEU	+ 200m	+ 6,062 TEU	+ 1	+ 4	
20,000TEU	+ 200m	+ 8,487 TEU	+ 2	+ 6	

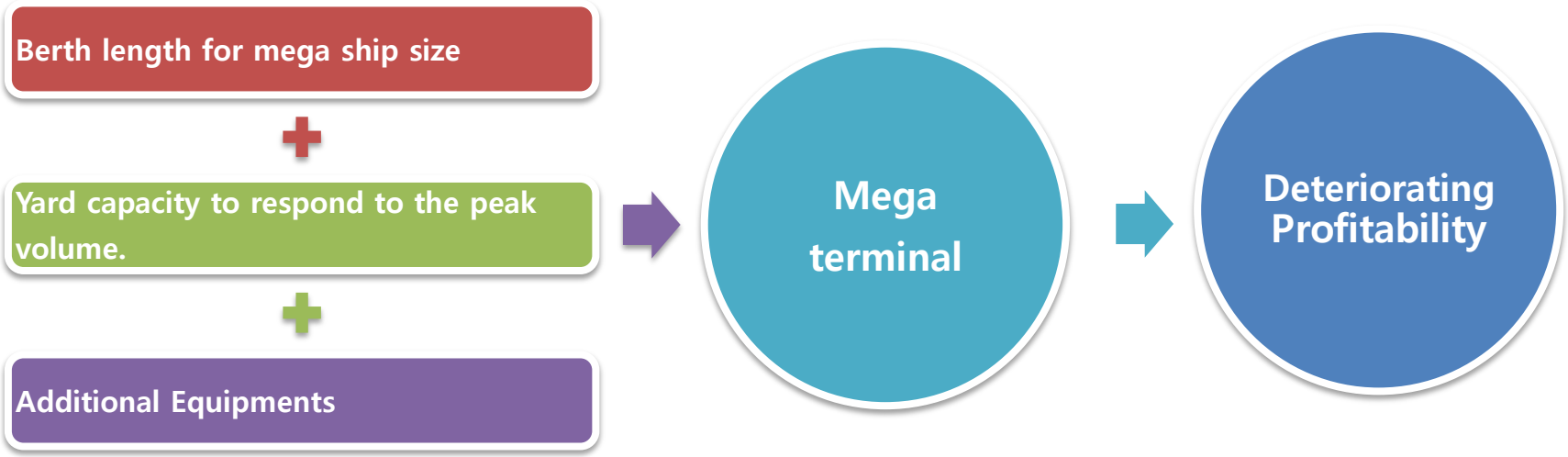
- The growth of Ship size gives a serious impact on the terminal productivity.

- Additional Investments on facility, equipment and manpower are inevitable to tackle the issue of reduced productivity and yard congestion.

4. Challenges posed to container terminals and the outlook

❑ Issues

- The rapid growth of container ship size and formation of alliance deteriorates profitability as the massive initial investments are required to handle tremendous increase of the volume.



- The reinforcing bargaining power of shipping lines through the formation of alliance makes it impossible to secure stable and seamless terminal operation.

4. Challenges posed to container terminals and the outlook

❑ Profitability Simulation

$$I \times R^n \leq \sum_{i=1}^{n} \{(A \times B) - C\}^{i-1} \times R^{n-i}$$

n = payback period(year), **I** = Total investment, **R**= Interest rate, **A** = Throughput, **B** = TEU tariff, **C** = Operation cost

Category			Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Flexible Factor	CPI	Tariff	2%	2%	2%	3%	3%	3%
		Operation	3%	3%	3%	3%	3%	3%
	TEU cost (10 thousand won)		4	5	6	4	5	6
	Labor cost (0.1 billion won)		0.5	0.5	0.5	0.5	0.5	0.5
Payback period			-	27years	16years	66years	21years	14years

"-" means impossibility of payback period in 70years

4. Challenges posed to container terminals and the outlook

❑ Outlook

■ The existing container terminals

- Joint operation of berths between the neighboring terminals to effectively accommodate mega ships is needed.

- Merger and Acquisition amongst neighboring container terminals.

■ Development of new terminals

- To streamline the terminal function by operating a interlinked hinterland for repairing, cleaning and stacking of “empty containers”.

- Through this separation of function, to make terminals focus on its original function of loading/unloading and stacking of full containers, releasing the high pressure on the infrastructure, yard and equipment.

- High cost of the initial investment is also expected to prompt diversified developments of terminals, where each different size of terminal is built to accommodate a various type sizes of container vessels.

4. Challenges posed to container terminals and the outlook

❑ Recommendation

- Huge cost burden arising from the enhanced infrastructure and equipment required to accommodate mega ships shall be ultimately passed onto the carriers.

- The economies of scale and cost savings effects realized through adoption of mega ships and formation of alliance can be largely offset due to this.

- This strong interconnectedness between mega ship and terminals requires lines to consider closely the possible implications on terminals in the design and deployment of mega ship in the future so that economies of scale may not turn into the unexpected disadvantages of scale and cost savings may not turn into cost burden.