



IMPEDIMENTS OF SHIPBUILDING INDUSTRY IN PAKISTAN



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CHAPTER 1

INTRODUCTION

1.1 Introduction

The shipbuilding industry, marking its global growth, is due to rising globalization demands and the ease with which raw materials, components, and completed goods may be transported across international waterways economically and efficiently, the shipbuilding industry has grown more global than local. Maritime nations such as the China, South Korea, Japan, Philippines, Italy, France, and Germany consistently dominate the shipbuilding industry.¹

Figure 1 illustrates the distribution of the global merchant fleet. Shipbuilding is broadly divided into commercial and naval segments. In the commercial shipbuilding market, China, South Korea, and Japan hold the major share of global output China alone received about 59 % of new shipbuilding orders in 2023, while the United States accounts for barely 0.13 % of global tonnage.²

In the naval segment, China's navy now leads in sheer ship count, while the United States still leads in total fleet tonnage and advanced naval capability. Other countries with significant naval production and fleets include Russia, Japan, and India.³ Shipbuilding is considered to be one of the most strategic, oldest, most open and highly competitive markets in the world. Although shipbuilding industry has vast experiences in surviving during peaks and slumps of economy, the current global economic and political crisis has hit shipbuilding industry more severely. As shipbuilding is a highly capital-intensive industry so strong government support and political stability is prerequisite to survive this industry.⁴

According to the Review of Maritime Transport 2024 by UNCTAD, approximately 80% of international trade by volume is carried by sea. Without shipbuilding, the large-scale and cost-effective movement of bulk goods, energy resources, and consumer products would not be possible.⁵

¹ United Nations Conference on Trade and Development (UNCTAD), Handbook of Statistics 2024 (Geneva: United Nations, 2025), <https://unctad.org/publication/handbook-statistics-2024>.

² Allison J. Luzwick and Christopher R. Nolan, "Growth Likely on the Horizon for America's Shipyards in 2nd Trump Administration," Holland & Knight Transportation Blog, January 2, 2025, <https://www.hklaw.com/en/insights/publications/2025/01/growth-likely-on-the-horizon-for-americas-shipyards-in-2nd-trump>.

³ Cancian, Mark F. China Dominates the Shipbuilding Industry. Center for Strategic and International Studies (CSIS), January 25, 2024. <https://www.csis.org/analysis/china-dominates-shipbuilding-industry>.

⁴ McCarthy, M., 2005. Ship's Fastenings: from sewn boat to steamship. TexasA&MPress, 2005.

⁵ United Nations Conference on Trade and Development (UNCTAD). 2024. Review of Maritime Transport 2024. Geneva: UNCTAD.

The shipbuilding industry is accountable for the design and construction of oceangoing vessels all around the globe. The industry is involved in the construction and modification of ships and these operations are carried out in specialized facilities which are known as shipyards. Shipyards must comply with IMO's international regulatory framework in order for its constructed vessels to be certified to trade internationally.

The key factors driving the growth of the market are GDP, global seaborne trade, improved economic growth, rising urbanization, fossil fuel price and increase in global steel production. Some of the noteworthy trends and developments of this industry are green shipbuilding technology, automation in the industry, modular shipbuilding technique, advanced outfitting, ship launching airbag, LNG/LPG fueled engines and solar and wind powered ships. Other recent factors include requirement for modern vessels capable of meeting IMO's decarbonization targets for 2030 in line with UN's SDGs and age restrictions imposed by global ports and terminals upon vintage of vessels calling at these ports.

However, the expansion of shipbuilding industry can be affected by increased competition, environmental regulations, enhanced globalization and political and financial instability.⁶

