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DETERMINANTS OF SOUTH KOREA'S DOMINANCE IN THE GLOBAL LNG CARRIER SHIPBUILDING MARKET: A COMPARATIVE ANALYSIS WITH CHINA

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Abstract:

South Korea dominates the global LNG carrier shipbuilding market because it combines advanced cryogenic engineering, membrane containment expertise, a highly integrated industrial ecosystem, and decades of experience in high-value vessel construction. Rather than competing on low-cost mass production, Korean shipbuilders such as HD Hyundai Heavy Industries, Samsung Heavy Industries, and Hanwha Ocean have specialized in technically demanding LNG carriers, where reliability, safety, and delivery performance matter more than the lowest initial price. However, South Korea still holds an advantage in design maturity, production integration, operational track record, and buyer confidence over China in high - value LNG carrier vessels. But the existing academic literature do not specifically explain why South Korea has ensured it's lead in LNG carrier shipbuilding sector over China. The publicly available data on the LNG carrier segment are relatively limited. For this reason, the competitive environment was less assessed to date. So, the investigation of the key drivers behind South Korea's dominance in LNG carrier shipbuilding based on a framework conceptualized on several determinants is important to understand as it offers clear understanding of the future of this significant sector. The study also examines the technological and structural barriers that protect its lead, the reasons global buyers continue to prefer Korean shipbuilders despite higher costs, and the extent to which China is narrowing the gap. Seven variables were set for scoring from 1-10 on the basis of evidence from secondary sources. A Heatmap illustrates the current capability comparison between China and South Korea, which was produced based on the scoring criteria provided on the conceptual framework, and thus it demonstrates South Korea's unchallenged leadership in LNG carrier shipbuilding market.

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Keyword:

Buyer Trust, China, Competitive Advantage, Delivery Reliability, Industrial Competitiveness, LNG Carrier Shipbuilding, Reputation, South Korea, Technological Maturity

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Introduction

As of 2026, the shipbuilding industry remains one of South Korea's most important economic pillars, with vessel exports projected to reach USD 33.92 billion in 2026, following a record-breaking performance in 2025 (Korea Chamber of Commerce and Industry, 2025). Accounting for nearly 4-5% of national GDP and serving as a primary driver of export growth, the shipbuilding sector has entered a super-cycle fuelled by high-margin orders for Liquefied Natural Gas (LNG) carriers. These specialized tanker vessels are designed to transport LNG safely across oceans and represent one of the most technologically advanced segments of global shipbuilding. While the modern Korean shipbuilding industry officially emerged in the early 1970s with the opening of the Hyundai Ulsan Shipyard in 1972, its foundations are deeply connected to Korea's maritime history. A remarkable event happened in 1971 when Hyundai founder Chung Ju-Young convinced Barclays Bank in London to finance Korea's first large shipyard project. He presented a 500-Korean won banknote depicting the sixteenth-century Turtle ship. That particular moment reflected Korean historical maritime identity and Korea's commitment to establish a globally competitive shipbuilding industry. Due to designating shipbuilding as one of the six industries under the Heavy - Chemical industry drive in 1973 designated by President Park Chung- Hee the industry expanded rapidly. National Investment fund (NIF) provided policy loans with interest subsidies. Institutions such as KAIST worked as technical training institutions for the workforce of the shipbuilding industry. So holistically government created necessary environment for large scale industrialization. Major chaebols such as Hyundai, Samsung, and Daewoo were encouraged to compete aggressively in the global export market. This ensured both industrial growth and global competitiveness. HCI industries accounted for over 60% of South Korea's manufacturing exports by 1981.

South Korea achieved dominance in technologically sophisticated LNG carrier industry for the long-term strategy taken by the Government. At the time when global market was increasingly demanding for LNG carriers requiring advanced cryogenic engineering, membrane containment systems, and highly reliable delivery schedules, Korean shipbuilders were already

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prepared with decades of accumulated experiences in those fields. South Korea demonstrated this capability by constructing its first LNG carrier ship back in 1994. After that, Korean shipbuilders rapidly gained global recognition for reliability, safety, and high engineering quality.

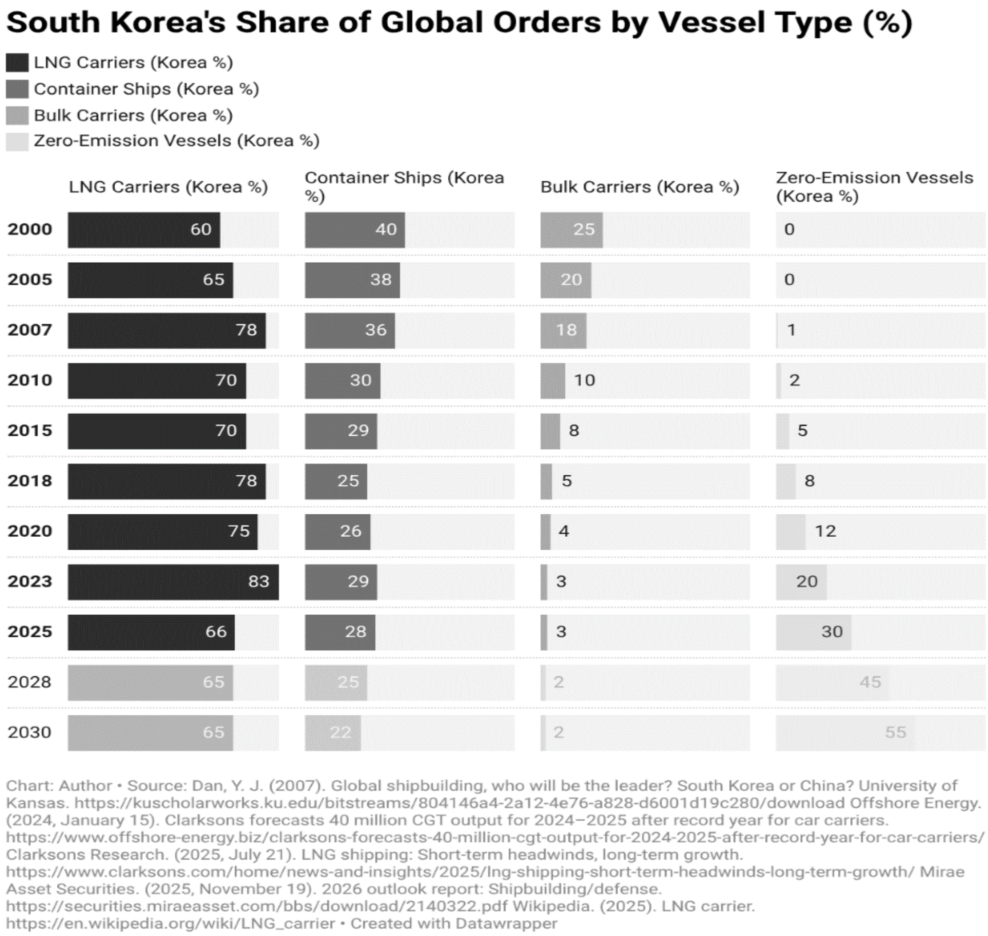

Figure 1: South Korean Shipbuilding Market Share Trends by Vessel Type (2000–2030 Projections)

Source: Authors own compilation

Due to which South Koreas share of global orders of LNG carriers rose day by day. Orders on LNG carrier ship was much higher than other vessel types like container ships, bulk carrier, and zero-emission vessels. The order share of LNG carrier vessels reached at peak during the year 2023 and it was over75%. Even the projected score for the upcoming years like 2028 and 2030 showed in the grouped bar chart above show a higher share of 65% of the global orders received by South Korea.

