

# Does the Forty Year's Success Myth of the Korea Shipbuilding Industry Come to an End?

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## **Abstract**

*Shipbuilding industry, having a great ripple effect on national economy, has been fostered by some countries as the national key industries. Korea also has supported shipbuilding industry as one of the industries politically fostered by the state. Accordingly, the shipbuilding industry of Korea has started to developed since 1970's, reaching the world's top position in 2000's with reference to all the relevant indices.*

*However, after the global financial crisis in 2008, the shipbuilding industries of Korea focused on offshore plants, resulting in huge deficit and being outranked by China.*

*In this article, the past growing procedure of Korea's shipbuilding industry was briefly reviewed, and the future plans for regaining the past glories as the shipbuilding power were sought.*

## **Keywords**

*Shipbuilding industry, offshore plant, Shipbuilding Industry Promotion Plan*

## **1. Introduction**

The world's shipbuilding industry was led by the UK in 1950's and Japan in 1960's. From 1970's on, countries from the third group came to the fore. Particularly, Korea came up to the second rank in early 1980's.

Although the marine transport and shipbuilding markets suffered a long-term depression in 1980's due to the effect of two oil shocks in 1970's, Korea's share in the world shipbuilding market steadily increased to the point of being ranked at the world's top with reference to the quantity of orders received in 1993, outranking Japan for the first time. In 2000's, Korea's shipbuilding industry was ranked at the top of the world with reference to all the indices including the quantity of orders received, quantity of ships built, and the quantity of orders at hand. In 2008, the total price of the ships exported from Korea reached 43.1 billion U.S dollars, being ranked at the top among the exported product items

of Korea.

However, the world's economy suffered heavily from the global financial crisis triggered by the subprime mortgage crisis of the U.S. in 2007. Being affected by the financial crisis, Korea's marine transport and shipbuilding markets came to an economic recession. Due to the extreme "order drought", many middle and small sized shipyards have been bankrupt or come under legal management, while large sized shipyards have recorded billion dollars of deficit, passing through the worst years in the forty years of Korean shipbuilding history. In particular, the shipbuilding industry has been supported by making up for the decrease in the orders of merchant ships with the orders of offshore plants or eco-ships. However, the motivation for the orders of offshore plants or eco-ships has been reduced due to the recent drop of oil price. On the other hand, Chinese shipyards are making good accomplishments and Japanese shipyards are supported by the low yen policy. Therefore, the troubles of Korean shipyards are growing fast.

In such a situation, the past history of Korea's shipbuilding industry which led the state's economic growth is briefly reviewed, and the strategies needed to regain the lead in the world's shipbuilding market are discussed.

## **2. Development of Early Shipbuilding Industry Following Independence from Japanese Rule**

In early 20th century, after forcefully occupying the Korean Peninsula, the Japanese Empire constructed shipyards in Korea for the military purpose of invading China and Russia. However, the Japanese people exclusively occupied all the facilities, technologies, and materials for the shipyards in Korea, and there was not a well-equipped educational institution to teach shipbuilding technology. Modern shipyards constructed in Korea were just two, which were the Bangeojin Ironworks constructed in 1929 and the Joseon Heavy Industries constructed in 1937.

Since the Independence from Japanese Rule in 1945, Korea's shipbuilding industry started to grow by succeeding the Japanese-possessed shipyards, most of which were small ironwork companies fixing wooden vessels and small ships by using deteriorated facilities and instruments.

During the Korean War, most of the industrial facilities were destructed, and most of the shipbuilding facilities in South Korea were severely damaged, except those in Busan region. However, during the war, the shipbuilding industry was activated not only by the demand for ships to transport war supplies and aid goods but also by the UN's requests to fix ships and to build new ships.

The Korean government promoted establishment of higher education institutes for the fostering of professional shipbuilding human resources. Department of Shipbuilding Engineering was established firstly at starting from Korea Maritime University in 1945, and then at Seoul National University in 1946, at Busan Fishery University in 1950, and at Inha University in 1954, beginning to provide shipbuilding experts. In addition, considering the huge funds for the facility and operation required for a shipyard, which is difficult for a private company to bear, the government established a state-owned shipbuilding company. On the basis of the Joseon Heavy Industries constructed in 1937, the

government established the Korea Shipbuilding Corporation in 1950.

In harmony with the government's positive support, the number of shipbuilding companies was increased from 56 at the time of the Independence by about 3.5 times to be 198 of 1959. The quantity of shipbuilding was also increased from 19,000 tons of 1945 to 45,000 tons of 1961.

The office devoted to shipbuilding industry, Section of Examination, Department of Administration, Bureau of Maritime Transport, was established in the Ministry of Transportation in 1948 to manage the shipbuilding industry. Many relevant organizations to form foundation of shipbuilding industry were also established around that time (Note 1).

Act on Promotion of Shipbuilding Industry was legislated and proclaimed in March 1958 as a political supporting system prepared to resolve the problem of avoiding shipbuilding in the shipyards in Korea (Note 2). To increase shipbuilding in Korea, the government gave a subsidy within the limit of 40% of the shipbuilding cost and a loan of 50% or more (5% annual rate, pay back within 5-10 years) of shipbuilding cost, but the policy was unsuccessful due to the lack of budget (Note 3).

Afterwards, the military regime which seized the power by a military coup in 1961 established economic development plans for industrialization and strongly promoted the plans. The shipbuilding industry was included in the plans. In the period of the 1st Economic Development Plan (1962-1966), a new Shipbuilding Promotion Plan was promoted, preparing various supporting plans to reduce the burden of shipbuilding cost. In addition, according to the Five-Year Shipbuilding Industry Plan, 990 million KRW for the capital increase of Korea Shipbuilding Corporation and 78.6 million KRW of subsidy for promoting shipbuilding mutual-aid project were appropriated. However, the Plan was not successful due to the small scale of Korea's maritime transport business which is the end user. The original plan was not implemented to achieve the goal as the priority of state industries moved to fertilizer, electricity, and cement industries.

In 1964, a three-year plan was established for fostering of shipbuilding industry with regard to fishery development, ship quality improvement, and maritime transport ship introduction.

By the Three-Year Plan for Fishery Development, 137 million dollars of loan was acquired to build 227 ships including long liners, "Stantroll" factory ships, and fishery mother ships, and additional 52.64 million dollars of loan was acquired to build 589 ships including large and middle sized steamers, trawlers, and whaling ships. Moreover, 52.64 million dollars of loan was used for motorizing of coastal fishery boats and dieselizing of low-performance fishery boats.

According to the Three-Year Plan for Ship Quality Improvement, deteriorated and inefficient ship engines were replaced by diesel engines, and fixation of aged ships were promoted. The facility expansion and modernization plan of the Korea Shipbuilding Corporation enabled yearly shipbuilding of about 66,000 tons.

According to the Three-Year Plan for Maritime Transport Ship Introduction, introduction of 175,000 GT of ships was promoted in order to establish a system where domestic cargos could transported by domestic ships, as the demand for ocean-going transport was increased.

