

INVESTMENT  
OPPORTUNITIES  
IN KOREA

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# Shipbuilding & Marine



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\* Figures on the report show the likely adjustment of average yearly currency rates from Korean Won (KRW) to the US dollar (USD). A rate adjustment is adopted particularly reflecting the recent average market variations to eliminate the valuation effects arising from movements in exchange rates in case when the data expressed shows an annual growth rate on the paper.

\* Rate adjusted figures are rounded off, but the sum is correct down or up to the decimal when the rounded values are not equal to the adjustment.



# 1 Industry Trends

## Definitions and Features

- (Definition) The shipbuilding and marine industry is a knowledge-based, eco-friendly/ ICT composite engineering industry established to develop, design, and build various small, medium, and large vessels, along with equipment for shipbuilding and marine projects.
  - This industry covers commercial vessels (container ships, tanker ships, LNG transport ships, etc.), special-purpose ships (ice breaker ships, warships, and offshore support vessels (OSVs), small and medium vessels (marine leisure ships, inland water service ships, fishing boats, family boats), and equipment for manufacturing these vessels.
  - The related equipment industry includes the design and manufacture of equipment that are supplied and necessary in ships, such as power and propulsion equipment, auxiliary machinery, navigation and communications equipment, mooring and unloading equipment, and residential and safety equipment.
  - The technology for eco-friendly shipbuilding and marine equipment is based on various objectives, including eco-friendly propulsion system to cope with regulations related to atmospheric environments (greenhouse gas and exhaust gas regulations, etc.), the protection of marine ecosystem (regulations on ballast water discharge, harmful antifouling paint, wastewater discharge, etc.), energy saving, and efficiency improvement for vessels.
  - The shipbuilding and marine industry combines various ICT technologies with the existing shipbuilding and marine industry. It is an industry developed and converged to strengthen national competitiveness and create new jobs and high added value by upgrading the industrial structure according to the fourth industrial revolution (Industry 4.0).
- (Feature) A comprehensive assembly industry with significant ripple effects on upstream industries such as steel, machinery, electricity, electronics, and chemicals, as well as downstream industries related to shipbuilding, shipping, and port
  - The shipbuilding industry requires the development of suitable linear and propulsion systems according to the business purposes and routes of operation. In addition, international standards and marine environmental standards (NOx, SOx, etc.) of various international organizations (IMO, etc.) should be applied when providing facilities for safe operation at sea, fire, and emergency escape, and the prevention of marine pollution.

## 1.1 Market Trends in Korea

### ▶ Shipbuilding markets locally and abroad

- Recently, headlines in the Korean shipbuilding and marine industry are restructuring in the industry, increasing orders for LNG carriers, and strengthened environmental regulations by the International Maritime Organization (IMO).

- On March 8, 2019, Hyundai Heavy Industries (HHI) and Korea Development Bank (KDB) signed a contract to acquire a stake in Daewoo Shipbuilding & Marine Engineering (DSME). As a result, the Big 3 (HHI, DSME, and Samsung Heavy Industries (SHI)) of the Korean shipbuilding industry has been reorganized into the Super Big 2 (HHI and SHI).
- This marked the move toward coexistence through restructuring in the industry by avoiding mutual destruction caused by excessive competition among Korean companies.
- Korea's large shipbuilders maintain their market position by focusing on high value-added ship types (giant tankers, super container ships, and LNG carriers) based on the combined outcomes of world seaborne trade volume, fleet volume, new orders, and restructuring trends of Korean, Chinese, and Japanese shipbuilders over the past 10-20 years.
- IMO strengthens the standards for ship emissions, such as sulfur oxide (SOx), nitrogen oxide (NOx), and carbon dioxide (CO<sub>2</sub>), to reduce marine pollutant emissions.
  - SOx emission regulations, which will be applied after January 1, 2020, will reduce the current sulfur emissions from 3.5% to less than 0.5% across all waters except the existing emission control area (ECA).
  - Ship owners are considering the use of low-sulfur oil as a realistic alternative. However, in the mid to long term, they are expected to select a new LNG-fueled ship.
- The Korean shipbuilding and marine industry is expected to manifest improvement in both orders and construction volume in 2H 2019 thanks to large orders for LNG.
  - For 70-80 units of LNG carriers, which are expected to be ordered in 2H 2019, Korean shipbuilders are expected to receive orders for at least 50 units of LNG carriers owing to their world-class technology.
  - In 2H 2019, Korean shipbuilders are expected to see orders of approximately 6.8 million CGT, a 116% increase compared to the first half. Overall, the 2019 performance is expected to be approximately 10 million CGT, a 24% decrease from the previous year.

\* CGT: Compensated Gross Tonnage

### New Global Shipbuilding Orders and Forecasts of Korea's Performance in 2019

(Unit: million CGT)

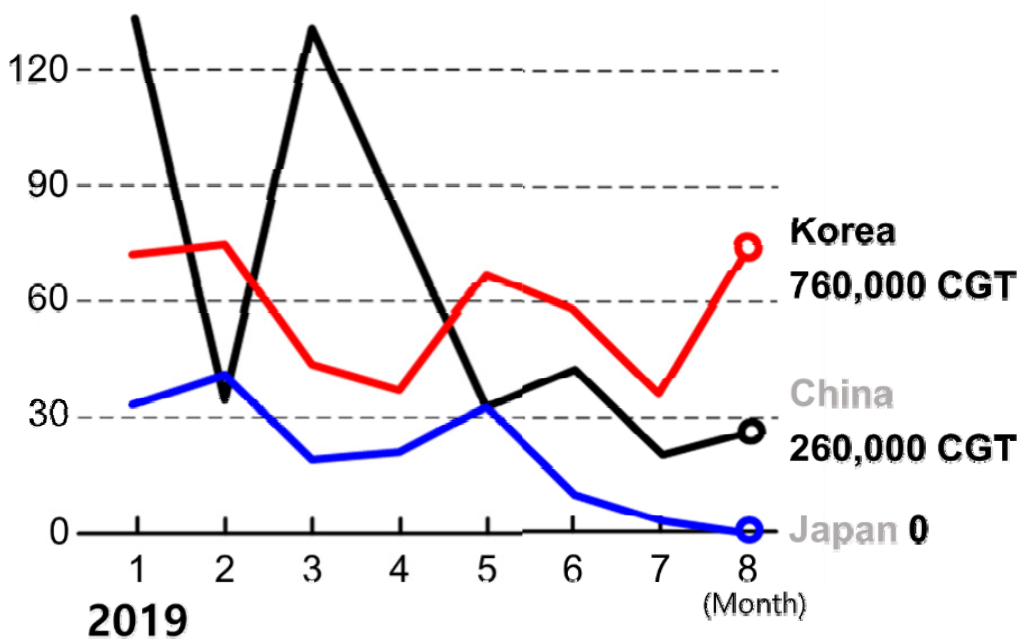
	1H 2019 performance	2H 2019 outlook	2019 outlook
World orders (rate of change)	10.3 (-42%)	15.2 (-7%)	25.5 (-25%)
Orders won by Korea (rate of change)	3.2 (-51%)	6.8 (+2%)	10.0 (-24%)

Source: "1H 2019 Trends and 2H 2019 Outlook in Shipping and Shipbuilding Industry," 2019 QUARTERLY REPORT, Vol. 2019-11, the Export-Import Bank of Korea



### Trends in Ship Orders Worldwide

(Unit: CGT)