Present Status of South Korea in LNG Carrier Shipbuilding

With in late 2024, South Korea captured approximately 75% of the global LNG carrier orders. This outcome was ensured by consistent performance by industry leaders like HD Hyundai Heavy industries, Samsung Heavy Industries, and Hanwa Ocean (HAN, 2026). Rather than emphasizing on mass production of low value vessels, South Korea has increasingly focused on high-value LNG carriers since the early 2000s. For this transformation the country achieved dominant position in the LNG carrier market. Along with that, South Korea has established an integrated ecosystem within the industry. Major shipbuilding hubs such as Ulsan and Geoje is concentrated on building technologically improved ships. Firms like POSCO supply advanced steel materials, working as a downstream industry to support the shipbuilding sector. The specialized suppliers and engineering firms contribute to coordinated production system. Additionally, South Korean government continues to increase the industry's global competitiveness through export financing and research development support. Ministry of Trade, Industry and Energy (MOTIE) and other financial institutions gave approximate USD 10.8 billion in advance payment to refund guarantees in 2024 (MOTIE, 2024). Moreover, in 2026 the government announced a 320 billion won research and development package for the industry. This package was announced specifically to improve areas like eco-friendly vessels construction, AI- integrated shipyards, and advanced maritime technologies (Yonhap, 2026). South Korea did not target to compete with China in low-cost ship market. From the very beginning South Korea was deliberately concentrated its effort on sophisticated and highly profitable vessels. This strategic focus has allowed Korean shipyards to maintain strong profitability and preserve global leadership in LNG carrier construction despite increasing international competition.

Global Buyer Preference Toward South Korean Shipyards

Global buyers prefer South Korean shipbuilders for reliability, safety, and lifecycle efficiency. The buyers continue to choose South Korean ships instead of having a higher price than other competitors. LNG cargoes are transported at approximately -162°C. The transportation involves considerable amount of technical and environmental risks. For this reason, the buyers prioritize proven operational performance and engineering reliability over low prices. In advance membrane containment systems developed by Gaztransport & Technigaz (GTT), South Korean shipbuilders possess decade long experiences. That's why they can contribute to higher fuel efficiency and lower boil-off rates. Korean Shipbuilders has reputation for comprehensive after sales technical support to solve critical technical issues with the LNG carrier vessels. They also provide consistent delivery performance and recognized for strong project management skills. Due to lower long-term operational risk, higher efficiency and stronger lifecycle value global buyers tend to prefer South Korean shipbuilders over Chinese alternatives. The increased reputation of Korean Shipbuilders has also received international recognition. Highlighting the strength of South Korea's maritime industry in a summit at oval office, U.S. President Donald J. Trump stated "We're going to be buying ships from South Korea. We're also going to have them (build) make ships here with our people, using our people, and we're going to back into shipbuilding business again. We love their ships" (Lee, 2025). This types of recognition from global leaders further strengthen consumer trust in Korean-built ships.

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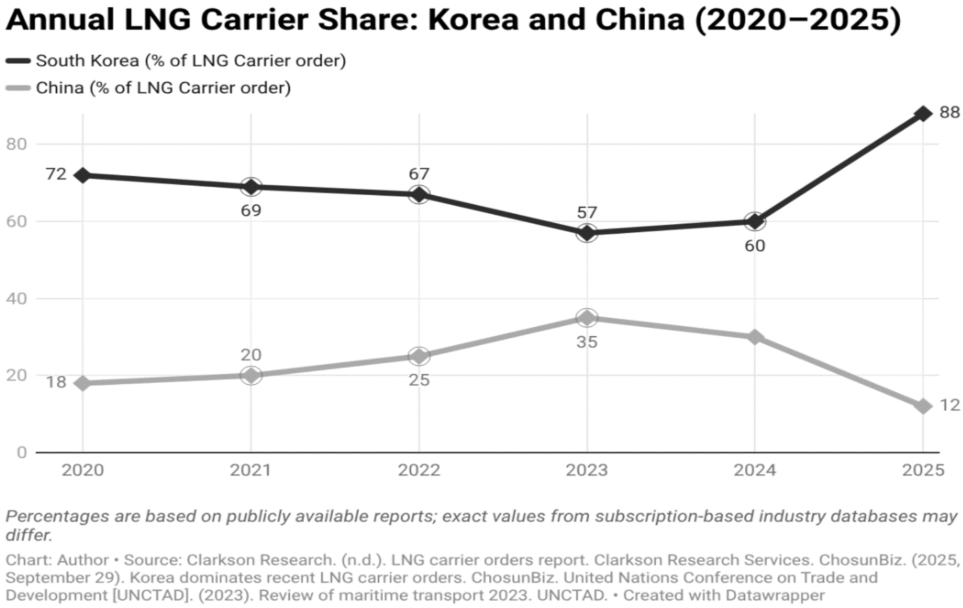

Figure 2: Annual LNG Carrier Share: Korea and China (2020-2025)
Source: Authors Own Compilation

Emerging Competition from China

Though South Korea dominates the LNG carrier construction, but presently it is facing incredible and increasing challenge by Chinese counterparts. Hudong-Zhonghua Shipbuilder from China under China State Shipbuilding Corporation (CSSC) have expanded their capacity significantly to secure a growing share of LNG carrier orders. By having strong state support, they have adopted aggressive pricing strategies. China has also adopted the membrane containment systems license from GTT and eventually has improved technologically. One of the evidences that china has improved technologically over time is, to secure the order of a technologically critical ship like Qatar's QC-Max class carriers. Nevertheless, global assessments consistently suggest that China still lag behind Korea. China is still behind of Korea in design optimization, integrating efficiency, boil-off performance, and operational reliability. So, South Korea continues to maintain what industry analyst describe as a 'super-gap' in LNG carrier shipbuilding performance. Korean shipyards have the reputation of achieving industry-leading boil off rates. Korean shipbuilders also maintain strong delivery reliability with integration of robotics, autonomous welding systems and AI- driven shipyard technologies. With increased geopolitical and energy security concern, Korean shipbuilders have secured a position not only as ship manufacturer, but also as an advanced maritime technology and high-value engineering solutions provider.