In March 1967, Act on Promotion of Shipbuilding Industry was legislated and proclaimed to prepare a legal basis to foster the shipbuilding industry in Korea (Note 4).

The Five-Year Economic Development Plan promoted by the military government rapidly scale up Korea's economy, and the demand for ships was quickly increased accordingly. However, the ratio of ships built in Korea was gradually decreased to 30% during the 1st Economic Development Plan and later to 13.5% during the 2nd Economic Development Plan. One of the main reasons for this result was that the quality and price of the ships built in Korea were not good, and another reason was the normalization of the diplomatic relation between Korea and Japan. As the diplomatic relation between the two countries became normalized, a considerable ratio of the economic cooperation fund provided as a loan was spent for buying ships for maritime transport and fishery. However, the free fund from Korea's property claim against Japan could be spent only for building of coastal fishery ships of 20 tons or less. Hence, ships were imported from other countries rather than built in Korea (Note 5).

**Table 1. Change of Financial Conditions of Shipbuilding Subsidy by Act on Promotion of Shipbuilding Industry (1967)**

Loan Condition	Before Amendment	After Amendment
Direct Subsidy	30%	abolished
Ratio of Loan	55%	85%
Period of Refund	20 years	15 years
Interest Rate	6% annual rate	7.5% annual rate

*Source:* Korea Offshore & Shipbuilding Association, Korea's Shipbuilding Industry: Growth and Tasks (2005, p. 170).

The policies for shipbuilding industry fostering promoted by the government in 1960's were focused on the increase of the small ship building based on domestic demand, and thus they were insufficient to modernize the facilities and strengthen the international competitiveness. In addition, since the early economic development policy was concentrated on light industries, the shipbuilding industry, which is one of heavy industries, did not get special benefit from the policies.

Eventually, it was in 1970's that the foundation for the development of Korea's shipbuilding industry was prepared. Scaling up of ships was undergoing worldwide at that time due to the closing of the Suez Canal. Also, expansion of shipyards was required in Korea to increase the self-sufficiency of ships from the end of 1960's. Hence, the government changed the direction of the policies to positive support of shipyard construction.

In September 1970, Hyundai Engineering & Construction Co., Ltd submitted the business plan to construct a giant shipyard by using the equipment and human resources which had been put to the construction works in Middle East. The initial plan was to build a 100,000-ton shipbuilding dock, but the plan was modified to build a 500,000-ton dock in harmony with the scaling-up trend of the world's

shipbuilding market. The shipyard construction commencement took place at the Mipo Bay, Ulsan, in March, 1972. However, the construction was further scaled-up to prepare a dock where a 1,000,000-ton oil tanker might be built, according to the “Long-term Plan for Shipbuilding Industry”. Eventually, with the expansion work in parallel, the world’s largest shipyard having a 900 m dock and a 560 m dock was completed.

Following the completion of the Hyundai Ulsan Shipyard, Hyundai Mipo Dockyard was completed in 1975. The giant shipyard started to be constructed at Okpo, Geoje, by the Korea Shipbuilding Corporation in 1973 was handed over to Daewoo Group to be Daewoo Heavy Industries & Machinery. Samsung Group Also established Samsung Shipbuilding Co., Ltd by merging Woojin Shipbuilding which had been constructing a shipyard at Geoje, Gyeongsangnam-do, to complete Dock No. 1 in 1979.

Table 2 shows the status of giant shipyards constructed in Korea in 1970’s.

The key policies promoted by Korean government in relation to shipbuilding industry in 1970’s include the Shipbuilding Industry Promotion Plan, established in February 1970, for the increase of domestic ship self-sufficiency, the elevation of domestic production rate, and the promotion of ship export.

The government provided a total of 2,070 million KRW including the financial fund of 1,190 million KRW and the mechanical industry fostering fund of 880 million KRW to implement the plan. Additionally, 30 million KRW was put into the modernization of the facilities from the fund prepared by selling industrial financial bonds.

In March 1973, the Long-term Plan for Shipbuilding Industry Promotion was established, which was to foster Korea’s shipbuilding industry by taking the advantage of the situation of that time in which the shipbuilding industries of Western countries and Japan were going down due to the high wage and deteriorated facilities. The outline of the plan is to integrate and systematize minor shipyards into specialized middle size shipyards on the basis of two world’s best giant shipyards including the Hyundai’s shipyard in order to greatly increase the shipbuilding capacity.

However, the Long-term Plan for Shipbuilding Industry Promotion had no choice but to be modified from the early stage due to the global economic recession caused by the oil crisis in 1973 as well as the depression of the world’s shipbuilding industry. Therefore, the government implemented the “Planned Shipbuilding System” to foster the shipbuilding industry in connection with the domestic maritime transport industry.

**Table 2. Status of Construction of Giant Shipyards in 1970’s**

Company	Construction Status
Hyundai Heavy Industries Co., Ltd.	<ul style="list-style-type: none"> <li>· Construction began in March, 1972</li> <li>· Completed in December, 1973</li> <li>· VLCC of 260,000 tons built in June, 1974</li> </ul>
Hyundai Mipo Dockyard Co., Ltd.	<ul style="list-style-type: none"> <li>· Factory No. 1 construction began in March, 1975</li> <li>· Hyundai Mipo Dockyard Co., Ltd established in April, 1975</li> </ul>

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Daewoo Heavy Industries & Machinery Co., Ltd.	<ul style="list-style-type: none"> <li>· Shipbuilding started July, 1975</li> <li>· Dock No. 1 construction began in Okpo by Korea Shipbuilding Corporation in August, 1973</li> <li>· Construction delayed by the 1st Oil Crisis in October, 1973</li> <li>· Dock No. 1 completed in August, 1978</li> <li>· Daewoo Group merged Okpo Shipyard in December, 1978</li> <li>· Additional facilities construction completed in 1981</li> </ul>
Samsung Heavy Industries Co., Ltd.	<ul style="list-style-type: none"> <li>· Korea Shipbuilding Co., Ltd established in March, 1974</li> <li>· Shipyard construction began in December, 1974</li> <li>· Merged to Woojin Shipbuilding Co., Ltd. in March, 1977</li> <li>· Merged to Samsung in April, 1977</li> <li>· Shipyard began operation in September, 1979</li> <li>· Dock No. 1 construction completed in December, 1979</li> </ul>

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*Source:* Korea Offshore & Shipbuilding Association, Korea's Shipbuilding Industry: Growth and Tasks (2005, p. 37).

The ultimate goal of the system was, "Our cargos are transported by our ships, which are built in our shipyards". In this system, national flag shipping companies recognized by the government as an ender user of shipbuilding fund were given the government's financial support to build the ships in the shipyards located in Korea.

The system was specifically implemented by the Comprehensive Plan for Ocean-Going Maritime Transport Fostering prepared in April 1974 and the Comprehensive Plan for Fostering Maritime Transport and Shipbuilding prepared in March 1976. The system obtained the legal basis by the Maritime Transport Promotion Act amended in December 1978.