Source: Korean Ministry of Trade, Industry and Energy, September 2019

### Development direction of Korea's shipbuilding and marine industry

- Korea's shipbuilding and marine industry is moving away from the growth centered on product performance improvement and is now responding to eco-friendly regulations and smartization based on technology convergence in ICT.<sup>1)</sup>
  - (Smartization of ships and sailing) Smartization of vessels is underway by applying core technologies of Industry 4.0, such as IoT and big data.
  - (Smartization of equipment) Efficiency improvement of equipment management, such as remote diagnosis and maintenance, optimal operation, and development of total remote solutions
  - (Smartization of production) Innovation of production processes and logistics by utilizing ICT infrastructure, such as the monitoring of production management based on real-time data and building a safe working environment

1) Analysis of current R&D status and issues of ICT convergence into shipbuilding and marine industry, ETRI Insight Report 2017-15, 2017

## 1.2 Industrial Competitiveness

### ▶ Increase in LNG carrier orders thanks to new environmental regulations

- Korean shipbuilders acquired orders for 102 LNG carriers, accounting for 73% of the global total. In 2019, they won orders for 17 out of 19 units of LNG carriers of 170,000 CBM or more (in 2018, all the orders went to Korea).<sup>2)</sup>
  - Membrane type LNG carriers produced by Korean shipyards are advantageous for making large vessels over 180,000m<sup>3</sup> compared to the Moss type produced by Japanese companies. China has lost its credibility because the LNG carrier Gladstone, which was built by Hudong-Zhonghua Shipbuilding, was stopped at sea because of an engine defect merely after two years since it was built.
- In the second half of 2019, orders were placed for 70-80 LNG carriers, including tankers and super container ships, which are projected to rise to approximately 15 million CGT.
  - In the second half of 2019, orders are expected for approximately 40 LNG carriers from Qatar, for 15 icebreaking LNG carriers from the Russian ARCTIC-LNG2 project and for 15 LNG carriers from the Mozambique projects by Anadarko, a US energy company.
  - In particular, Korean shipbuilders have strength in building LNG carriers, allowing them to receive all the orders for 70-80 units. In addition, orders for tankers and super container ships are also expected, so their orders in 2H 2019 are forecasted to be 6.8 million CGT orders, more than double that of the first half.

### ▶ Available for orders for various ship types

- Korean shipbuilders win orders for a wide variety of ships, including high-priced LNG carriers, large container ships, Aegis ships, submarines, etc.
- Recently, new orders received by Korean shipbuilders are concentrated on certain types of ships in which they have comparative advantages, and they are relatively more affected by these trends than in the past.
  - In 2018, Korea's big growth in new orders compared to global growth is largely attributable to orders for LNG carrier and LNG-fueled ships, for which Korean shipbuilders have a comparative advantage.
  - At present, Korean large shipbuilders have an advantage over competitors in giant tankers, super container ships, and LNG carriers.

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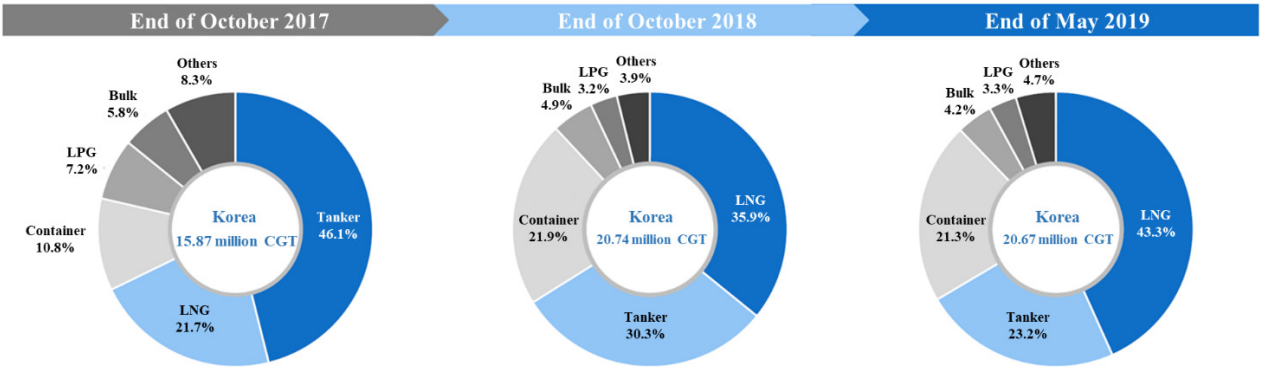
2) Clarkson Research

### Recent Orders Won by Korean Shipbuilders (Late September to Early October 2019)

Shipbuilder	Type of ship	No. of ships	Contract amount
Hyundai Heavy Industries (HHI)	15,000-TEU container ship	11	USD 1.5 billion
	Aegis ship	1	USD 565 million
Hyundai-Samho Heavy Industries	VLCC	1	USD 94 million
	Suezmax-grade crude oil carrier	2	USD 130 million
Hyundai Mipo Dockyard	MR tanker	2	USD 72 million
Samsung Heavy Industries (SHI)	23,000-TEU container ship	6	USD 920 million
	LNG carrier	2	USD 460 million
Daewoo Shipbuilding & Marine Engineering (DSME)	LNG carrier	2	USD 374 million
	Submarine	1	USD 932 million

Source: dongA.com, October 15, 2019 (Hi Investment & Securities, re-quotation of data from the shipbuilding industry)

### Ratios by Ship Type in Korea’s Backlog of Orders (Backlog of orders Based on CGT)



Source: Meritz Research, Meritz’s 2H 2019 Outlook Series 16

### Accelerating technical independence of key products including equipment used for LNG carriers

- At present, in the face of the uncertainty of the global industrial value chain being destroyed because of trade problems between Korea and Japan, Korea’s shipbuilding and marine equipment industry is also in a difficult situation.
  - Because of the nature of the procurement process in the shipbuilding industry, the destination and purpose of export products are clear. Hence, it is expected that most shipbuilding equipment imported from Japan as finished products would not be classified as strategic materials.



- The fact that Korea's order share in the global market as of 2018 is 44.2%, overwhelming Japan's 12.6%, would make it difficult for Japan to restrict exports against the interests of shipping companies that lead the value chain of the global marine industry.<sup>3)</sup>
  - At present, all LNG cargo pumps are imported only from Japan, and the localization rate of equipment for LNG carriers is 50%-60% lower than that of other ship types.

## 1.3 Promising Fields in Korea

### ▶ Eco-friendly high value-added ship

- IMO 2020's new environmental regulations will accelerate the replacement of old ships and will give the Korean shipbuilding industry, which is now building a number of eco-friendly, high value-added ships, new opportunities.
- Since 2020, IMO has regulated the SOx allowance for ship's fuel oil worldwide from 3.5% to 0.5%.
  - The shipping industry should come up with alternative plans from 2020. The alternatives are narrowed down to 1) using low-sulfur oil, 2) installing scrubbers (desulfurizer), and 3) purchasing LNG-fueled ships.

#### Measures to Respond to IMO 2020 SOx Emission Rules

Classification	Summary	Pros and cons
Using low-sulfur oil	Use low-sulfur oil instead of existing high-sulfur oil	No additional facility cost is required, but the price of low-sulfur oil is higher than that of high-sulfur oil.
Installing scrubbers (desulfurizer)	Install SOx removal devices on existing ships	The existing high-sulfur oil can be used, but the current scrubber installation is limited because of the reduced cargo loading space.
Purchasing LNG-fueled ships	Purchase ships using LNG instead of existing HFO	Although regulations on SOx and other emission gases can be complied with, the new purchasing cost is 20%-30% more expensive than the existing ships, and LNG bunkering infrastructure is required.