Technological Barriers and Strategic Dominance

South Korea secures it leadership through technological capacity and strong barriers to entry for the newcomers. LNG carrier construction requires strong capacity on cryogenic engineering. Because LNG must be stored at approximately -162°C using advanced insulation systems, membrane containment technologies, and specialized materials. In this case particularly, specialized materials like 9% nickel steel are used. (IEA, 2023; UNCTAD, 2023). Korean shipbuilders have spent decades mastering this complex technological capacity. Moreover, firms such as HD Hyndai Heavy industries and Samsung Heavy industries have got extensive expertise in accurate welding, safety management, containment integration and quality control. All together these knowledges create strong barrier for the new entrants to properly compete in the sector. The construction of LNG carrier ships involves long construction cycles. At the same time, high capital is required for the business. Global authorities like International Maritime organization (IMO), AMS and DNV also enforce high international safety standards. Due to expertise, South Korean shipbuilders have been able to ensure this safety standards. They have developed efficient production systems that is capable of reducing the build time and maintain high quality. Additionally, South Korea gets a benefit of highly integrated industrial ecosystem involving suppliers, engineering firms and clustered shipbuilding hubs. LNG carriers made by Korea has been able to achieve lower boil-off rates and stronger operational efficiency in comparison to new competitors. This reflects Korea's superior engineering and integrated production capability. Altogether, these factors explain why South Korea continues to dominate technologically in the LNG carrier construction sector.

Research Problem and Research Gap

A nation can face risk of stagnation without constant upgrading, which can be compared with the middle-income trap in development economics (Islam et al., 2003). Industrial sectors like shipbuilding can also face structural traps without constant upgradation of technological strategies. South Korea has dominated the LNG carrier shipbuilding sector for long time. But the existing literature has not yet fully explained the reasons behind South Korea's sustained dominance in LNG carrier shipbuilding sector. Studies like Chen et al. (2010) applied Porter's Diamond framework to explain Korea's overall shipbuilding competitiveness. Dan (2007) examined technological competition between South Korea and China. More recently, Lee (2019) utilized the Analytic Hierarchy Process (AHP) to compare competitiveness across vessel types to confirm South Korea's Dominance in LNG carrier construction.

Previous studies fall short of offering a comprehensive explanation of LNG carrier dominance over China and they do not adequately integrate institutional, technological, industrial, and strategic dimensions into a unified framework. Moreover, the literature provides only limited coverage of developments after 2020. China's accelerated entry into LNG carrier construction and the rising significance of technological specialization, buyer confidence, and integrated industrial ecosystems are also not covered in the literatures found. This study fills those gaps by identifying the factors behind South Korea's dominance in LNG carrier shipbuilding, investigating the technological barriers that sustain its competitive edge, analysing the drivers of global buyers' preference for Korean shipyards, and assessing how far China has closed the competitive gap.

To address these critical gaps, this study examines the multifaceted dynamics driving South Korea's dominance in the global LNG carrier market. Specifically, it examines how the nation's technological capacities in carrier design and construction creates strong entry barriers for global competitors. Additionally, this research evaluates the strategic rationale of international buyers who consistently favour South Korean shipbuilders despite their premium pricing. The study concludes by examining how China's rising presence is reshaping the competitive dynamics of LNG shipbuilding. The study also provides insights into the industry's future trajectory.

To theoretically explain the multidimensional analytical framework evaluating national dominance in the global LNG carrier shipbuilding industry, this study utilizes Michael Porters Diamond Model of National Advantage. Porter (1990) proposes that a country's international competitiveness is a particular industry depends on a closely connected system of four interdependent determinants. According to Porter (1990) these four determinants are factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry. These four determinants are fundamentally shaped by the twin catalyst of government policy and chance events. The seven dimensions of the proposed conceptual framework used in this study specifically taken based on these theoretical pillars. Specially, Technological maturity and Delivery reliability represents highly sophisticated and specialized factor conditions developed through sustained human capital and engineering investment. These dimensions distinguish between South Korea's experienced and matured engineering capability from China's license- based capabilities. The qualitative conditions in Buyer Trust and reputation, and market demand measured by dimension LNG Order Share, reflects the demand conditions and structural reputation pressure imposed by Global energy clients. Furthermore, Institutional and State Financial Support perfectly operationalizes Porters explicit government catalyst, demonstrating how government supported export financing, R&D funding, and policy driven demand shield shipyards and facilitates long-term industrial expansion. Finally, the difference of South Korea's premium pricing model against China's cost leadership model evaluated under Cost Competitiveness, combined with structural scaling dynamics under Capacity Growth Rate, incorporates the firm strategy, structure, and rivalry determinant. These illustrates how the domestic production mechanism and market takes shapes dur to differing national microeconomic strategies. By utilizing the Porter's model, the conceptual framework develops a lucid cause and effect relationship for depicting the industry condition. It explains how the combination of local technological capacities; government support and company strategies functions to create dominant position in the shipbuilding industry.

Literature Review

The literature on global shipbuilding competition identifies factors behind South Korea' dominance in LNG carrier sector. LNG carrier shipbuilding industry in South Korea in a complex outcome of several factors like technological specialization, industrial coordination, government support and market reputation. Koran industry leaders such as HD Hyundai Heavy Industries, Samsung Heavy Industries and Hanwha Ocean have developed advanced expertise in different engineering capabilities through long term collaboration with GTT. Research have done several studies on reasons behind Koran growing shipbuilding industry. But recent study focusing on reasons depicting LNG carrier shipbuilding market remains sparse. South Korea concentrates on high value vessels, while China focuses on low-cost shipbuilding. But both the countries have a growing shipbuilding industry, though the industry matrix and initiatives are constantly changing due to policy. So, a comparative analysis between these two competitors in LNG carrier shipbuilding would provide impactful insight.

Global Competition in the Shipbuilding Industry

Tan (2017) did a comparative analysis of the shipbuilding industries among South Korea, China and Japan. Tan (2017) showed that South Korea overtook Japan in the year 2004 before China surpassed South Korea in overall shipbuilding in the year 2010. However, the study only focused on overall shipbuilding competitiveness. But the study did not focus on LNG carrier shipbuilding sector specifically.

Though Tan (2017) highlighted the strategic role of Korean chaebols such as Hyundai, Samsung and Daewoo in developing advance vessels including LNG carriers. But the study still lags detailed analysis of LNG carrier sector and technological factors behind South Korea's long-term leadership position.

Technological Competitiveness Between South Korea and China

Dan (2007) compared the technological competitiveness of South Korea and China across important shipbuilding dimensions. The grouped bar below is developed from result of Dan (2007), which depicts Koreas lead in every aspect. Dan (2007) compared technological competitiveness of the two countries broadly in dimensions covering design capability, production management and engineering performance. The study showed that South Korea held a huge lead over china in all critical aspects of shipbuilding during the mid-2000s. The findings of the study depicted South Korea's capacity as an early mover in the industry. But this advantages as an early mover did not remain unchallenged. In 2010, China overtook Korea in overall shipbuilding. But at present also, Korea remains the industry leader in LNG sector. This puzzle needs to be addressed. Moreover, Dan (2007) only examined overall shipbuilding competitiveness, but did not specifically focus on LNG carrier sector. After nearly two decades the condition of the market has also changed. So, the assessment of the changed condition can provide important insight.