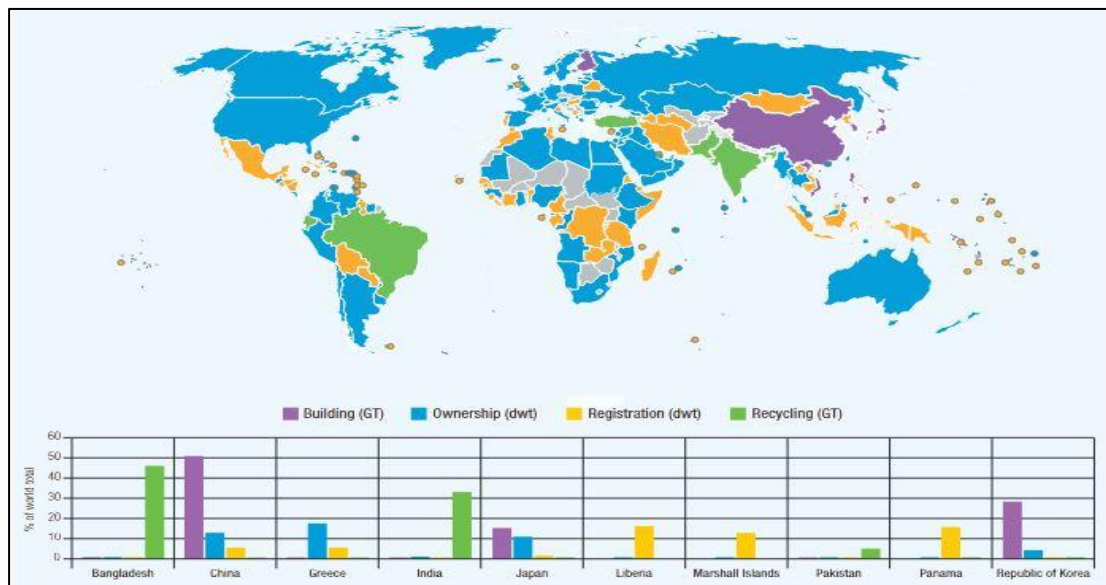


Figure 1: Global distribution in shipbuilding, ownership, registration, or recycling within maritime trade.⁷

The development of container ships, LNG tankers, oil tankers, and bulk carriers has revolutionized global supply chains and enabled globalization. For instance, the construction of ultra-large container vessels (ULCVs), that are

⁶ Sawyer, L.A. and Mitchell, W. H. 1985. The Liberty Ships: The History of the "Emergency" Type Cargo Ships Constructed in the United States During the Second World War, pp. 7-10, 2nd Edition, Lloyd's of London Press Ltd., London, England, 1985.

⁷ UNCTAD, UNCTADstat 2024 and Clarkson's research.

larger than the Triple-E Class, allows for the transportation of over 24,000 TEUs, significantly reducing cost per unit and improving trade efficiency.^{8 9 10}

In 2024, Japan had only 12 percent of the global ship deliveries compared to 25 percent in 2018 and 6.7 percent appeal of new order as gross compensated tonnage. However, in a heavy contrast, China won 70 percent of the world ship orders in 2024 and surpassed four times more than ship vessels delivered by Japan. The Japanese shipbuilding industry which is worth around USD 21 billion is faced by a challenge of a fixed production capacity, space constraints, and expensive labor and raw materials coupled with a massively aging labor force. Such limitations have made it difficult to meet the recent demand increase in new vessels across the world. The labour is now approximately 76,000, however the industry is growing to increasingly utilize immigrant labour force, which has now reached almost 20 percent of labour force, an immense change compared with only a decade ago. Figure 2 highlights China's dominance in global shipbuilding for the year 2024, both in terms of new ship orders and completed vessel deliveries.¹¹

The industry is vital for national defense, allowing countries to build and maintain fleets of, aircraft carriers, submarines, frigates and destroyers. A strong naval shipbuilding sector enhances a nation's geopolitical reach and maritime sovereignty, particularly in contested regions like the South China Sea. Nations like the US, China, Russia, and India heavily invest in domestic military shipbuilding to ensure strategic autonomy.

Shipbuilding is also trending towards being a high-tech industry by using digital twin technologies to design ships, artificial intelligence (AI) and machine learning to enable autonomous navigation, Internet of Things (IoT) sensors to perform predictive maintenance, and robotics at the shipyard. Such development facilitates the cross-sector renewable energies, automation, propulsion, and advanced materials innovation. An example of this trend is South Korea, which has moved towards automation and the adoption of AI to support productivity and quality in shipbuilding its Smart Shipyard initiative.

⁸ United Nations Conference on Trade and Development (UNCTAD). 2024. Review of Maritime Transport 2024. Geneva: UNCTAD. <https://unctad.org/webflyer/review-maritime-transport-2024>

⁹ OECD (Organisation for Economic Co-operation and Development). 2015. The Impact of Mega-Ships. Paris: OECD Publishing. <https://doi.org/10.1787/9789282105952-en>

¹⁰ Notteboom, Theo, and Jean-Paul Rodrigue. 2020. "Container Shipping and Ports: The Box That Changed the World." In The Geography of Transport Systems, edited by Jean-Paul Rodrigue, 5th ed. New York: Routledge. <https://transportgeography.org>

¹¹ Rich, Motoko. "Japan's Shipbuilders Look to Consolidation to Take on China: US Ally Mounts Most Ambitious Push in Decades to Revitalise Sector Dominated by Chinese and South Korean Groups." Financial Times, August 5, 2025. <https://www.ft.com/content/63021c76-5f67-4f58-aec0-3032718886f9>.