Source: 2019 Keywords in Shipbuilding: "restructuring in the industry," "LNG carrier orders increased," "enhanced environmental regulations," NICE Investors Service (May 9, 2019)

3) In the mid to long term, the government and related companies are in a hurry to promote the localization roadmap for key equipment of LNG carriers, Korea's flagship product.



## Global and Korean Major Shipping Companies' Response to IMO 2020 "SOx"

(○: Purchase plan announced, △: Under consideration)

Country	Name of shipbuilder	Countermeasures under consideration/preparation			Response status
		Using low-sulfur oil	Installing scrubbers	Purchasing LNG-fueled ships	
Denmark	Maersk	○	△	○	<ul style="list-style-type: none"> <li>■ In principle, most ships will use low-sulfur oil, while some ships will be equipped with scrubbers. New LNG-fueled ships will also be ordered.</li> <li>■ In August 2018, construction was started to build a dedicated terminal for low-sulfur oil in the Port of Rotterdam in cooperation with Vopak, a Dutch tank terminal operator.</li> <li>■ In May 2019, it signed a new shipbuilding contract with China's Jiangnan Shipyard for five 2,200-TEU LNG-fueled container ships.</li> </ul>
Swiss	MSC	△	○	△	<ul style="list-style-type: none"> <li>■ It said that it would respond to IMO regulations mainly by installing scrubbers.</li> <li>■ MSC has decided to install scrubbers on 120 units of its fleet.</li> </ul>
France	CMA-CAM	○	△	○	<ul style="list-style-type: none"> <li>■ It basically adapted low-sulfur oil but announced plans to purchase 15 LNG-fueled ships.</li> <li>■ The orders for nine units of 22,000-TEU container ships placed in China in early 2019 will be built as LNG-fueled ships.</li> </ul>
Japan	ONE	○	○	○	<ul style="list-style-type: none"> <li>■ It decided to use low-sulfur oil with a sulfur content of less than 0.5% and is continuously conducting an experimental operation.</li> <li>■ In August 2018, it signed an MOU with three Japanese power companies for the LNG bunkering project.</li> <li>■ It plans to issue 10 billion yen of Green Bond, the first in the shipping industry, to invest in LNG-fueled ships and scrubbers.</li> </ul>
China	COSCO		○	○	<ul style="list-style-type: none"> <li>■ In 2018, it ordered 11 LNG-ready vessels that can be converted to an LNG-fueled ship while using LNG and existing bunker C oil.</li> </ul>
Norway	Fredriksen	○	○	△	<ul style="list-style-type: none"> <li>■ It announced plans to install scrubbers on its 36 tankers and acquired a 20% stake in Feen Marine Scrubber Inc., a scrubber manufacturer.</li> </ul>
Korea	Hyundai Merchant Marine	△	○	○	<ul style="list-style-type: none"> <li>■ By early 2020, it plans to install scrubbers in approximately 70%-80% of its fleet, including 20 super container ships.</li> <li>■ A total of 20 units of its super container ships will be equipped with LNG-ready systems with the support of Korea Ocean Business Corporation (KOBC).</li> </ul>

Country	Name of shipbuilder	Countermeasures under consideration/preparation			Response status
		Using low-sulfur oil	Installing scrubbers	Purchasing LNG-fueled ships	
	SM Line	○	○	△	<ul style="list-style-type: none"> <li>■ If scrubbers are installed, the investment payback period is not long enough because of the age of ships owned. Thus, it is expected to respond to the regulations by using low-sulfur oil.</li> </ul>
	Korea Marine Transport	○	○	△	<ul style="list-style-type: none"> <li>■ Because of its fleet characteristics that comprise many small and medium-sized ships, low-sulfur oil was selected as the main countermeasure.</li> <li>■ It plans to mount scrubbers on its existing 5,000-TEU-class vessels as well as four new vessels scheduled for delivery in 2019, and the rest of its vessels will use low-sulfur oil.</li> </ul>
	Sinokor Merchant Marine	△	○	△	<ul style="list-style-type: none"> <li>■ In consideration of fuel consumption and charter conditions, only the suitable ships will be installed with scrubbers, while the rest of the ships will use low-sulfur oil.</li> <li>■ Scrubbers were installed on 14 newly built ships. For the 50 existing ships, scrubber installation is under consideration.</li> </ul>
	EUKOR Car Carriers Inc.	△	○	△	<ul style="list-style-type: none"> <li>■ By 2021, the company plans to install hybrid-type scrubbers on 16 ships or 23% of the ships in operation.</li> </ul>
	POLARIS Shipping Co., Ltd.	△	○	○	<ul style="list-style-type: none"> <li>■ It ordered to construct 18 high-efficiency, eco-friendly ships built with LNG-ready systems. A fleet replacement plan is underway to replace existing vessels from 2018 until 2022.</li> <li>■ For 11 existing vessels under 10 years of age in operation, scrubbers will be installed by the first quarter of 2020.</li> </ul>

Source: Samjong KPMG Economic Research Institute (July 2019)

## ▶ LNG carrier construction

- The market share of Korean shipyards in LNG carriers is expected to remain No.1 in the world.
  - Clarkson expects Korean shipbuilders to monopolize the LNG carrier market until 2024.
  - According to Clarkson, in 2018, 76 LNG carriers were ordered, including 9 small LNG carriers, and large Korean shipbuilders (Hyundai, Daewoo, Samsung) attained the new orders for LNG carriers pouring into the market.<sup>4)</sup>
- Development of an eco-friendly, dual-fuel engine that selectively uses two fuels, diesel, and natural gas to reduce harmful emissions, such as nitrogen oxides (NOx) and sulfur oxides (SOx)
  - Hyundai Heavy Industries (HHI) has developed a new model of the “HiMSEN” engine that boasts of the world’s largest output<sup>5)</sup>. HHI plans to increase the sales of the “HiMSEN” engine from USD 230 million in 2018 to USD 900 million by 2020.
- In the shipbuilding industry, orders are the most important variable, especially during the order recovery period among the three phases of a three-year cycle that comprises the order recession period, the order recovery period, and the order faltering period. After the number of orders rebounds, the vessel prices also rebound three to six months later, acting as a catalyst for the stock price rally.
  - Looking at the recent situation, in 2H 2016, orders began to pick up again. In 2017, the prices of the ships hit rock bottom, showing the sign of a faltering order period, but unlike normal cycles, the price is expected to rise again in 2020, following a faltering order period that may last until 2019.<sup>6)</sup>
  - Volume is on the rise, and the demand for the replacement of ships 20 years old or more is expected to rise to 23.4% of the total fleet for more than 20 years (ships 20 years old or more by type: tanker ships (31.4%), container ships (16.4%), LNG carriers (13.7%), and bulk carriers (10.3%)).
  - Ships that are 10 years old or more accounts for 53.0% of the total fleet, while ships 20 years or more accounts for 23.4%, and 23 years or more 18.4%. Since 1996, the average annual order volume of the four types of ships has reached 1,188 units, which is 3.5% of the total fleet, accounting for 28.5 years of a ship’s life cycle.