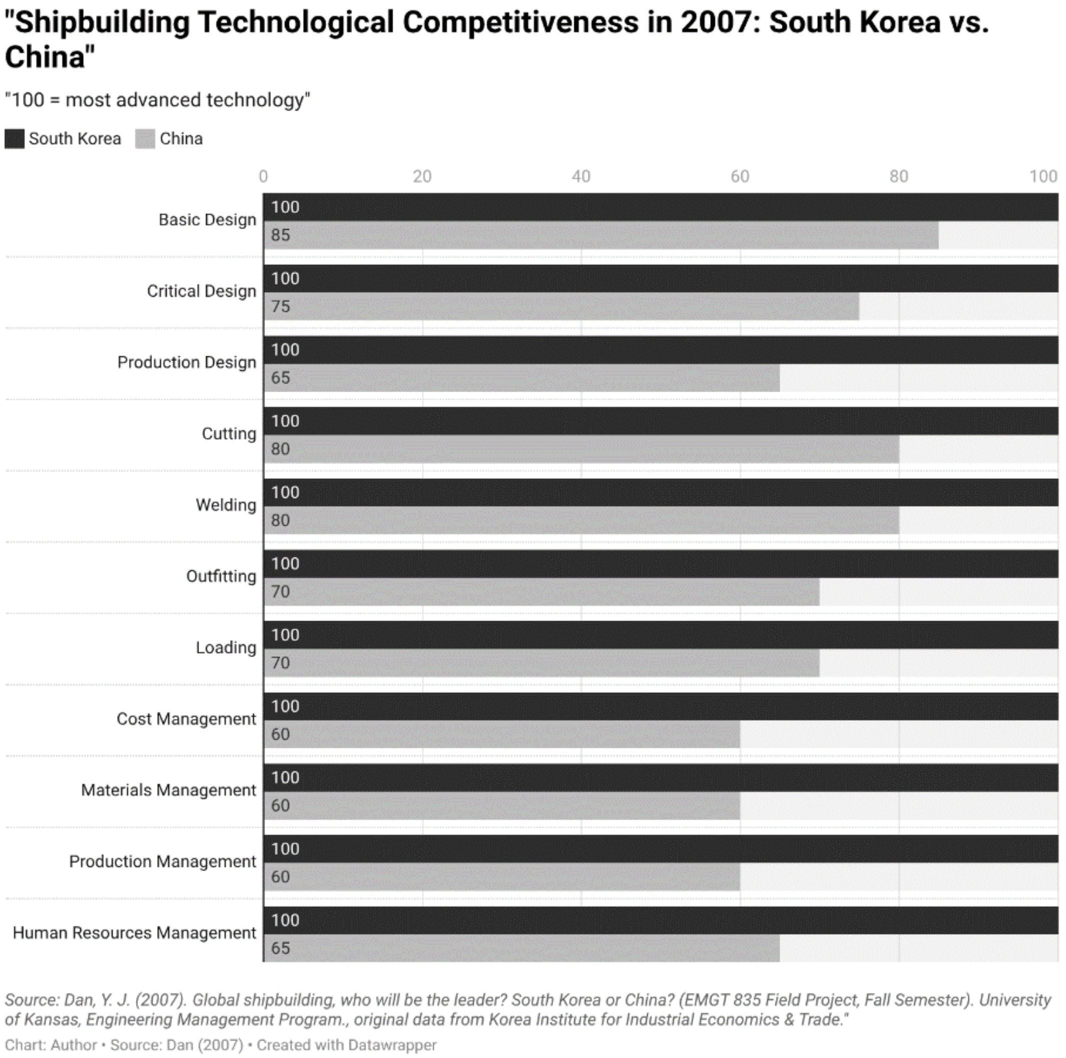

Figure 3: Shipbuilding Technological Competitiveness in 2007: South Korea vs. China,
Source: Dan, Y.J. (2007)

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LNG Carrier Competitiveness and High-Value Vessel Leadership

Analytical Hierarchy Process (AHP) was utilized by Lee (2019) to compare the competitiveness of South Korea and China across different vessel categories. The study quantified competitiveness weights across several technological and industrial dimensions by gathering expert evaluations from shipowners, builders and financiers. Lee (2019) argued that although China had improved significantly in general shipbuilding competitiveness, but South Korea retained a huge lead in highly technical LNG carrier sector. The stacked bar below is developed from the result found by Lee (2019). According to Lee (2019) South Korea achieved a competitiveness weight of 0.62 compared to 0.38 achieved by China. The results of the study suggest that Korea continues to dominate high-complexity LNG carrier vessels categories despite China's overall lead in the shipbuilding sector. The study further indicated that China's LNG carrier sector still lacks the operational history, engineering maturity, and lifecycle reliability. Consequently, a substantial qualitative gap still exists between the two countries in the LNG carrier sector.

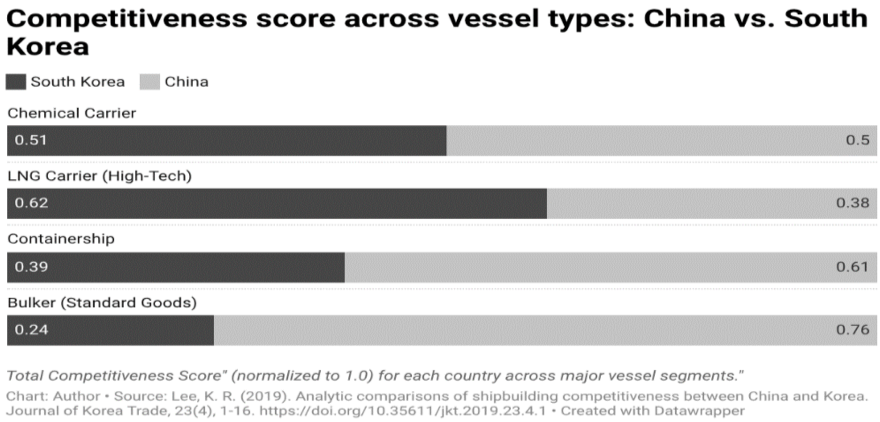

Figure 4: Competitiveness Score Across Vessel Types: South Korea vs. China Shipbuilding

Source: Lee, K.R. (2019)

This study uses a multidimensional analytical framework to assess the factors behind South Korea's competitive advantage in the global LNG carrier market relative to China. The framework comprises of seven interconnected, evidence-based dimensions. These dimensions together capture supply-side capabilities and market performance and offers a thorough evaluation of industry competitiveness.