According to the planned shipbuilding, all home-waters liners and 75% of ocean-going ships could be built by the funds for planned shipbuilding, and a loan of 80% of the ship price (appraised value entrusted to Korea Appraisal Board by Korea Development Bank) was provided. The planned shipbuilding greatly helped the industry in the sense that the minimum shipbuilding quantity could be maintained even during the depression of the shipbuilding industry (Note 6).

Like this, in early 1970's, the competitive scale for the world's shipbuilding market was prepared by the construction of the shipyards of Hyundai, Samsung, and Daewoo, and the government made a huge contribution to the shipbuilding industry by providing financial support for facility expansion and implementing the planned shipbuilding project. Thanks to these efforts, different from the European and American shipbuilding companies which were reducing the facilities or being bankrupt due to the global depression of the shipbuilding industry, Korea expanded the shipbuilding facilities and rapidly grew to be one of the largest shipbuilding countries within just 10 years from the state of 1960's having almost no foundation for the industry.

### 3. Revival of Korea's Shipbuilding Industry

The depression of the global maritime transport market following the two times of oil crisis in 1970's

cause a considerable trouble to the shipbuilding industry. The government of Korea decided to make shipbuilding an export industry in harmony with the domestic and international conditions during the 4th Five-Year Economic Development Plan. The policies put emphasis on making shipbuilding an export industry through the supply increase based on deferred payment export, improving self-sufficiency of shipbuilding technology, positively implementing planned shipbuilding, interconnecting and fostering of maritime transport business and shipbuilding industry, and increasing domestic production of the equipment and materials.

In response to the shipbuilding industry fostering policies of the government, Dock No. 2 of Daewoo Shipbuilding was completed in January 1983 and Dock No. 2 of Samsung Heavy Industries was completed in March 1983, concluding the long-term project of shipyard construction. As of end of 1983, the number of shipbuilding companies in Korea was increased to have four large companies, 7 middle sized companies, and 223 small sized companies (Note 7). The rank of Korea's shipbuilding industry jump to the second of the world from early 1980's.

However, the global economy kept a low growth rate of 2.4% from 1980 to 1987 due to the shock of the oil crisis. Accordingly, the world's trade was significantly decreased, and the maritime transport traffic was decreased even more by the trend that the key industries of the advanced countries were shifted from heavy industries to high-tech industries such as semiconductor industry. Therefore, the depression of the maritime transport and shipbuilding industries continued for a long time. Particularly, shipping owners often delayed ship take-over intentionally for the reason of the depression of the maritime transport market, resulting in closing of shipbuilding companies due to financial problems.

In such a global economic situation, the shipbuilding companies of Japan, which were leading the world's shipbuilding market, were greatly damaged. In particular, the competitiveness of the Japanese companies was drastically decreased as the exchange rate was suddenly increased by the Plaza Accord. As many shipbuilding companies were bankrupt and close, the Japanese government reduced the shipbuilding capacity through a rationalization measure. Some shipping companies of Korea were also bankrupt due to the deterioration of the financial status, and some ships were detained in other countries.

To support the shipbuilding industries in severe difficulties, the Korean government prepared a special supporting plan called "Plan for Rationalization of Maritime Transport Industry (Draft)" in December 1983, deliberated the plan in the Industrial Policy Council in May 1984, and passed the plan in July 1985. The Rationalization Plan included the reduction and exemption of the registration tax, acquisition tax, and special value-added tax according to the Tax Reduction and Exemption Act for the shipping companies designated as the rationalization targets, and financial support in KRW and foreign currency. Accordingly, among 66 national flag shipping companies, 63 companies participated in the shipping company reorganization work, except 3 companies which were joint ventures with foreign capital. As a result, the conventional 63 ocean-going maritime transport companies were rearranged into 20 group shipping companies at the end of December, 1985.

In 1986, to strengthen the global competitiveness of the shipbuilding industry, the deferred export financing conditions for the ships supported by the Export-Import Bank of Korea were changed to the OECD credit understanding standards. In addition, 110 items of ship equipment and materials were systematized for the fostering of the equipment and materials production industries. As a part of local machinery manufacturing policy, 58 items of shipbuilding equipment and materials were determined as the local manufacturing and development targets in 1986, and the large shipyards were encouraged to purchase the developed equipment and materials to enhance local manufacturing.

Fortunately, the global shipbuilding market started to be recovering from the bottom in 1985. Thanks to the “three-low” (exchange rate, oil price, and raw material price), the quantity of orders was increased, and the recovering phase started from 1986. In 1987, most of the world’s shipbuilding orders were concentrated on Korea, and thus the world market share was increased up to 30.2%. However, a large scale labor dispute took place in the domestic political and social confusions following the pro-democracy movement and the 29 June Declaration in 1987. From late 1987, the shipbuilding industry suffered hardships including delayed arrival date, and wage increase due to the severe labor dispute, as well as appreciation of Korean Won due to the disappearance of “three-low” effects. The financial status of Korea’s shipbuilding industry became worse in 1988. Due to the “three-high” (high exchange rate, high oil price, and high interest rate), Korean Won was highly appreciated (15.2%). The ability to pay was greatly decreased since the orders were made with reference to the ship price on the basis of the depreciated Korean Won, causing confusions in the management. The wage was greatly increased due to the labor dispute, and the price of equipment and materials including the steel materials was also increased, resulting in an overall elevation of shipbuilding cost in almost all sections. Therefore, the shipbuilding companies confronted the risk of bankruptcy with the concerns for the impact to the national economy and society which might be caused by chain-reaction bankruptcy of relevant middle and small sized equipment and material companies, large-scale unemployment, and shock to the local economy in the regions of shipyards. Thus, in August 1989, the Korean government published the national “Shipbuilding Industry Rationalization Measure” to improve financial structure of the shipbuilding companies and rationalize the management. The Measure encouraged the rationalization target companies to take self-efforts for financial status improvement by selling subsidiaries and assets, or by integrating the subsidiaries or to promote normalization of the management by being merged into a third party. In such cases, the target companies were supposed to be given a number of special preferences such as tax support, exemption of registration and acquisition tax in the case of a merger and acquisition, exemption of withholding tax for the preserved asset in the case of acquisition by a third party, and admission of exception for exceeding the investment limit for the subsidiaries. In addition, new construction or expansion of shipbuilding facilities was restricted to the end of 1993. The Ship Export Recommendation System, which was prepared for the government to allocate export, was implemented to prevent excessive competition including receiving low-price overseas orders.



**Table 3. Comparison of Shipbuilding Market Shares by Individual Countries (with Reference to Quantity of Shipbuilding) (Unit: %, 10,000 GT)**

	1965	1970	1975	1980	1985	1990	1995	2000	2003
Korea	n.a	n.a	1.2	4.0	14.4	21.8	27.8	39.1	38.3
Japan	41.5	48.1	49.7	46.5	52.3	43.0	41.6	38.4	35.3
China	n.a	n.a	n.a	n.a	0.9	2.3	4.3	4.8	10.5
Western Europe	49.2	40.4	38.2	22.6	16.3	17.9	19.3	13.2	10.6
World Total	1,176	2,098	3,420	1,310	1,816	1,589	2,239	3,124	3,550

*Source:* Lloyd's Statistical Data for Each Year (including ships larger than 100 GT).