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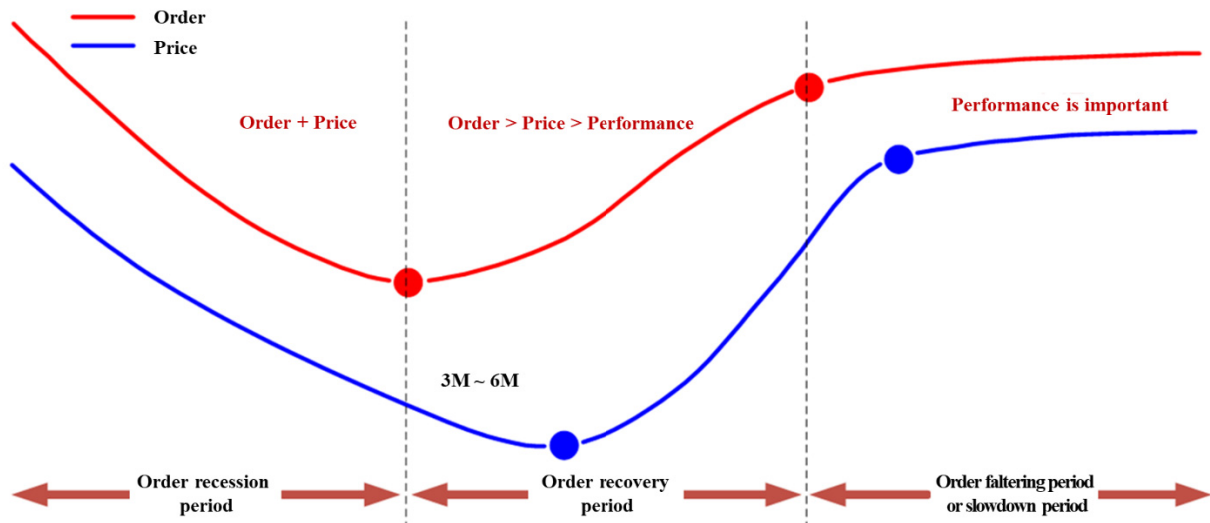
4) Clarkson estimates that LNG carrier orders will reach a maximum of 467 in 2019–2024. A total of 58 vessels will be released in the shipbuilding market in 2019, and 68 vessels by 2020, and 100 orders are expected in 2024.

5) The new HiMSEN engine (model: H54DF) has a maximum output of 36,000 hp.

6) “Strengthened Upward Pressure on Shipbuilding,” Daishin Securities, May 2019



### Stock Price Cycle of Shipbuilding Companies



Source: "Strengthened Upward Pressure on Shipbuilding," Daishin Securities, May 2019

### Age Distribution by Major Ship Type

(Unit: No. of ships, %)

Type of ship	1-5 years	6-10 years	11-15 years	16-20 years	21-23 years	Over 23 years	Total
Tanker	2,090(14.1%)	3,105(21.0%)	2,914(19.7%)	1,415(9.6%)	608(4.1%)	4,655(31.5%)	14,787(100.0%)
Bulker	2,595(22.7%)	5,012(43.9%)	1,665(14.6%)	979(8.6%)	488(4.3%)	688(6.0%)	11,427(100.0%)
LNG carrier	187(33.2%)	104(18.4%)	152(27.0%)	44(7.8%)	19(3.4%)	58(10.3%)	564(100.0%)
LPG carrier	343(23.8%)	273(18.9%)	223(15.4%)	149(10.3%)	113(7.8%)	343(23.8%)	1,444(100.0%)
Containership	879(16.7%)	1,147(21.8%)	1,642(31.2%)	735(14.0%)	446(8.5%)	416(7.9%)	5,265(100.0%)
Total	6,094(18.2%)	9,641(28.8%)	6,596(19.7%)	3,322(9.9%)	1,674(5.0%)	6,160(18.4%)	33,487(100.0%)

Source: Clarkson (2019)



## Smart ships and smart ports

- Recently, the major issues in port-logistics, as well as shipbuilding and offshore plant sectors, are smart, large-scale, eco-friendly, and logistics integration systems. As such, the Korean government is rapidly integrating related industries and functions to build smart ports in various locations.<sup>7)</sup>

### Comparison of Smart Ship Development Status among Competing Countries

Items for comparison	Country	Content
Development status	Europe	<ul style="list-style-type: none"> <li>Development is focused on platforms, equipment, laws, and systems rather than the physical structure of ships.</li> <li>Remote controls are estimated to be under development.</li> </ul>
	China	<ul style="list-style-type: none"> <li>Platforms and ship systems are under development with the support of the government.</li> <li>Remote monitoring systems are estimated to be under testing.</li> </ul>
	Japan	<ul style="list-style-type: none"> <li>The development of a national standard platform and operation on real ships are completed.</li> <li>The development of autonomous navigation vessels is underway with the goal of commercializing them by 2025.</li> </ul>
	Korea	<ul style="list-style-type: none"> <li>Three shipbuilding companies are in the process of developing their own platforms and ship systems.</li> <li>The development of remote monitoring is completed and is in the process of commercialization.</li> </ul>
Smart ship production	Europe	<ul style="list-style-type: none"> <li>An order was placed for a small inner port ship aiming at unmanned automation function.</li> </ul>
	China	<ul style="list-style-type: none"> <li>Test ships for testing monitoring systems are in operation.</li> </ul>
	Japan	<ul style="list-style-type: none"> <li>The test of the remote monitoring system is estimated to be completed through the operation of test ships.</li> </ul>
	Korea	<ul style="list-style-type: none"> <li>There is no record that Korean shipbuilders constructed a test ship for the development of the remote monitoring system, but it is assumed that the shipbuilders have installed their remote monitoring systems on the ships they sold to collect necessary data.</li> </ul>

7) According to the report titled "Status and Challenges of Smart Ship Development" by the Overseas Economy Research Center of the Export-Import Bank of Korea (January 2019), it was suggested that cooperation among Korean companies as well as national support would be needed for the development of "Smart Ships," which is considered the future cash cow in the shipbuilding industry. For example, Kongsberg, a Norwegian marine electronics company, is developing its own platform for smart ships, and in 2018, it acquired Rolls-Royce Commercial Marine, one of the leading companies in smart ship development. Thus, the report emphasizes that "Kongsberg is likely to become the dominant company in the new shipbuilding market, monopolizing the smart market in the future. That it cannot be ruled out that the world's No. 1 Korean shipbuilding industry might be dependent on Kongsberg, which is now only a small equipment supplier."

Items for comparison	Country	Content
Pan-national cooperation	Europe	- EU extended its support and active cooperation among institutions in Europe.
	China	- Strengthened cooperation is evident among domestic and foreign organizations under the government's lead.
	Japan	- Pan-national cooperation is widely reinforced in the country.
	Korea	- Efforts are made to cooperate with individual external organizations of the three shipbuilders without any pan-national cooperation.
Related studies including laws and systems	Europe	- Very active
	China	- It is estimated that there will be government-led research efforts.
	Japan	- It is assumed that there will be discussion and planning within the government.
	Korea	- There seems to be little discussion.

Source: Korea Marine Equipment (KME), "Smart Ship - A Leverage for Future Ship Market Leadership," Biannual Vol. 40 (January 2019)

## 2 Foreign Direct Investment Trends

### 2.1 Foreign Direct Investment Status

#### ▶ Status of foreign direct investment in the shipbuilding industry and equipment

- According to the data from the Ministry of Trade, Industry and Energy (2019), Korea's total foreign direct investment (FDI) in 2018 amounted to USD 26.9 billion, the largest ever.
- In August 2019, Korea was removed from Japan's white list, but its impact on the shipbuilding and marine industry has been insignificant.<sup>8)</sup>
  - Most of the equipment and parts used for shipbuilding have been localized, and only a small part of them are imported from Europe. In addition, in the case of offshore production facilities, the localization rate is low, but most of them are imported from Europe, America, etc., so the influence from Japanese export restrictions is limited.
- Direct investment in Korea by foreigners related to the shipbuilding and marine market has been sluggish as the commercial vessel/plant market has cooled down since the second half of 2014 after the recession of the shipbuilding and marine market.