The initial component, Technological Maturity, evaluates the level of engineering expertise and technological advancement in the shipbuilding industry, especially in high-value domains such as membrane containment systems, cryogenic engineering, and advanced fuel propulsion technologies.

This dimension distinguishes South Korea's established technological leadership from China's relatively newer and largely license-based technological capabilities. The second dimension, Delivery Reliability, focuses on the shipyards' operational track record in terms of punctual delivery, project execution, and production management. Since building LNG carriers involves complex engineering and tight schedules, the ability to deliver vessels on time is a key factor in reducing risks for global energy companies and shipping clients. Dimensions like Buyer Trust and Reputation represents the qualitative brand value of the national shipbuilding

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industries. This dimension assesses the extent to which global buyers prefer particular shipbuilders based on historical performance, safety standards, engineering reliability, and successful completion of high-risk projects. In the LNG carrier sector, long-term trust and operational credibility significantly influence purchasing decisions.

The fourth dimension in LNG order share which is a direct measure of market dominance. This dimension looks at the percentage of global LNG carrier orders secured by each country. This dimension shows actual market demand and offers a clear view of competitive positioning in the global LNG carrier industry. Institutional and State Financial Support is taken as the fifth dimension. This dimension is chosen as it assesses how the government action helps improve the industrial competitiveness. This includes export financing mechanisms, research and development (R&D) funding, industrial policy support, state-backed credit guarantees, and policy-driven demand creation through state-linked enterprises. Such institutional support provides financial stability and strategic assistance for long-term industrial expansion. The sixth dimension is Capacity Growth Rate. This dimension is chosen because it examines the industry's ability to scale production capacity over time. It focuses on the expansion of shipyard infrastructure, workforce availability, technological upgrading, and the speed at which firms pursue market expansion and industrial growth. Finally, Cost Competitiveness assesses the relative price efficiency of shipbuilding production. This dimension contrasts South Korea's premium pricing approach-anchored in advanced technology, higher labour costs, and superior engineering standards-with China's cost-leadership strategy. Taken together, the framework offers a holistic foundation for examining the structural, technological, financial, and market forces that define competitive advantage in the global LNG carrier shipbuilding sector

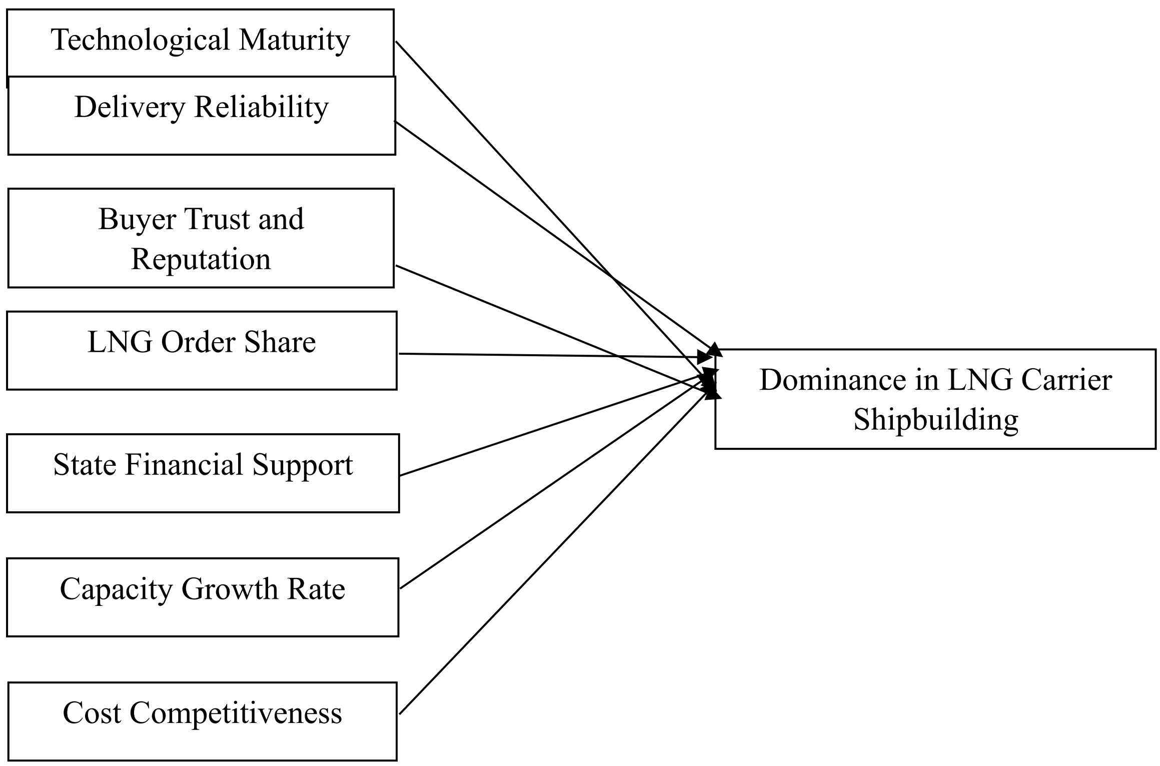

Figure 5: Research Framework

Methodology

This study utilizes a secondary data driven literature review methodology based exclusively on secondary data to identify determinants of South Korea's dominance in the global LNG carrier shipbuilding market. Data were gathered systematically from industry publications (for example, Clarkson Research), peer-reviewed journals (including Lee, 2019 on competitiveness rankings), government documents and policy portals (such as MOTIE releases), reports from international organizations (e.g., IEA and UNCTAD), and established news outlets. Relevant sources were located via targeted searches tied to the study's main objectives, with a focus on themes such as technological leadership, entry barriers, buyer preferences, and competition from China. To ensure the credibility of the analysis, preferences was given to contemporary, reputable, and sector specific sources. The gathered data underwent thematic synthesis, which organized the findings into key analytical categories related to competitiveness in LNG carrier shipbuilding. A comparative analysis was subsequently conducted to evaluate market shares, technological performance metrics, industrial strengths, and policy influences in both South Korea and China. To ensure coherence and reliability, evidence from multiple sources was systematically cross-validated throughout the study. Furthermore, this study utilizes a qualitative comparative scoring framework to assess the relative capabilities of South Korea and China in LNG carrier shipbuilding. Instead of relying in econometric modelling, a structured and evidence based comparative evaluation approach was adopted by the study. Seven key determinants were selected based on prior literature and industry reports, namely (i) technological maturity, (ii) delivery reliability, (iii) buyer trust and reputation, (iv) LNG order share, (v) institutional and state financial support, (vi) capacity growth rate, and (vii) cost competitiveness. These factors collectively represent supply-side industrial capabilities and market-oriented performance outcomes. Thus, they offer a thorough framework for assessing competitive advantage in the global LNG carrier shipbuilding sector.