In these difficult times, the Korea Shipbuilding Corporation, the long time representative of Korea's shipbuilding history, was merged in 1990 to become Hanjin Heavy Industries & Construction. With respect to Daewoo Shipbuilding, while many argued to sell the company due to the excessive shipbuilding facilities in comparison with the maritime transport demand, the government decided to support the company for fear of unemployment problem which might be caused by mass discharge of workers. Incheon Shipbuilding was acquired by Halla Group to have a new name of Halla Heavy Industries.

The "Shipbuilding Industry Rationalization Measure" eliminated the risk of chain-reaction bankruptcy of relevant companies including the subsidiaries and shipbuilding equipment and material companies as well as the risk of mass discharge of workers. Internationally, the Measure enabled for Korea's shipbuilding industry to maintain foreign credit rating by preventing contract failure which could happen due to the bankruptcy of the relevant companies. Therefore, the Measure is considered as an appropriate action at an appropriate time. However, there is a critical point of view toward the Measure that the government inhibited the industry from acquiring self-reliance by the direct intervention, not letting the companies overcome the difficulties of the economic depression through restructuring by themselves (Note 8).

From 1989, the global shipbuilding market came out of the depression phase and enter into a thriving phase. Shipbuilding orders started to be increased by optimistic ship owners. The market share of Korean companies was gradually increased, even being ranked at the top with reference to the quantity of orders received in 1993, outranking Japan due to the strengthening of Japanese Yen. As the "Shipbuilding Industry Rationalization Measure" was discontinued, the Ship Export Recommendation System was abolished on July 1, 1993, and the temporary restriction of new construction or expansion of shipbuilding facilities was also discontinued. Taking this opportunity, Samsung Heavy Industries extended the length of Dock No. 2 in December 1993 for the building of giant oil tankers, and completed the construction of Dock No. 3 in October 1994, having the complete system for building giant oil tankers. Hyundai Heavy Industries also completed the construction of Docks No. 8 and No. 9 in August and November, 1995 (Note 9).

However, Japanese shipbuilding industry, which was behind Korea in the price competitiveness due to

the strong Yen, quickly recovered the competitiveness from late 1995 on the basis of the continuous depreciation of Japanese Yen, increased importing of materials from other countries, and the efforts for rationalization. On the contrary, Korea's shipbuilding industry had difficulties in receiving orders in 1996, as the competitiveness was lost due to the cost increase by the rise of labor cost and the equipment and material price. In particular, as Japan increased the capacity to supply by relieving the equipment regulations, the global competition was intensified, resulting in a difficult situation once again due to the decrease of the price for new ships and the deterioration of the financial balance.

Moreover, due to the continued bankruptcy of companies under the IMF administration after the currency crisis in 1997, credit crunch of companies became worse and the financing became more difficult, causing the sense of crisis, which led to intensified reconstructing of shipbuilding companies. Halla Heavy Industries, having a debt ratio of 1,000% or higher, came under a bankrupt state. Samsung Heavy Industries, which had been making financial loss in two consecutive years due to huge plant and equipment investment, was able to escape from the financial loss in early 1998 through the restructuring of selling the heavy building equipment part and the transport and cargo handling part to Volvo, Sweden, and Clark, U.S., respectively.

**Table 4. Variation of Korea, Japan, and China in Global Shipbuilding Market Status (with Reference to Orders Received, 10,000 GT)**

		1995	2000	2003	2005
World market		2,553	4,514	7,404	6,133
Quantity of orders received (10,000 GT)	Korea	776 (30.4%)	2,069 (45.8%)	3,240 (43.8%)	2,161 (35.2%)
	Japan	891 (34.9%)	1,287 (28.5%)	2,363 (31.9%)	1,650 (26.9%)
	China	111 (4.3%)	253 (5.6%)	1,065 (14.4%)	1,062 (17.3%)

*Source:* Lloyd's Statistical Data for Each Year.

*Note.* World market share in parenthesis.

However, the currency crisis provided an opportunity to strengthen price competitiveness of Korea's shipbuilding industry at a single sweep. A drastic appreciation of Korean Won increased the price competitiveness of the shipbuilding industry, and greatly improved the financial environment by the foreign-exchange profit since the advances and the payment for the ordered ships were received in dollars. Therefore, except the bankrupt companies such as Halla Heavy Industries or Daedong Shipbuilding or Daewoo Heavy Industries & Machinery following the composition procedure, the currency crisis provided an opportunity for the entire shipbuilding companies in Korea. In addition, Japanese shipbuilding companies which had already secured work projects for the year of 2000 were not actively receiving shipbuilding orders for the fear of decrease of ship price. Korea's shipbuilding industry was able to overcome the IMF relief loan crisis and recover the competitiveness in the global market in a relatively short period of time for the reasons that Korea and Japan were the only two

countries capable of constructing competitive merchant ships at that time and that Korea's shipbuilding companies had accumulated trust with foreign ship owners. Korea returned the top rank in 1999 with reference to the orders received for the second time after 1993, and then kept the top rank in 2000, recording top rank in the two consecutive years with 45% of share in the global shipbuilding orders.

As described above, Korea's shipbuilding industry had fluctuation in 1990's. However, there was neither a governmental policy implemented for the fostering or supporting of the shipbuilding industry nor a large-scale research and development project carried out solely by the shipbuilding industry. There were only few research and development projects included in industrial infrastructure projects. This is related to the conversion of the government's industrial restructuring policy to market principle. Before mid 1980's, the government supported individual industries, and the shipbuilding industry received various political benefits as a concentrated fostering subject. However, in mid 1980's, the system to support individual industries was abolished, and the direction of governmental policies was changed to respect the autonomy of the industry. In addition, the shipbuilding industry was considered as a matured industry in Korea in 1990's, meaning that the companies were able to conduct research and development with their own capability. In addition, shipbuilding industry requires less fundamental research projects in comparison with other industries.

From 2000, Korea's shipbuilding industry, having well overcome the IMF administration in late 1990's, took the lead in the world's shipbuilding market with references to all the indices including quantity of orders received, quantity of ships built, and the quantity of orders at hand. As of 2003, Korea's shipbuilding companies had the quantity of orders received of 32,400,000 GT, sharing 43.8% of the global market and thus returning to the top rank for the fourth time after 1993, 1999, and 2000. The global market share with reference to the quantity of ships built was 38.8%, followed by 35.3% of Japan and 10.5% of China. Korea returned to the top rank with reference to the quantity of ships built for the third time after 2000 and 2002. Korea's global market share with reference to quantity of orders at hand was 39.9%, taking the lead in six consecutive years from 1998. These data mean that Korea's shipbuilding industry has a firm position as the world's leader.

On the other hand, Japan, which had led the world shipbuilding industry for more than 40 years from 1960's, was outranked by Korea from the top position around the year of 2000, since Japanese shipbuilding companies passively responded to the changes of the global demand. Japan has started to be led even by China since 2006.