8) Korea Marine Equipment (KME), "Japan's Economic Retaliation Can't Stop the Korean Shipbuilding Industry from Sailing in the Blue Ocean," Biannual Vol. 41 (August 2019)

- Meanwhile, shipbuilding orders are expected to recover in 2H 2019 because of the signs of recovery in the marine industry, rising oil prices, and an increase in the operation of the drillship.
- Some large shipbuilders are changing production facilities for the construction of LNG carriers and super-sized vessels. Moreover, some vessel parts and metal processing companies have increased their investment in producing eco-friendly components for ships.<sup>9)</sup>
- During 2014–2016, Korean shipyards lost cash liquidity because of delays in the delivery of large-scale offshore plants, but it sharply improved as the resale of undelivered drill ships was confirmed for Daewoo Shipbuilding & Marine Engineering (DSME) and Samsung Heavy Industries (SHI), and the shipbuilding volume (LNG ships) increased.
- The delivery of ships by the Korean shipbuilding industry was 234 in 2019 and 235 in 2020.
- In particular, the strengthening of environmental regulations, such as NOx, BWTS, and IMO 2020 sulfur oxide regulations, has lowered the attractiveness of investing in second-hand ships. However, in 2019, LNG carrier prices rose the fastest in relation to eco-friendly energy use.
- Foreign investment in shipbuilding and shipbuilding equipment has been made mainly in the Miseum district (Busan) located in the Southeast area.

## 2.2 Success Cases of Major Foreign-Invested Companies

- German/Japanese companies, which are the vast majority of the shipbuilding equipment industry, also occupy the majority of foreign-invested companies in the shipbuilding and marine industries of Korea.
- As the overseas expansion of component companies aims to stabilize supply lines, Korean local governments have highlighted the strengths of Korea's innovation capabilities and settlement conditions rather than providing direct economic incentives when attracting them, which worked very well.
- Since foreign-invested companies entered the Southeast region, Korean local governments have continued to support them to cooperate with local companies so that they can quickly collaborate and cooperate with the companies engaged in the front and back industries of shipbuilding and in the same industry.

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9) Economic Report of Southeast Region, Bank of Korea, September 2019



### Successful Cases of Foreign-Invested Companies in Shipbuilding Equipment

Investor Country	Investor	Details and content
USA	GE Korea	<ul style="list-style-type: none"> <li>Since 1976, GE has been investing in Korea in the form of a GE Korea subsidiary and is carrying out various projects, including health care, engineering procurement construction (EPC), aviation, and gas turbines for ships. Its total investment until recently has exceeded USD 3 billion.</li> <li>GE's Offshore Engineering Unit has various offshore support vessels (OSVs), such as PSV, AHT/AHTS, and CSV, along with marine energy production solutions, construction designs, and project operations, so it is also working on a related project.</li> </ul>
Japan	Korea Nikken	<ul style="list-style-type: none"> <li>The company was co-founded in 1987 by the headquarters of Nikken Works in Japan and the capital company of Korea.</li> <li>Since the 1990s, it has succeeded in localizing the "tool holder," a cutting tool connecting device, and exported the products back to the headquarters in Japan.</li> </ul>
USA	Hankuk Honeywell	<ul style="list-style-type: none"> <li>The company was founded in the late 1980s as a joint venture capital between LG and Honeywell.</li> <li>It entered the automatic control system business related to the offshore plant and won a large-scale project contract (2008 Samsung Heavy Industries' FLNG Project, etc.).</li> </ul>
Austria	Geislinger	<ul style="list-style-type: none"> <li>In 2012, the company invested manufacturing facilities at the Mieum Parts and Materials Industrial Complex in Busan, specializing in the manufacture of anti-vibration dampers for ship engine shafts.</li> <li>Over 100 workers are employed in the Busan area, and the produced products are supplied to Doosan and STX.</li> </ul>
Germany	Wilo Pump	<ul style="list-style-type: none"> <li>Founded in Busan, Korea, in 2000, it is a subsidiary of WILO SE, a German global leader in pumps and pump systems.</li> <li>As of 2019, the company has over 300 employees, producing general pumps and special pumps for ships and offshore plants.</li> </ul>
Germany	Bosch Rexroth Kore	<ul style="list-style-type: none"> <li>Bosch Rexroth is a subsidiary of Bosch Group, a global company specializing in machine and system construction. It is a total company with overall technologies driving and control related to heavy equipment, industrial machinery engineering, factory automation, and renewable energy based on its technology and knowledge fostered through its history of more than 200 years.</li> <li>Since the establishment of Bosch Rexroth Korea in 2001, it invested in a new plant in Busan in 2014. It supplies hydraulic devices and automation systems for special ships, drill ships, and FPSOs.</li> <li>As of 2019, it has 178 employees.</li> </ul>



## 3 Policy and Location

### 3.1 Key Policies and Incentives

#### Intensive support from the government for eco-friendly, high-efficiency ships

- To cope with IMO's SO<sub>x</sub> and NO<sub>x</sub> regulations, the Ministry of Trade, Industry and Energy and the Ministry of Land, Infrastructure and Transport (MOLIT) of Korea continuously endeavor to improve the investment environment by supporting substantive partnerships, such as joint research with Korean companies and co-exploration into overseas markets, and by attracting foreign expert companies to the Free Economic Zones, Special Research and Development Zones, etc.
  - The Ministry of Trade, Industry and Energy plans to establish a mid to long-term roadmap to respond to LNG demand (September 2018) and build infrastructure to offer LNG bunkering at ports in Busan, Ulsan, Gwangyang, Incheon, and Pyeongtaek by 2025.
  - In 2018, the Ministry of Land, Infrastructure and Transport (MOLIT) revised the Marine Environment Management Act, the Urban Gas Business Act for the Construction of LNG-fueled ship (Bunkering), and the Harbor Transport Business Act to accommodate IMO's sulfur oxide content in ship fuel (SO<sub>x</sub> 0.5% or less).
  - Korea Ocean Business Corporation will reduce interest rates and guarantee fees on LNG-fueled ships, offer subsidies for eco-friendly vessels (10% of ship prices), reduce the fees for using port facilities for coastal cargo ships, and reduce the acquisition tax on coastal LNG-fueled ships.
  - To revitalize the introduction of LNG-fueled ship in 2018, ongoing support is offered for the installation of LNG-fueled equipment developed by domestic companies in the local government vessels (Busan, Ulsan, etc.).
- In 2018, the Ministry of Trade, Industry and Energy established "Development Strategy for the Shipbuilding Industry" to plan and implement shipbuilding development strategies for six implementation strategies. The details are shown in the table below.