Data Analysis

To ensure consistence and prevent biased evaluations, specific assessment criteria were established for each dimension. For setting this criterions, industry insights and prior literature were given importance. Each dimension was evaluated on a 1-10 ranking scale. In the ranking scale higher values represent stronger relative performance. Scores were assigned through triangulating data from multiple sources, including academic journals, reports from UNCTAD, the International Energy Agency (IEA), Clarkson Research, and other industry publications. Qualitative industry evidence was transformed into a structured scoring framework, allowing for a systematic comparison of South Korea and China across selected competitiveness dimensions. Although the scores are not precise measurements, they effectively capture the relative positions of the two nations in LNG carrier shipbuilding. The results are presented in a heatmap, visually illustrating each country's comparative strengths and weaknesses.

To keep the analysis clear and credible, all charts and visuals in this study-such as the industrial capability heatmaps, market share line graphs, and technological competitiveness charts were created with Datawrapper. Datawrapper is a web-based platform designed for professional data visualization. This platform was chosen because it converts complex data into clear, consistent, and accessible visualizations. It also allowed the implementation of a standardized grayscale colour scheme to emphasize the technological "super-gap" and performance differences between South Korean and Chinese shipbuilders, especially in the LNG carrier segment.

Scoring Framework and Marking Criteria

The seven dimensions are set depending on the Michael Porters Diamond Model of National Advantage. These dimensions set serve as criteria for Qualitative Comparative Scoring framework for supporting the study. By allocating these variables score from 1 to 10, this study will generate a comparative heatmap. The heatmap will visually show the trade-offs and reasons of South Korea technical leadership and China's rapid industrial growth.

Table 1: Evaluation Criteria and Scoring Framework for Assessing LNG Carrier Industry Determinants

Dimension	Spread of scores	Description
Technological Maturity	1-3	No or limited engineering capability
	4-6	Emerging capability with reliance on foreign technology
	7-8	Advanced capability with partial design independence
	9-10	Global technological leadership with decades of innovation
Delivery Reliability	1-3	Weak delivery record with frequent delays
	4-6	Limited track record with moderate reliability
	7-8	Generally reliable with occasional delays
	9-10	Uniform on-time delivery over decades
Buyer Trust & Reputation	1-3	No repeat buyers, low credibility
	4-6	Growing trust but limited high-value contracts
	7-8	Established reputation among major buyers
	9-10	Preferred choice for high-value, high-risk projects
LNG order share	1-3	less than 10% global share
	4-6	10-40% share
	7-8	40-70% share
	9-10	Dominant position (>70%)
State Financial Support	1-3	Minimal state involvement
	4-6	Indirect support (tax, policy incentives)
	7-8	Strong targeted support (R&D, export credit)
	9-10	Direct ownership, subsidies, and guaranteed demand
Capacity Growth rate	1-3	Stationary or diminishing
	4-6	Incremental advancement
	7-8	Accelerated advancement
	9-10	High velocity scaling
Cost Competitiveness	1-3	Substantially higher cost
	4-6	Moderately priced
	7-8	Competitive pricing
	9-10	Lowest-cost producer

Source: Authors Own Compilation

Evidence Based Score Justification

The following justification rates South Korea and China on seven selected dimensions ranging scores from 1 to 10. Each score was determined by triangulating findings from academic studies, industry databases, and institutional reports. The scores represent the average of the evidence identified. This framework does not assert exact numerical precision. Rather, it offers a transparent, structured, and reproducible method for comparatively positioning the two countries.

South Korea attains a technological maturity score of 9, underscoring its decades-long expertise in cryogenic engineering and the integration of membrane containment systems. Leading Korean shipyards have consistently adopted GTT licensing as part of their advanced shipbuilding practices since the early 1990s. Due to this reason they have gathered substantial propriety competencies beyond those original technological foundations. Industry benchmarking consistently identifies Koran-built LNG carriers as achieving the lowest boil-off rates, which ranges approximately from 0.07% to 0.085% per day. This ability shows improved insulation design, greater welding precision, and system-level engineering integration. Daewoo Shipbuilding and Marine Engineering built the world's first ice-breaking LNG carrier, highlighting Korea's pioneering engineering skills. This particular vessel is 300-meter-long, which is capable of operating in temperatures as low as -52°C and breaking through 2.1-meter-thick ice layers. This illustrates the extent of South Korea's commendable technological advancement beyond license production system.

On the other hand, China is given a score of 6 for this dimension. The score reflects real advances alongside constraints tied to its relatively shorter experience in LNG carrier construction. Hudong-Zhonghua Shipbuilding has completed vessels for large-scale programs, including work on Qatar's QC-Max project, signalling notable gains in engineering capability. However, China's LNG carrier construction experience remains approximately 14 years shorter than that of South Korea, limiting the amount of accumulated expertise and iterative technological refinement. Chinese shipyards also remain more dependent on license designs and imported technological systems (Lee, 2019). Similarly, UNCTAD (2023) points out that Chinese shipyards have not yet reached the level of design optimization and engineering skill shown by Korean shipbuilders, even though they have achieved functionality. Therefore, a score of 6 indicates an emerging but still somewhat dependent technological capability.

South Korea receives a score of 9 in terms Delivery Reliability dimension. Korean shipyards have gained a global commercial reputation based on consistent project implementation, disciplined production management, and reliable on-time delivery performance. Industry analyses repeatedly identify punctual delivery and operational reliability as major reasons why global buyers continue to engage in repeated contracts to Korean shipyards despite substantial price premiums over Chinese competitors (Lee, 2019; Clarkson Research, 2024). The standard industry time for finishing LNG carrier ships is 30 to 40 months. However, Korean shipbuilders have cut the construction time down to about 30 to 36 months, from the start of steel cutting to final delivery. This shows their efficient production systems and the experienced workforce built over decades of focusing on LNG carriers.

Delivery delays in LNG infrastructure projects can disrupt supply chains and generate significant contractual penalties. China receives a score of 6 on this dimension. The score reflects a comparatively shorter operational history in LNG carrier delivery. While Chinese shipyards have made notable strides in production efficiency and project execution in recent years, their relatively limited record of accomplishment in completing large-scale LNG carrier projects continues to raise concerns among global buyers, particularly regarding long-term delivery reliability and operational performance.

A score of 9 is assigned to South Korea in the dimension of Buyer Trust and Reputation. But China receives a score of 5. One of the clearest indicators supporting this assessment is the distribution of global LNG carriers' orders. According to Clarkson research (2024), between 2020 to 2025, South Korean shipyards have captured more than 75% of new global LNG carrier orders. Figure 2 shows the market data. These concentrations indicate that buyer choices are driven by factors beyond price alone. Korean LNG carriers typically command about USD 230-260 million each, a premium of roughly USD 20-30 million compared with similar Chinese-built ships. Even with the higher cost, purchasers repeatedly prefer Korean yards because of their established reliability, safety performance, engineering quality, and reduced operational risk (Lee, 2019; Clarkson Research, 2024).