#### **4. Global Financial Crisis and Risk of Korea's Shipbuilding Industry**

A direct factor to the prosperity of shipbuilding industry from 2003 to 2007 was the increase of transport traffic due to the increase of raw material demand of emerging countries including China and the increase in trade between advanced countries and emerging countries. In response to the prosperity of shipbuilding countries, Korea's shipyards swept No. 1 to 7 ranks of the global market with references to the quantity of orders at hand in 2006. The quantity of export by shipbuilding industry in

2008 was 43,100,000,000 dollars, which was more than 10% of the entire export quantity of Korea, taking the lead for the first time by outranking the automobile and semiconductor industries.

However, as New Century Financial, which was the second largest housing fund loan company in the U.S., filed for bankruptcy in April 2007, global financial crisis spread to not only in the U.S. but also in other countries, resulting in an impact on shipbuilding industry which is sensitive to economic fluctuation. The shipbuilding market was speedily decreased as the ship price was unusually lowered due to the decrease of raw material demand, reduction of maritime transport of crude oil, cancellation of shipbuilding orders, decrease of new shipbuilding orders, and reduction of maritime transport quantity. Accordingly, with reference to Lloyd statistics, the global quantity of orders received was decreased from 87,290,000 CGT of 2007 to 41,390,000 CGT of 2008, and 16,580,000 CGT of 2009 by more than 80% within just two years. Korea's quantity of new shipbuilding orders received was also strikingly decreased, and thus Korea was outranked by China with reference to the quantity of orders received and the quantity of orders at hand in 2009 and with reference to the quantity of ships built in 2010 (Table 5).

In 2010, shipbuilding industry came out of the worst situation as the global quantity of orders received was increased more than two times in comparison to that of the previous year. In 2011, while the global quantity of orders received was again decreased by more than 20% in comparison to that of the previous year, Korea's shipbuilding companies temporarily returned to the world's top rank by focusing on the orders (more than 40% of order quantity of the world) of high value-added ships such as LNG ships, large container ships, and drill ships. On the other hand, China's quantity of orders received was decreased by about 50% relative to that of the previous year due to the depression of the bulk carriers, which were the major products of Chinese shipbuilding companies. However, Korea's shipbuilding industry was once again outranked by China after 2012 with reference to all the indices including quantity of orders received, quantity of ships built, and the quantity of orders at hand. As the orders were concentrated on high value-added ships produced by large shipbuilding companies, middle and small sized shipbuilding companies suffered severe difficulties.

From 2009 to 2012, most of Korea's shipbuilding companies showed an increase of the profit, coming out of the depression just after the financial crisis. However, after showing a decreasing trend from 2012, the companies, especially the large shipbuilding companies, showed shocking results.

The STX Offshore & Shipbuilding Co., Ltd., once called one of the Big 4 in shipbuilding industry, was dissolved due to a liquidity crisis in 2013. Hyundai Heavy Industries, the world's top shipbuilding company, recorded 3,249.5 billion KRW of business loss in 2014 for the first time since its establishment. Samsung Heavy Industries recorded 362.5 billion KRW of business loss in the first quarter of 2014 and then manage to turn into a profit in the second quarter.

The direct cause of the unprecedented large loss by the Korea's large shipbuilding companies was the bad financial state originated from the offshore plant business.

Offshore plant is the tye symbol of the matchless competitiveness of Korea's shipbuilding industry. The

offshore plant market was a very big market sharing about 51% of the entire shipbuilding industry in 2012. Korea's Big 3 shipbuilding companies almost monopolized the world market, leaving Japanese and Chinese companies behind.

Due to the decrease in the maritime transport traffic during global economic recession following the financial crisis in 2008, the assets of Korean shipping companies were gradually decreasing as the orders of merchant ships including container carriers and bulk carriers were significantly decreasing. At that time, due to the high oil price, global oil managers ordered a considerable quantity of offshore plant construction for the deep sea resource development from 2010. The Big 3, which just received orders of coastal plants, actively participated in the offshore plant business, competitively receiving orders of offshore plant projects in a turn key base system (contract for design and construction combined).

**Table 5. Shipbuilding Market Indices of Korea, China and Japan: 2007-2013**

Index	Year	Korea		China		Japan		Global	
		1,000 CGT	%	1,000 CGT	%	1,000 CGT	%	1,000 CGT	%
Quantity of Orders Received	2007	32,861	37.6	31,382	36.0	10,017	11.5	87,288	100
	2008	15,833	38.3	13,148	31.8	6,525	15.8	41,386	100
	2009	3,443	20.8	6,987	42.1	3,895	23.5	16,580	100
	2010	11,172	28.9	16,083	41.6	5,373	13.9	38,625	100
	2011	13,550	43.9	8,224	26.7	4,073	13.2	30,846	100
	2012	6,823	27.9	8,110	33.2	4,318	17.7	24,421	100
	2013	15,553	30.8	17,671	35.0	6,941	13.8	50,453	100
	2014	12,076	32.0	13,280	35.2	8,819	23.4	37,747	100
Quantity of ships built	2007	11,277	32.5	6,795	19.6	8,913	25.7	34,670	100
	2008	14,509	35.4	9,065	22.1	9,759	23.8	41,019	100
	2009	14,466	33.1	12,387	28.4	9,608	22.0	43,692	100
	2010	14,906	28.8	18,800	36.3	9,820	19.0	51,664	100
	2011	15,797	30.9	19,198	37.6	9,160	17.9	51,044	100
	2012	13,391	27.9	19,331	40.3	8,350	17.4	47,918	100
	2013	11,395	29.7	11,784	30.7	6,828	17.8	38,349	100
	2014	10,120	33.5	10,193	33.7	6,585	21.8	30,218	100
Quantity of orders at hand	2007	64,575	35.6	53,101	29.3	31,355	17.3	181,449	100
	2008	64,357	33.8	62,001	32.6	30,649	16.1	190,266	100
	2009	47,576	31.3	54,357	35.8	24,460	16.0	151,952	100
	2010	39,145	30.5	48,922	38.2	19,835	15.4	128,013	100
	2011	33,066	29.7	38,872	34.9	15,829	14.2	111,442	100
	2012	24,164	27.3	29,361	33.1	12,223	13.8	88,674	100
	2013	27,883	27.9	33,427	33.5	13,337	13.4	99,767	100
	2014	29,081	30.8	36,417	38.5	17,046	18.0	94,555	100

Source: Lloyd's World Shipping Statistics, Each year.

Note. Quantity of orders at hand as of the end of each year.

The quantity of offshore plant orders received by Korea's shipbuilding companies was highly increased from 5,242 million dollars of 2009 to 8.86 million dollars of 2010, 17,500 million dollars of 2011, and 21,785 million dollars of 2012, almost monopolizing the orders. In 2012 and 2012, which was the climax of the offshore plant orders, the ratio of offshore plants in the entire quantity of orders received by Daewoo Shipbuilding & Marine Engineering and Samsung Heavy Industries was almost 90%.