### Implementation Plan of Shipbuilding Development Strategy

Promotion strategies	Details
Competition and restructuring	<ul style="list-style-type: none"> <li>Three large companies: Promote structural changes through autonomous market reorganization</li> <li>Mid-sized companies: Implement restructuring and cooperation among companies</li> <li>Strengthen competitiveness in the fields of ship repair, remodeling, and services</li> </ul>
Enhancement of the competitiveness of small and mid-sized shipbuilders	<ul style="list-style-type: none"> <li>(R&amp;D) Design small and medium-sized ships and develop production technology suitable for small and medium ships</li> <li>(Design) Build a high-speed and high value-added design support center</li> <li>(Production) Promote the Korean Smart Shipyard (K-Yard) project</li> </ul>
Proactive creation of markets and the development of overseas markets	<ul style="list-style-type: none"> <li>Create a demand centering on LNG-fueled ships</li> <li>Expand orders for the reconstruction of marine transport and public orders (Ministry of Defense, Korea Coast Guard, etc.)</li> <li>Pioneer mid- and long-term markets through new north and new south projects</li> </ul>
Investment for the future (eco-friendly and autonomous vessels)	<ul style="list-style-type: none"> <li>Succeed in the development and operation of autonomous vessels (2022)</li> <li>Convert aged tugboats to LNG-fueled ship (to reduce fine dust in ports)</li> <li>Promote projects to demonstrate eco-friendly equipment</li> </ul>
Strengthening the industrial ecosystem through a win-win growth	<ul style="list-style-type: none"> <li>Build a win-win system of shipbuilding-shipping-finance</li> <li>Expand the joint development of new technology equipment</li> <li>Establish a model to develop a virtuous cycle in the areas specializing in shipbuilding.</li> <li>Improve win-win systems for the defense sector (warranty and liquidated damages for delay)</li> </ul>
Retention of jobs and creation of quality jobs	<ul style="list-style-type: none"> <li>Stabilize employment in preparation for the market recovery (extension of special employment support, etc.)</li> <li>Create high-quality jobs for the youth and local people through design and advanced manufacturing</li> <li>Increase the recruitment of youth centered on large three companies in line with order recovery</li> </ul>

Source: Ministry of Trade, Industry and Energy, April 2018

### Classification of Shipbuilding and Marine Equipment

Classification	Hull	Design	Engine	Electronic equipment
Dense area	Gyeongsangnam-do (Geoje), Ulsan, Jeollanam-do and Jeollabuk-do	Gyeongsangnam-do (Gimhae) and Busan	Gyeongsangnam-do (Changwon)	Busan
Detailed item	Blocks and steel structures	Cabins, plumbing, and fences	Engines and generators	Wiring and radars
Characteristics	Low technical levels High labor costs	Multiple items Many companies	Ideal for large or medium-sized companies	High level of skills and workforce

Source: "Development Strategy of the Shipbuilding Industry," Ministry of Trade, Industry and Energy, April 2018

## ▶ **Fostering ICT convergence in the context of Industry 4.0 (shipbuilding and marine)**

- To adapt to the Industry 4.0 era, related infrastructure is being created for the verification of ICT, software quality, and performance related to shipbuilding and offshore-ICT convergence. In addition, a base is being constructed to foster personnel and build a network for marketing and win-win cooperation.<sup>10)</sup>
  - The “Shipbuilding & Marine ICT Creative Convergence Center” has been established to support companies by offering them equipment, such as a real-time simulator, data analysis and software testing devices, etc.

## **3.2 Major Locations**

### ▶ **Locations of the shipbuilding and marine and equipment industry in Korea**

- In 2016, the number of businesses in the Korean marine industry was 17,854: 40.7% of them are in maritime and port businesses, 27.9% in the ship and offshore plant construction and repair industries, and 10.7% in marine tools and equipment manufacturing industries.
  - By region, 75% are concentrated in Busan, Ulsan, Gyeongsangnam-do, and metropolitan areas, with Busan, Ulsan, and Gyeongsangnam-do taking up 53.9% and Seoul-Incheon area, 22.9%.
  - In Busan, Gyeongsangnam-do, and Southeast regions, companies can secure active networks because they have clusters consisting of Korea’s top manufacturers of shipbuilding and offshore plant parts (50% or more) along with marine leisure vessels (40% or more).
- (Busan-Ulsan-Geoje) In Busan, Ulsan, and Gyeongsangnam-do, the shipbuilding industry has a relatively high proportion of large shipyards and related companies, while the proportion of small businesses is lower than that of other regions.
  - There are more large companies in this area than in small ones. Large shipyards located here include Hyundai Heavy Industries (Ulsan), Daewoo Shipbuilding & Marine Engineering (Geoje), Samsung Heavy Industries (Geoje), and Hyundai Mipo Dockyard (Ulsan), as well as medium-sized shipbuilding equipment companies (Sejin Heavy Industries, Shinhan Heavy Industries, etc.), which manufacture blocks.

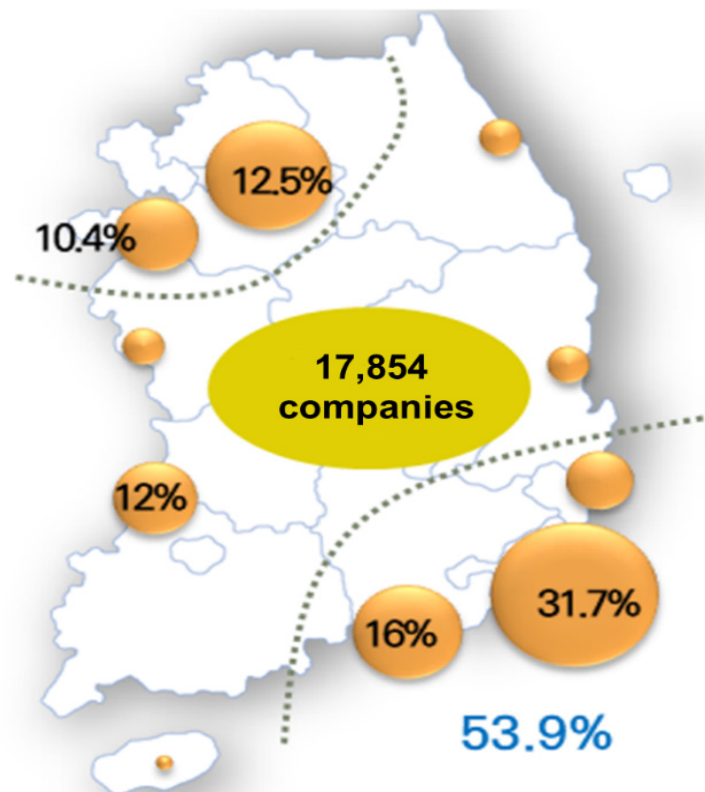
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10) Location: 25B-2, Ulsan Techno Industrial Complex, Nam-gu, Ulsan, Scale: 1st basement level and 7th floor



- (Jeollanam-do) The shipbuilding industry in Jeollanam-do is dominated by a large company (Hyundai-Samho Heavy Industries). However, there are many small and mid-sized shipbuilders and shipbuilding equipment companies that are operating on a small scale.
  - In 2014, Hyundai-Samho Heavy Industries recorded sales of USD 3.96 billion, accounting for 61.4% of the total sales of the shipbuilding companies in Jeollanam-do (USD 6.44 billion).
  - Small and mid-sized shipbuilders and shipbuilding equipment companies account for 99% of the total number of shipbuilding companies in Jeollanam-do, but the number of employees and sales volumes of them is small.