In addition, geopolitical alignment and international confidence further enhances South Korea's reputational advantage. The statement by U.S. President Donald J. Trump that 'We're going to be buying ships from South Korea. We're also going to have them (build) make ships here with our people, using our people, and we're going to back into shipbuilding business again. We love their ships' (Lee, 2025) reflects broader international confidence in South Korean shipbuilding capability. China's score of 5 acknowledges that its credibility within the LNG carrier sector is advancing, particularly through participation in projects such as the Qatar's QC-Max programme. However, Chinese shipyards have not yet attained the level of confidence required to become the chosen providers for the most technologically demanding and high-risk LNG transportation projects.

Among all the seven dimensions, LNG order share represents the most directly quantifiable indicator of market competitiveness. South Korea gets a score of 9, which reflects its dominant share of approximately 70%-75% of the global LNG carrier orderbook in the year 2023 (Clarkson Research, 2024). This score aligns with the grading criterion representing a dominant market share exceeding 70%. The findings from Figure 2 indicate that South Korea's market leadership was not merely temporary but consistently sustained over the 2020-2025 period. South Korea also maintained major control of the market and reached a peak share of over 75% in 2025. China receives a score of 5 in this dimension. The score is assigned as the orderbook share is approximately 20%-25% during the stated period. Although this indicates growing and meaningful market presence, but it remains significantly below South Korea's dominant position. Therefore, the scoring asymmetry in this dimension is directly grounded in observable market data rather than interpretive inference.

The dimension of Institutional and State Financial Support is the category where China scores higher than South Korea. China gained the maximum score of 10, reflecting huge and direct state intervention in its shipbuilding industry. The China State Shipbuilding Corporation (CSSC) operates as a state-owned enterprise. CSSC allows Chinese government to directly influence capital investment allocation, industrial expansion, financial risk absorption, and strategic targeting of sectors to allocate capital. This condition provides Chinese shipbuilders with subsidized financing, state-backed credit guarantees, and politically directed purchasing orders which reduces the exposure to market volatility significantly. UNCTAD (2023) identifies state-directed industrial finance as a major factor behind China's speedy expansion into high-value shipbuilding sectors.

South Korea receives a score of 7 in this dimension. The score is assigned as there was substantial but comparatively indirect institutional support. South Korea's Financial Services Commission and associated institutions introduce approximately USD 10.8 billion in advance payment refund guarantees to strengthen export led growth in shipbuilding industry in June 2024 (MOTIE, 2024). Moreover, MOTIE announced a KRW 320 billion research and development fund for supporting eco-friendly vessels, AI-integrated shipyards, and advanced LNG carrier technologies in 2026 (Yonhap, 2026). Unlike China's state ownership model, South Korea's approach specifically focuses on reducing financial risks and promotes technological innovation rather than directly subsidizing output volume. Eventually, while Korea's institutional support remains substantial, China's state support demonstrates greater direct financial intensity regarding Industrial Capacity Growth Rate. China receives a score of 9 while South Korea receives a score of 6. China's higher score reflects the swift growth in LNG-capable shipyard infrastructure, workforce training initiatives, and purpose-built production facilities from 2019 to 2024. Its share of LNG carrier orders rose from a modest position in the early 2010s to around 25% by 2023. It marks a rapid expansion of industrial capacity in the recent history of complex shipbuilding.

South Korea's score of 6 reflects a more controlled and profitability-oriented growth pattern. It also depicts that instead of aggressively expanding output volume, South Korean shipbuilders have prioritized preservation of the quality, boosting automation and precise manufacturing. Investments in autonomous robotic welding and AI-enabled production technologies are primarily aimed at safeguarding engineering parity and mitigating challenges such as labour shortages. As a result, Korea's moderate score reflects a strategy of measured and controlled industrial advancement rather than rapid expansion in output volume.

Lastly, in terms of Cost Competitiveness dimension South Korea receives a score of 5. China receives a score of 9 in this dimension. Korean LNG carriers' costs between USD 230 million and USD 260 million per vessels due to higher labour cost, superior engineering systems, advanced materials, and strict quality assurance standards (Lee, 2019; Clarkson Research, 2024). Chinese shipyards can price LNG carriers about USD 20 million to USD 30 million cheaper than their Korean competitors. This cost advantage stems from more affordable labor, robust state-backed supply chains, and large-scale manufacturing efficiencies.

China score reflects greater structural cost advantage, although not a perfect score because LNG carrier construction remains highly capital-intensive even within Chinese production mechanism. South Korea's score of 5 reflects its position as a relatively higher-cost producer. That price premium, however, does not imply inefficiency; it instead signals the higher quality that global buyers are willing to pay for-greater reliability, advanced engineering, and lower long-term operational risk.

Taken altogether, these scores reveal a structurally segmented and competitive condition in which South Korea maintains decisive leadership in technological maturity, operational reliability and buyer confidence. Conversely, China holds a stronger advantage in production scale, cost efficiency, and state-supported industrial financing. This imbalance underpins the study's central argument that, South Korea and China are not currently interchangeable within the LNG carrier market but instead occupy distinct, strategically differentiated positions. The dimensions on which South Korea leads remains crucial for leading the industry. Taken together, these dimensions clarify why South Korea continues to sustain its dominance in the sector despite China's rapid industrial expansion.

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Discussion

The heatmap depicts the core logic of dominance of South Korea in LNG carrier shipbuilding market. South Korea achieved full scores in dimensions like, technological maturity, delivery reliability and buyer trust and reputation. These three dimensions ensures South Korean precision, safety and proven performance which actually matters the most for ensuring dominance in the sector. This lead is due to three decades of expertise and experiences gathered in this sector by South Korean Shipyards. On the other hand, China scores more than South Korea in dimensions like state financial support, capacity growth rate and cost competitiveness. This is due to industrial strategy and strategy of scaling up production adopted by China. But this lead in state financial support, capacity growth rate and cost competitiveness dimensions are yet to be translated into technological capacity that would empower Chinese shipyards to overtake South Korean shipyards in LNG carrier market.