However, the side effects of the offshore plant project orders received by the large shipbuilding companies came to the fore as the plants started to be handed over. The Big 3 of Korea's shipbuilding industry recorded the worst loss ever. The most fundamental reason for the result was that the project cost needed for the structurally complicated plant was not accurately calculated due to the lack of experience and that the companies competitively received orders without the basic design ability and the capability to produce core equipment and materials.

Eventually, some construction projects were delayed, the design was often modified, and the construction process was not well maintained, resulting in snowballing of the building cost. Moreover, the quantity of offshore plant orders received was drastically decreased due to the sudden fall of oil price in late 2014, and the utilization of drilling equipment was also decreased. Therefore, offshore plant ordering bodies tried to delay the hand-over as much as possible or cancelled the contract, and the shipbuilding companies were unable to fulfill the hand-over date, resulting of cancellation of contracts. In this way, the risk of the Big 3 became worse and worse. In 2015, Samsung Heavy Industries recorded 1,501.9 billion KRW of business loss, Hyundai Heavy Industries 1,540.1 billion KRW, and Daewoo Shipbuilding & Marine Engineering 5,505.1 billion KRW, summing up to be 10,000 billion KRW of loss within just two years of 2014 and 2015 (Note 10). Offshore plant, which had been regarded as timely rain in times of drought or a money spinner for Korea's shipbuilding industry, fell so low as to become a massive white elephant bringing about astronomical loss. The after effect is expected to continue in 2016, because there are so many unexpected factors such as low price orders received, contract cancelled, and hand-over delayed.

Worse than the Big 3, the fate of Korea's middle and small sized shipbuilding companies hangs by a thread, because their major products are in competition with Chinese companies. STX Offshore & Shipbuilding, Sungdong Shipbuilding & Marine Engineering, SPP Shipbuilding, and Daesun Shipbuilding & Engineering started voluntary negotiation (Note 11) with the creditors, but they are like candle in the wind. Daehan Shipbuilding, Shina SB, Jinse Shipbuilding, and Orient Shipyard are under legal management to be sold. Sekwang Shipbuilding, C&Shipbuilding, Nokbong Shipbuilding, Samho Shipbuilding, 21th Century Shipbuilding, and Seko Shipbuilding were already sold or closed. According to the industrial news, about 10,000 billion KRW was already invested to the four shipbuilding companies undergoing the voluntary negotiation.

In such a situation, China and Japan are challenging the high value-added shipbuilding market which was almost monopolized by Korea's shipbuilding companies. Since 2015, Chinese and Japanese shipbuilding companies started to received orders for large container carriers, extending to large oil

tankers and LNG carriers.

### 5. Future Task of Korea's Shipbuilding Industry and Concluding Remarks

Korea developed the shipbuilding industry by acquiring the shipyards possessed by Japanese people after the Independence from Japanese Imperialism, but the industrial foundation was very weak in 1960's.

As the industrialization focused on heavy and chemical industries was promoted by the military power of President Park Chung-hee in 1970's, large enterprises such as Hyundai Heavy Industries, Daewoo, and Samsung positively participated in the shipbuilding industry, coming out of the small domestic market and entering to the global market. The government encouraged to increase the self-sufficiency of ships and local production of equipment and materials through the Shipbuilding Promotion Plan, the Long-term Plan for Shipbuilding Industry Promotion, and the planned shipbuilding system, inducing stable manufacturing at shipyards.

In early 1980's, the financial status of Korea's shipbuilding companies became deteriorated due to the long-term depression in the global maritime transport and shipbuilding market caused by the after-effect of oil crisis in 1970's. However, starting from late 1986, as the global shipbuilding market was recovered, the quantity of orders received was increased, and most of the orders came to Korea. As a result, Korea recorded over 30% of global market share to begin rapid development.

In 1990's, Korea's shipbuilding industry experienced severe fluctuation. As the Plan for Rationalization of Maritime Transport Industry ended in 1992, the middle and large sized shipbuilding companies including Samsung Heavy Industries, Hyundai Heavy Industries, Halla Heavy Industries, and Daedong Shipbuilding started to expand the shipbuilding facilities. The profitability was improved in almost all the shipyards, and the competitiveness was recovered, recording business gain. Eventually, at the time when the shipyards in advanced countries were closed due to the economic depression, Korea's shipbuilding companies rather expanded the facilities and scaled-up to increase their share in the global shipbuilding market to prepare a stepping stone for further growth in the prosperous phase. The technological level was elevated in a short period of time. The orders for high value-added ships including LNG ships, large container carriers, and Floating Production, Storage, and Off-Loading systems (FPSO) were significantly increased in 1990's. Although the country as well as the shipbuilding industry faced a serious crisis in 1997 due to the currency crisis, the shipbuilding companies took the opportunity to restructuring the companies and improve the efficiency, early escaping from the currency crisis.

Korea's shipbuilding industry, which had managed to export a deep-sea fishing vessel of 2500 T in 1969, took the lead in global market for 9 consecutive years from 1999 to 2007 with reference to the quantity of orders at hand. Korean shipbuilding companies ranked from 1 to 7 in 2006 with reference to the quantity of orders received. In 2008, the shipbuilding industry had the largest share in the export from Korea. Korea's shipbuilding industry truly outranked Japan to be at the top of the world in all

aspects from the year 2000.

Such a brilliant growth of Korea's shipbuilding industry was possible thanks to the positive investment strategies of companies and the government's timely policies. In particular, abundant provision of low-paid workers, low-price provision of various shipbuilding equipment and materials, and development of mechanical, steel, and electronic industries helped Korea's shipbuilding industry maintain a dominant position in price competitiveness.

Above all, the rapid growth of the shipbuilding industry was due to the growth strategy focused on chaebols, the giant business tycoons. The government had no choice but to work with chaebol enterprises, because there were no other companies having enough capital and human resources to start a shipbuilding business than chaebol enterprises. When shipbuilding companies recorded a great loss in the early stage, chaebol companies were able to overcome the crisis with the help from the subsidiaries or by the cooperation with relevant subsidiaries in similar business. The competition between the chaebol companies also enabled bold expansion of shipbuilding facilities and development of high technologies through research and development, contributing a lot to the growth of Korea's shipbuilding industry. As a result of the successful strategy, the Big 3 of Korean shipbuilding industry ranked at No. 1 to 3 positions. The world's top shipbuilding company, Hyundai Heavy Industries, set the new world records one after another in the number of ship hand over (1,000 ships in March 2002 and 2,000 ships in May 2015).

However, after the global financial crisis in 2008, Korea's shipbuilding industry faced a serious crisis, losing all the fame and riches accumulated in the world market previously. The quantity of orders received was remarkably decreased due to the reduced transport traffic caused by the economic recession of global economic powers including China and European countries. Meanwhile, Korea's shipbuilding industry had to give the leading position to China. Offshore plant which came to the fore in the difficult times drew attention as future growth engine for Korea's shipbuilding industry, and Korea's Big 3 joined in the competition, almost sweeping global orders. However, the project backfired on since the business was started without sufficient building experience and technologies. The Big 3 are now recording loss of more than 10,000 billion KRW in last two years. Most of the middle and small sized shipbuilding companies are in a life-and-death situation. Korea's shipbuilding industry which used to rule over the global shipbuilding market is now facing the crisis to be a peripheral country, giving the lead to the neighboring countries like China and Japan (Note 12).