#### Regional Shares of the Shipbuilding and Marine Industry

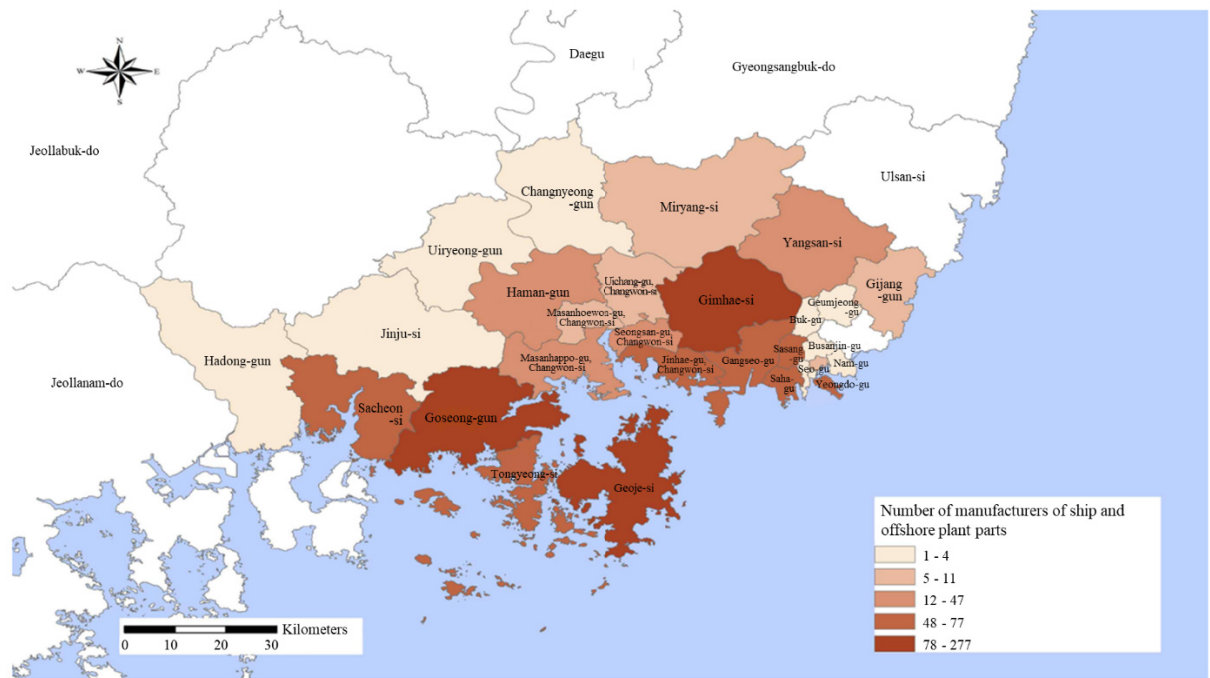


Source: "A Study on Necessity of Creating New Sea City," KMI, January 2019



Infrastructure and Locations in Busan, Gyeongsangnam-do, and Southeast Regions

Distribution of manufacturers of ships and offshore plant equipment



Source: “The First Basic Plan for Ocean Industry Cluster 2017–2021,” (Ministry of Oceans and Fisheries, April 2017)

Industrial competitiveness by major marine cities in Korea

- In 2016, the total number of businesses in the Korean marine industry was 17,854, and the main policies on shipbuilding, marine industry, and ports are shown in the table below.

Marine Industry Competitiveness and Major Marine Policies of Main Port Cities

Classification	Competitiveness of the marine industry	Major policy
Busan	<ul style="list-style-type: none"><li>■ As a port city, it specializes in water transportation, warehouse, and transportation support services.</li><li>■ Establish a maritime innovation base, such as a maritime innovation cluster, maritime law, and finance.</li></ul>	<ul style="list-style-type: none"><li>■ Establish a maritime capital base for Northeast Asia.</li><li>■ Foster the new marine industry based on marine science and technology.</li><li>■ Foster and expand the foundation of knowledge service for the shipping and port industry.</li></ul>
Ulsan	<ul style="list-style-type: none"><li>■ Support the specialization of the ship and boat building industry as well as warehouse and transportation support services.</li><li>■ Support the specialization of manufacturing and shipbuilding.</li></ul>	<ul style="list-style-type: none"><li>■ Promote the floating offshore wind power industry.</li><li>■ Promote the policy for economic exchange with northern regions.</li></ul>

Classification	Competitiveness of the marine industry	Major policy
Changwon	<ul style="list-style-type: none"> <li>Promote large-scale development projects, such as New Busan Port (Jinhae-gu), New Masan Maritime City, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Develop a map for a new eco-friendly LNG industry centered on Gyeongsangnam-do and foster related industries.</li> </ul>
Geoje	<ul style="list-style-type: none"> <li>Although the region had an overwhelming advantage in the shipbuilding and boating industry, the regional economy was hit by the crisis in the Geoje Shipbuilding industry.</li> </ul>	<ul style="list-style-type: none"> <li>Geoje Offshore Plant, National Industrial Complex</li> </ul>
Mokpo	<ul style="list-style-type: none"> <li>Construct a small and medium-sized ship repair complex</li> </ul>	<ul style="list-style-type: none"> <li>Construct a southwest comprehensive support center for eco-friendly fishery</li> <li>Plan to construct a yacht marina and a marine sports center</li> </ul>

Source: "A Study on Necessity of Creating New Sea City," KMI, January 2019, edited the January 2019 issue

## 4 Potential Partners

### 4.1 List of Related Companies

- The shipbuilding and marine industry is comprised of shipbuilding companies, such as Korea Shipbuilding & Offshore Engineering (KSOE: Hyundai Heavy Industries, Hyundai Mipo Dockyard, Hyundai-Samho Heavy Industries, and Daewoo Shipbuilding & Offshore Engineering), Samsung Heavy Industries, shipping companies (Hyundai Merchant Marine, SM Line, Korea Marine Transport, etc.), and several engine and equipment suppliers.

	Company name	Main items	Website	Location
KSOE Marine	Hyundai Heavy Industries	Offshore plants, ships, engines, pumps, electric motors, heavy electric equipment, and heavy equipment	www.hhi.co.kr	1000, Bangeojinsunhwando-ro, Dong-gu, Ulsan
	Hyundai Mipo Dockyard	Ships	www.hmd.co.kr	100, Bangeojinsunhwando-ro, Dong-gu, Ulsan
	Hyundai-Samho Heavy Industries	Ships	www.hshi.co.kr	93, Daebul-ro, Samho-eup, Yeongam-gun, Jeollanam-do

Company name		Main items	Website	Location
	Daewoo Shipbuilding & Marine Engineering	Offshore plants and ships	www.dsme.co.kr	3370, Geoje-daero, Geoje-si, Gyeongsangnam-do
Samsung Heavy Industries (SHI)		Offshore plants and ships	www.shi.samsung.co.kr	23, Pangyo-ro 227beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do
Korean shipping companies (Hyundai Merchant Marine, SM Line etc.)		Ships, logistics		

- In 2019, the three shipbuilders are expected to achieve their sales targets thanks to a surge in orders in 2H.
  - The achievement rates of the three shipbuilders are 20.1% for Hyundai Heavy Industries, 33.1% for Daewoo Shipbuilding & Marine Engineering, and 41% for Samsung Heavy Industries.
- Composition of backlogs of the three shipbuilders (end of May 2019)
  - 43.3% for LNG ships, 23.3% for tankers, and 21.3% for container ships (backlog as of October 2018)
  - Korean shipbuilders won 17 out of 19 orders for LNG carriers of 170,000 CBM or higher in 2019. (It won all the orders in 2018.)

#### **Korea Shipbuilding & Offshore Engineering (KSOE: Hyundai Heavy Industries, Hyundai Mipo Dockyard, and Hyundai-Samho Heavy Industries)**

- On January 31, 2019, Hyundai Heavy Industries (HHI) signed a basic agreement to take over Daewoo Shipbuilding & Marine Engineering (DSME), raising the issue of restructuring of the shipbuilding industry.
- As the world's largest shipbuilding and offshore company, the company has secured orders for 268 ships (94 ships by Hyundai Heavy Industries, 110 ships by Hyundai Mipo Dockyard, and 64 ships by Hyundai Samho Heavy Industries) and 2 offshore plants (by Hyundai Heavy Industries), with USD 35.357 billion in backlog as of end of August 2019.