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Current capability comparison: South Korea vs. China Shipbuilding

Capability Score (1–10)

5 10

Dimension	South Korea Score	South Korea Label	China Score	China Label	Scale Description (1–10)	Scoring Basis
Technology maturity	10	Dominant	6	Developing	1 = No LNG engineering capability → 10 = Decades of cryogenic mastery and independent design optimization	Korea has 30+ years of GTT membrane integration. China adopted licensing only recently. Source: UNCTAD (2023); IEA (2023)
Delivery reliability	10	Dominant	6	Developing	1 = Frequent delays and no track record → 10 = Consistent on-time delivery across decades verified by buyers	Korea has a decades-long on-time delivery record. China's first large LNG delivery was only in the 2010s. Source: UNCTAD (2023); IEA (2023)
Buyer trust & reputation	10	Dominant	5	Developing	1 = No repeat buyers and untested in high-risk segments → 10 = First choice of global energy majors for high-value orders	Global energy majors consistently choose Korean yards for high-risk LNG projects despite higher cost. Source: UNCTAD (2023); IEA (2023)
LNG order share	9	Dominant	5	Developing	1 = Less than 5% of global LNG orders → 10 = 70%+ of global LNG orders	Korea held ~75% of LNG-specific orders in 2023; China held ~25%. Source: Clarkson Research via Greek City Times (2024)
State financial support	7	Advanced	10	Dominant	1 = No government involvement → 10 = Direct state ownership with subsidized financing and guaranteed contracts	China: CSSC is a state-owned conglomerate with direct capital. Korea: targeted R&D grants and export credit only. Source: UNCTAD (2023)
Capacity growth rate	6	Developing	9	Dominant	1 = Declining or stagnant order intake → 10 = Rapidly expanding share and entering new vessel segments aggressively	China grew LNG order share from under 10% (2021) to 30% (2022) in one year. Korea intentionally restrains volume. Source: Maritime Executive via Clarkson (2023)
Cost competitiveness	5	Developing	9	Dominant	1 = Most expensive by wide margin → 10 = Lowest price in market with strong cost advantage	Korean yards command a $10–15M price premium per vessel over Chinese yards. Source: Seatrade Maritime via Clarkson (2024)

Table: Author • Source: Clarkson Research. (2024). Shipping intelligence weekly & LNG carrier orderbook data. Clarkson Research Services. https://insights.clarksons.net International Energy Agency. (2023). Gas market report, Q2-2023: LNG outlook and infrastructure. IEA. https://www.iea.org/reports/gas-market-report-q2-2023 The Maritime Executive. (2023, August 16). Korean shipbuilders retake top spot overtaking China with LNG orders. https://maritime-executive.com/article/korean-shipbuilders-retake-top-spot-overtaking-china-with-lng-orders United Nations Conference on Trade and Development. (2023). Review of maritime transport 2023. United Nations. https://unctad.org/rmt2023 • Created with Datawrapper

Figure 6: Current Capability Comparison Through Heatmap Generation: South Korea vs China Shipbuilding

Source: Authors Own Compilation

Most significantly, even on the dimensions where South Korea is behind china, on those dimensions also South Korea ensures competitive close scores. Across all the seven dimensions, South Korea achieved a total score of 57. China only achieved total score of 50. Overall, performance of South Korea in all dimensions are above than China. Overall, it is understood that the difference in between in them is compartmentalized. Though China is trying to ensure rapid expansion and cost driven growth, but South Korea focuses on high value and technology driven sections.

Conclusion

South Korea has got unchallenged leadership in LNG carrier shipbuilding industry, and it is due to her decade long experience and technological capacities which has been achieved over time. Dur to this 'technological lead' Korean shipyards can ask for premium prices and at the same time also earns a large no of orders. To sustain this leadership, South Korea must keep on moving forward and also have to move beyond its current strength. For ensuring future leadership position South Korea must focus on updated eco-friendly vessel technologies, expand their initiatives to digital shipbuilding and automation and also need to increase integration along the supply chain. Simultaneously, providing after sales service and solutions to lifecycle problems is also important in ensuring long term client relationship. Also keeping focus on targeted policy support in financing, talent development and industrial upgrading to counterbalance China's speedy growth. Finally, South Korea's dominance will rely not only on maintaining its technological lead, but also on continuously redefining it in an increasingly competitive global market.

Practical Implications

Korea successfully avoids competing on cheap prices by building expensive and high-risk ships. For this expensive and complex vessels buyer care most about, top quality and reliability. The dominance of Korea is reinforced by robust internal ecosystem comprising the 'Big Three' shipyards. Specialized steel suppliers like POSCO, and proactive government financing for R&D in the shipbuilding sector has also contributed to ensure South Korea's lead. Technical capabilities like the industry leading boil off rate and 30-36 months build cycles are the main reasons global buyers justify a USD 20 million to USD 30 million price premium per vessel. Qualitative superiority thus retained by South Korea, where full convergence by China will take time and depend on the initiatives taken by Chine's shipyards in the coming years. Nevertheless, China's rapid production capacity expansion and successful delivery of large-scale vessels signal intensifying competition in the near future.

To sustain its dominance amid increasing Chinese expansion and a shrinking workforce South Korea should concentrate on three strategic pillars. First, increasing the use of autonomous robotics beyond current applications in welding and heavy fabrication. This is significantly important to combat chronic labour shortage problem, to enhance workforce safety, and to maintain the precision required for complex vessel construction. Second, redirecting research and development focuses on carbon-neutral fuels, such as ammonia and hydrogen-ready carriers which at the same time pursuing commercialization of these technologies and repositioning toward nuclear marine propulsion. These initiatives are crucial to remain ahead of tightening IMO environmental regulations. Third, taking a transition from a traditional maritime shipbuilder to a comprehensive maritime software and technology solutions provider. This capacity will strengthen expertise in AI-driven predictive maintenance for real-time vessel health monitoring, which will prevent costly failure and simultaneously advance the commercialization of Maritime Autonomous Surface Ships (MASS)

Suggestions for Further Research

Future academic and industry analyses should undertake comparative studies of maintenance cost and hull integrity between South Korean and Chinese LNG carriers after more than 15 years of service to understand the real scenario and to quantify the reliability premium. Such research is particularly important given the limited availability of long time as well as year wise operational data for Chinese LNG carriers. Moreover, initiatives like U.S. 'MASGA' and western energy collaborations are shifting new orders from Korean shipyards to Chinese shipyards. This particular mechanism is needed to be investigated.

Limitations of the Study

The main limitation of this study includes not using primary data. The study depended on secondary data, which cannot provide actual prevailing conditions of production cost required, internal R&D process and detailed lifecycle performance. Moreover, recent operational data revealing Chinese LNG carrier shipbuilding industry remains sparse. Primary data such as shipowner interviews would increase the depth of the study. In spite of that, cross-checking within the secondary data sources used in the paper has been done. Even though these constraints mean that some outcome of the study refers to the best available evidence than comprehensive industry insights.

Abbreviations

ABS- American Bureau of Shipping
AHP-Analytic Hierarchy Process
AI- Artificial Intelligence
CSSC- China State Shipbuilding Corporation
DNV- Det Norske Veritas
GDP- Gross Domestic Product
GTT- Gaztransport & Technigaz
HCI- Heavy Chemical Industry
IEA- International Energy Agency
IMO- International Maritime Organization
KAIST- Korea Advanced Institute of Science and Technology
LNG- Liquified Natural Gas
MOTIE- Ministry of Trade Industry and Energy (South Korea)
NIF- National Investment Fund
POSCO-Pohang Iron and Steel Company
R&D- Research and Development
UNCTAD- United Nations Conference on Trade and Development

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