To overcome the current state of crisis and regain the past world No. 1 position, Korea's shipbuilding industry may need to carry out the following tasks.

First, to continuously take the lead in the world market, Korea's shipbuilding industry should make continuous efforts in the development of edge-cutting technologies. The past competitiveness of Korea's shipbuilding industry originated from not a paradigm-changing innovative technology, like that of the British or Japanese technologies, but from the good human resources and technological power of the shipbuilding part based on the large sized docks possessed by chaebol companies. The shipbuilding



industry fostering policies by government also played an important role. However, since around the year 2000, as Korean shipbuilding companies started to have the ability to building various ships on the basis of the accumulated technological competence, they began to use the differentiating strategy focusing on superships, high value-added ships (LNG tankers, drilling ships, and ice breakers), and offshore plants. In 2004, Korea's shipbuilding companies dominated the high value-added market, receiving 70% of the global orders for LNG tankers with reference to the number of ships. However, the rate of localized production of high value-added ships is about 60% or lower, in comparison with the localized production rate of 90% or higher in the case of general ships (Note 13). Particularly, the rate of localized production of the equipment and materials is about 20% to 30%, and the design is mostly dependent on the foreign technologies in the case of offshore plants, causing huge business loss in Korea's Big 3. The design and technology in the field of offshore industry are exclusively possessed by the global companies of the Europe and the U.S, and thus penetrating the market is not easy currently.

Therefore, Korean government published the Offshore Plant Industry Development Plan in November 2013 to develop offshore plant technologies and to increase the rate of localized production of equipment and materials. The plan included concentrated investment of 900 billion KRW for fostering the industry, and establishment of offshore plant cluster in Busan, Ulsan and Gyeongnam, the southeastern region of Korea. However, the relevant investment is continuously decreased or withheld, as the offshore plant industry is considered as the cause of the business loss of Korea's large shipbuilding companies.

However, Korea's shipbuilding companies still have comparative advantages in the building of offshore plants, which will give another opportunity to Korea's shipbuilding companies with the recovery of global economy and the rise of oil price. Therefore, even though the current situation is not easy, the companies should continuously invest funds to research and development without letup. Such a difficult time may give an opportunity to secure offshore plant technologies, which will bring about more added-value in the future as the oil price rises and the demand for offshore plant facilities increases.

In this regard, Korea's Big 3 should do a self-examination and learn from the past mistakes made in the previous projects.

As mentioned above, Korea's shipbuilding industry has grown on the basis of large enterprises. The competitive system between large enterprises played an important role in elevating the global competitiveness of the entire shipbuilding industry of Korea. In addition, the competitiveness was further increased through mutual exchange of knowledge, technology, and know-how by sharing cooperative subsidiaries as well as human resources. However, the excessive competition between Korea's Big 3 brought miserable result of the largest business loss ever, causing low-price orders received. At that time, Korea's Big 3 were the only companies having the capability to build offshore plants, and oil managers had no other ways to order if the Big 3 had refused to receive. Nevertheless,

due to the excessive competition, the Big 3 caused delayed hand-over and deteriorated profitability by undertaking even insufficient design. Therefore, the companies should prevent such excessive competitions among companies, refuse impractical orders, and choose profitable ones, being focused on orders without design. The rate of localized production of offshore plant equipment and materials should be increased for timely procurement. Within the limit of not damaging the market economy, the Big 3 should collaborate in some areas for cooperation and standardization. The companies have already recognized the need for standardization. The ship classification societies of the U.S., Norway, and Germany, together with the major oil managers, are promoting standardization of the materials, design, and work procedures until early 2016.

Second, for Korea's shipbuilding companies to grow continuously, high-quality human resources needed in the shipbuilding industry should be positively fostered. Any industries need to foster and supply high level human resources in the relevant areas for continuous growth. In 1970's and 1980's when Korea's shipbuilding industry speedily developed, a number of high-quality human resources gathered in the department of shipbuilding engineering in many universities, and the human resources developed and provided the fundamental technologies and applied technologies for the shipbuilding industry, helping Korea to be the top shipbuilding country of the world. However, due to the long-term depression of the shipbuilding industry, the preference of high-quality human resources to shipbuilding industry is gradually decreased to the point of losing mid-term and long-term competitiveness. Moreover, due to the Sewol Ferry Accident in 2014, the maritime industry started to have bad impression. Still being recognized as one of the 3D industries, outstanding students of science and engineering are heading to some of the edge-cutting technologies such as IT or BT with the decreasing preference to the fields relevant to shipbuilding industry.

To solve the problems, the government decided to provide funds of 7.9 billion KRW for five years from 2015 to 2019 in three areas of Ocean Energy Expert Human Resource Projects, including "human resource fostering project for offshore plant service industry", "human resource fostering project for ocean energy research and development projects", and "human resource fostering project for integrated ocean energy industry". However, the plan partly modified due to the depression of the offshore plant industry. The human resources required by shipbuilding industry may not be secured by such a short-term support by the government focused on some specific aspects. Therefore, companies have to establish scholarship foundations and figure out ideas to invite high-quality human resources to foster human resources in shipbuilding industry. The academic section may contribute to foster researchers with the master's or doctor's degree by developing curriculums appropriate for the market demands and establishing relevant graduate school in the departments related to shipbuilding industry.

Third, it is necessary to accurately predict the trend of world economy and environment, and to improve the ability to develop technologies accordingly.

This issue is closely related with the firstly mentioned high technology development in the shipbuilding field. Recently, the global environmental regulations for pollution prevention have been intensified, and

the environment-friendly technologies became more important. Accordingly, issues are raised with regard to global clean energy, increased demand for new energy transport, “smart ships” combining shipbuilding and IT, and new concepts of high speed and ultra sized ships for energy saving. Other changes are made in luxurious leisure and sports boats due to the increase of income.

The International Maritime Organization (IMO) already started to regulate double-hulled vessels or ballast water treatment. The IMO made the regulation that ships should be built to reduce greenhouse gas emission by 15% in 2015, 20% in 2020, and 30% in 2025 with reference to that of 2014. Therefore, in the worst case, a ship that does not satisfy the greenhouse gas emission standard may be refused to come into a harbor.

Regulations on Energy Efficiency Design Index as well as SO<sub>x</sub> and NO<sub>x</sub> discharge are being intensified step by step. As the North Pole Route, which has been closed due to global warming, is newly open, new demand for the ships that could be used in the polar region is created.

However, the ratio of research and development in the budget of Korea’s Big 3 is continuously decreasing year by year because of their financial situation, making the future of the shipbuilding industrial technology dark.