### Cumulative Orders (as of May) and Backlog of Shipbuilding and Marine Sector of KSOE

(Unit: USD million, No. of units)

Company	New order			Same period last year		Backlog		Same period last year	
	Amount	No. of ships		Amount	No. of ships	Amount (Delivery)	No. of ships	Amount (Delivery)	No. of ships
Hyundai Heavy Industries	1,677	8	TK 2/Con 0/LNG 4	2,494	19	24,099	100	21,180	94
Commercial vessel	1,044	8		1,913	19	12,878	98	11,148	93
Marine	5	0		-8	0	2,600	2	1,889	1
Plant	7			86		6,599		6,629	
Engine machine	621			503		2,022		1,514	
Hyundai Mipo Dockyard	727	19	TK 14/Con 5/LNG 0	871	25	4,148		4,072	109
Hyundai-Samho Heavy Industries	1,002	10	TK 9/Con 0/LNG 1	2,782	25	7,085		6,279	67
Korea Shipbuilding & Offshore Engineering (KSOE)	3,406	37		6,147	69	35,332		31,531	270

Source: Hanwha Investment &amp; Securities Research Center, July 2019

Note: As of May 2019 / Same period last year (as of May 2018)

- Hyundai Heavy Industries Group establishes a global R&D center in the Pangyo New Town
  - Located at Pangyo New City, Seongnam, Gyeonggi-do, the R&D center has 5,000 employees and is aimed at strengthening the company's technological competitiveness acting as a technology control tower within the group by gathering research personnel scattered in the metropolitan area.

### ▶ Samsung Heavy Industries

- Winning offshore plant orders in two years
  - By the first half of 2019, it received orders for 10 LNG carriers, 3 tankers and special vessels, and 1 offshore plant (as of the end of June), which amounted to USD 3.2 billion in total. Combined with two LNG carriers and two tanker ships in July, the total sales will reach USD 3.6 billion or 46% of its annual target.<sup>11)</sup>

11) NH Investment & Securities, Samsung Heavy Industries (010140.KS), Stable order status for both LNG and offshore plants, July 23, 2019



- In April 2019, it won an order from Reliance MJ FPSO in India, amounting to USD 1 billion, which was the first offshore plant order since 2017. Positive effects are expected based on years of learning, downsizing, and customer diversification.

Cumulative Orders (as of May) and Backlog of Shipbuilding and Marine Sector of Samsung Heavy Industries

(Unit: USD million, No. of units)

Company	New order			Same period last year		Backlog		Same period last year	
	Amount	No. of ships		Amount	No. of ships	Amount (Delivery)	No. of ships	Amount (Delivery)	No. of ships
Samsung Heavy Industries (SHI)	2,600	9		2,300	24	19,900	88	17,500	82
Commercial vessel	1,500	8	TK 0/Con 0/LNG 8	2,300	24	13,400	84	11,000	77
Marine	1,100	1		0	0	6,500	4	6,500	5

Source: Hanwha Investment & Securities Research Center, July 2019

Note: As of May 2019 / The same period last year (as of May 2018)

### Daewoo Shipbuilding & Marine Engineering

- Daewoo Shipbuilding & Marine Engineering (DSME) has recorded 11 ship orders by May 2019, including 5 LNG carriers and 6 VL tankers. As the type of ships ordered is the same as those of Daewoo Shipbuilding & Marine Engineering, the shipbuilding margins are likely to be further improved.
  - As repeated shipbuilding of the same ship type continues, the shipyard’s dockyard efficiency is maximized and ship delivery volume increases within a unit period.
  - As Daewoo Shipbuilding & Marine Engineering has an order backlog consisting of three types of vessels, LNG carriers, VL tankers, and super container ships, its dockyard efficiency seems relatively high compared to rival shipbuilders.<sup>12)</sup>

12) Hanwha Investment & Securities, Daewoo Shipbuilding & Marine Engineering (042600), June 12, 2019 (Equity Research)

### Cumulative Orders (As of May) and Backlog of Shipbuilding and Marine Sector of Daewoo Shipbuilding & Marine Engineering

(Units: USD million, units)

Company	New order			Same period last year		Backlog		Same period last year	
	Amount	No. of ships		Amount	No. of ships	Amount (Delivery)	No. of ships	Amount (Delivery)	No. of ships
Daewoo Shipbuilding & Marine Engineering (DSME)	2,490	11		2,790	24	21,660	101	23,640	96
Commercial vessel	2,490	11	TK 6/Con 0/LNG 5	2,790	24	16,570	96	17,250	89
Marine	0	0		0	0	5,090	5	6,390	7

Source: Hanwha Investment &amp; Securities Research Center, July 2019

Note: As of May 2019 / SThe same period last year (as of May 2018)

## 4.2 Related Associations

Company name	Website	Major roles
Korea Offshore & Shipbuilding Association	<a href="http://www.koshipa.or.kr/">http://www.koshipa.or.kr/</a>	This association promotes friendship among members, strengthens the market information system, and seeks mutual benefits through the cooperation of the shipbuilding industry. It also contributes to the national economy by supporting the export of ships and expanding the Korean shipbuilding industry through efforts to nurture it.
Korea Marine Equipment Association (KOMEA)	<a href="http://www.komea.kr/">http://www.komea.kr/</a>	This association strengthens the linkage among shipyards ranging from small and medium to large, and increases the world's top-class products by developing excellent equipment companies in the shipbuilding and marine fields.
Korea Shipbuilding Industry Cooperative	<a href="http://www.kosic.or.kr/">http://www.kosic.or.kr/</a>	This organization contributes to the sound development of the shipbuilding industry and mutual welfare among members, and encourages independent economic activities by carrying out cooperative projects and mutual-aid projects. It also tries to promote the economic status of members and the balanced development of the national economy.

Company name	Website	Major roles
Korea Shipowners' Association	<a href="http://www.shipowners.or.kr/">http://www.shipowners.or.kr/</a>	This association was established not only to promote the interests of members but also to foster friendship among members. It also exerts efforts to improve the economic and social status of Korea's overseas shipping industry and promote international activities and the sound development of the industry.
Korea Marine Equipment Research Institute (KOMERI)	<a href="http://www.komeri.re.kr/">http://www.komeri.re.kr/</a>	This foundation is established to improve the international competitiveness of the shipbuilding and marine equipment industry by carrying out research and development activities necessary for technological innovation in the shipbuilding and marine equipment and related parts industry and by building close cooperation networks among industry, academia, R&D institutes, and the government.
Korean Register (KR)	<a href="https://www.krs.co.kr/">https://www.krs.co.kr/</a>	As a nonprofit corporation that performs the classification of ships, this organization is intended for protecting the safety of life and property at sea and for promoting technological advances in shipbuilding, shipping, and marine activities.
The Korean Society of Marine Engineering (KOSME)	<a href="http://www.kosme.or.kr/">http://www.kosme.or.kr/</a>	It contributes to the improvement and dissemination of knowledge and technology related to shipbuilding, marine equipment, and related industries; plays an active role in promoting information exchange among industry, academia, research, government, and press; and serves as a think tank.
The Society of Naval Architects of Korea	<a href="http://www.snak.or.kr/">http://www.snak.or.kr/</a>	This corporation was authorized to be established on January 31, 1976, and is supervised by the Ministry of Science, ICT and Future Planning. It aims at promoting science and technology by contributing to the advancement, application, and distribution of shipbuilding and marine engineering.





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# Investment Opportunities in Korea

## Shipbuilding & Marine

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