The environment and the technology around shipbuilding industry will continuously change. Countries capable of accurately predicting the changes and providing needed technologies at the proper time will lead the global shipbuilding industry. Korea should recognize such changes around shipbuilding industry and search various methods of culturing the ability by promoting a special institute for the prediction and development of needed technologies in order to be able to beat Japan having technological power and low Yen effect as well as China making efforts for restructuring and bold innovation.

In the global shipbuilding market, the competitive advantage has been moving to the regions with cheaper price. It moved the UK through Europe, Japan and to Korea. Currently, the status of world’s best Korea’s shipbuilding industry is being shaken from the bottom in the time of global economic recession.

In 2015, the Big 3 shipbuilding companies, which tried to accomplish the goals of steady quantity of orders received, reached only the half of its goal. Such a trend became more severe in 2016; the shipbuilding orders received until June 2016 by the Big 3 shipyards of Korea were just 12, while Daewoo Shipbuilding received just two of the 12 orders, and Samsung Heavy Industries received none. Among the Big 3 shipyards in crisis with the “Order on the Cliff” state continues, Hyundai Heavy Industries and Samsung Heavy Industries submitted their own self-rescue plans to the major creditor bank and the plans were approved in early June to start restructuring.

According to the self-rescue plans, Hyundai Heavy Industries will reduce the debt ratio from current 134% to 100% until 2018 by preparing a total of 3,500 billion KRW, including 1,500 billion KRW through the selling of stocks and real estates, 800 billion KRW through business management rationalization such as manpower restructuring, and 1,200 billion KRW through business restructuring.

Samsung Heavy Industries also decided to prepare 1,500 billion KRW by selling non-business estates including Samsung Hotel Geoje and Pangyo R&D Center and decreasing production facilities. However, the self-rescue plan submitted by Daewoo Shipbuilding & Marine Engineering Co., Ltd, which is in the deepest crisis, has not been approved yet. So, the survival of the company is still unclear.

The future of Korea's shipbuilding industry, which is currently in an unprecedented danger, will be determined depending on the problem solution of the Big 3 through their realization of the self-rescue plans as well as the direction of shipbuilding industry reconstructing policies decided by the Korean Government.

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## Notes

Note 1. Korea Offshore & Shipbuilding Association was established in January 1948, Society of Naval Architects of Korea in November 1952, and Korean Register of Shipping in charge of promotion of ship safety as well as shipbuilding, maritime, and ocean technologies in 20 June 1960.

Note 2. Since most of the parts including the engines, equipments, and machinery fittings were imported, the shipbuilding industry at that time had a low competitiveness due to the shipbuilding unit price in Korea higher than that of the international price.

Note 3. *History of Korea's Shipbuilding Industry.* Retrieved from [http://www.kin.naver.com/qna/detail.nhn?d1id=4&dirId=409&docId=34862559&qb=7KGw7ISg7J6l66Ck7LGF&enc=utf8&section=kin&rank=1&search\\_sort=0&spq=0&pid=SvowjlpYSENsscAlcvdssssssN-444079&sid=VDowagpyVmcAAHigEUE](http://www.kin.naver.com/qna/detail.nhn?d1id=4&dirId=409&docId=34862559&qb=7KGw7ISg7J6l66Ck7LGF&enc=utf8&section=kin&rank=1&search_sort=0&spq=0&pid=SvowjlpYSENsscAlcvdssssssN-444079&sid=VDowagpyVmcAAHigEUE)

Note 4. Kim, Hyo Chul. *Ship of Korea*. (Jisungsa, 2006, pp. 62-63, Table 1).

Note 5. Other factors to the change are the easiness of procuring ship purchasing fund due to the loan payment delay, saving of fund due to the introduction of used ships, and tax exemption for imported ships (Kim, Hyo Chul. *Ship of Korea*. (Jisungsa, 2006, p. 60)).

Note 6. During the period from 1976 and 1990 where the planned shipbuilding was implemented, the ocean-going fleet of the Korean shipping companies was increased by 11,853,000 G/T, about 35% of which was secured by the planned shipbuilding.

Note 7. At that time, the big four companies were Hyundai Heavy Industries Co., Ltd., Daewoo Shipbuilding Industry Co., Ltd., Korea Shipbuilding Corporation, and Samsung Heavy Industries Co., Ltd. The 7 middle sized companies were Korea Tacoma Shipbuilding Industry Co., Ltd., Daedong Shipbuilding Co., Ltd., Daesun Shipbuilding & Engineering Co., Ltd. Donghae Shipbuilding Co., Ltd., Shina Shipbuilding Industry Co., Ltd., Incheon Shipbuilding Co., Ltd., and Busan Shipbuilding Industry Co., Ltd. Besides, there were shipyards specialized for large ship fixation including Hyundai Mipo Shipyard Co., Ltd. and Busan Fixation Shipyard Co., Ltd.

Note 8. Korea Offshore & Shipbuilding Association. *History of Korea's Shipbuilding Industry*. Retrieved from <http://www.koshipa.or.kr/>

Note 9. Korea Offshore & Shipbuilding Association. *Korea's Shipbuilding Industry: Growth and Tasks*,

2005, 52-53.

Note 10. In end of 2016, Daewoo Shipbuilding & Marine Engineering modified 440.9 billion KRW of gain for the year of 2013 to 778.4 billion KRW of loss, and 471.1 billion KRW of gain for the year of 2014 to 742.9 billion KRW of loss. Accordingly, the business loss for the year of 2015 was revised to be 2,937.2 billion KRW.

Note 11. According to the news from the industry, 5,000 billion KRW of loan has been given by the banks since 2010 to Sungdong Shipbuilding & Marine Engineering, 2,900 billion KRW to SPP Shipbuilding, 1,670 billion KRW to Daesun Shipbuilding & Engineering, and 3,500 billion KRW to STX Offshore & Shipbuilding since 2013. The total amount of the fund given to the four shipbuilding companies currently undergoing voluntary negotiation with the creditors is more than 10,000 billion KRW. "Rumors Coming Out About M&A of Middle and Small Sized Shipping Companies With No Funding". *Monthly Maritime Korea* (Association of Korean Register, June 2015, pp. 66-70).

Note 12. According to the statistical data collected by Korea's Ministry of Trade, Industry, and Energy, in addition to the Big 3, 23 more companies had export accomplishment in 2007, but the number was decreased to 8 in July 2015. Orient Shipyard and Sekwang Heavy Industries were closed, and Daehan Shipbuilding and Shina SB are under legal management. Among the remaining 8 companies, Hyundai Samho Heavy Industries and Hyundai Mipo Dockyard are the subsidiaries of Hyundai Heavy Industries. STX Offshore & Shipbuilding, Sungdong Shipbuilding & Marine Engineering, SPP Shipbuilding, and Daesun Shipbuilding & Engineering are under the creditors' management (voluntary agreement).

Note 13. Park, Jeong-Ho, Jae-Myung Kim, Yun-Kyun Oh, Dong-Sun Im & Ho-Sang Ham. (2010, November 3). Integration of Shipbuilding and IT for Advancement of Shipbuilding Industry. Weekly Technology Trend. *National IT Industry Promotion Agency*, 1470, 21-31.