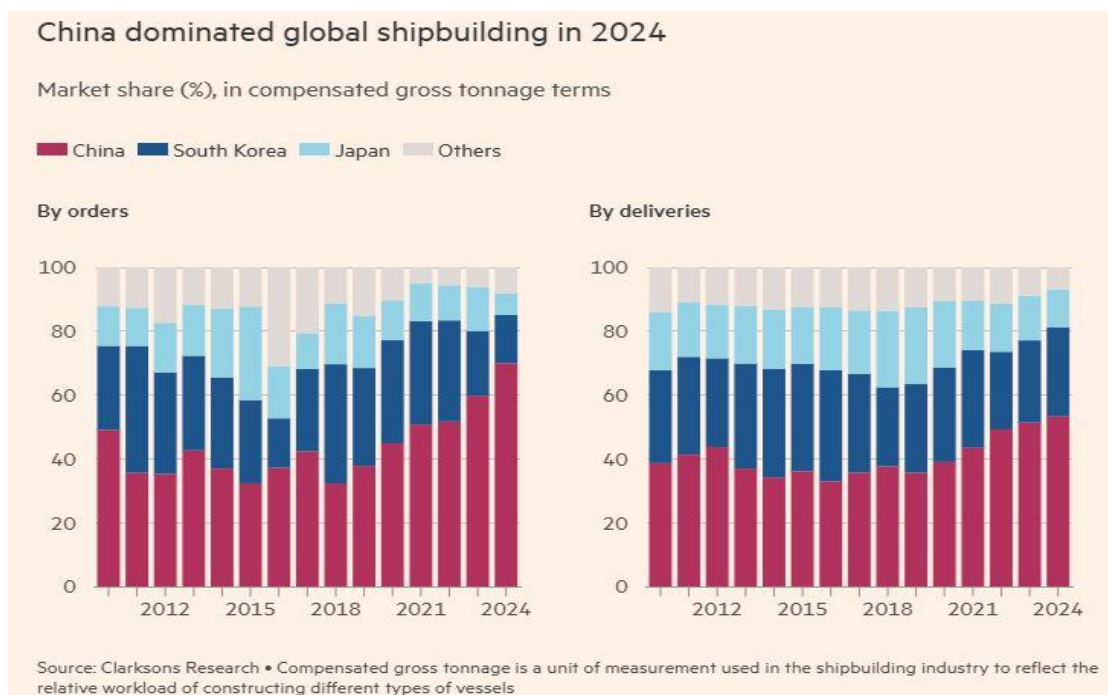


Figure 2: China's Lead in Global Shipbuilding, 2024

Domestic shipbuilding increases sovereignty of supply chains, particularly in, pandemics (e.g. COVID-19 disruptions), maritime conflicts, geopolitical sanctions etc. Having an advanced ship building capability will enable countries to diversify transport logistics, secure trade routes, and respond to crisis much quicker.

1.2 Problem Statement

The ship building industry in Pakistan is still faced with major structural and institutional reforms that are hampering its growth towards a competitive self-sustaining industry. Although it has a long coastline and has strategic maritime value, production of marine grade steel, high-tech propulsion systems, as well as built-in electronic subsystems are grossly underdeveloped, creating an over reliance on foreign suppliers and a lack of defense autonomy.¹² The sector is in a dire need of strong research and development and design establishments, governmental contributions through subsidies, tax concessions and favorable procurements, as well as, its overreliance on importation of foreign components and propulsion units.¹³ Global shipbuilding industries have now advanced very well in the last few decades and in fact even smaller shipyards across the world have enlarged their average DWT (deadweight tonnage) capacity. Comparatively, Karachi Shipyard & Engineering Works (KSEW) has failed to grow its capacity beyond level of 26,000 DWT. Consequently, it has struggled to find local and foreign contracts in shipbuilding and repair. In the meantime, other countries have diversified their shipbuilding activities to manufacture

¹² Hamna Ghas Sheikh, "Maritime Reforms in Pakistan: Strategic Leap in Shipbuilding and Recycling," Modern Diplomacy, February 10, 2025

¹³ Shazad, Sajid Mehmood, and Umbreen Javaid. "Development of shipping sector in Pakistan: options and proposed strategy." J. Pol. Stud. 23 (2016): 537.

different types of commercial vessels, and have been performing dynamically in the area of ship innovation with the aim to expand their competences and be more likely to compete with other nations.¹⁴

KSEW in March 2024 signed a contract with Pakistan National Shipping Corporation for the construction of a feeder size container vessels to be delivered in 36 months from the date of signing of contract. Similarly, KSEW entered into a contract with Saudi Arabian Navy for the construction of two supply tanker. These two contracts are not enough to rank KSEW as a significant exporter of tonnage however they be positively regarded as a starting point.

1.3 Objectives of the Research

The objectives of this research are as follows:

- a. Identify the major impediments in Pakistan's shipbuilding industry.
- b. Evaluate the role of government policies, investment barriers, and technological gaps.
- c. Analyze the applicability of green technologies in shipbuilding.
- d. Compare Pakistan's shipbuilding industry with regional and global competitors.
- e. Propose policy interventions and investment strategies to enhance shipbuilding capacity.

1.4 Methodology

This paper has taken a mixed approach methodology to analyze the obstacles to shipbuilding in Pakistan with both qualitative and quantitative methods used to form a complete picture of the issue. The research design was exploratory and descriptive; the descriptive aspect described the present position of the shipbuilding industry in Pakistan with the help of numbers and facts, whereas, the exploratory aspect identified the cause behind this situation and the inherent issues concerning its future development.

Primary data were gathered by undertaking semi-structured interviews with key stakeholders such as top-level officers at Karachi Shipyard & Engineering Works (KS&EW), officials of the Ministry of Maritime Affairs, the investor in the private sector, operators of ship repair facilities and maritime engineers. A questionnaire was sent to employees of the shipyards, maritime scholars, and policy makers to quantify opinions on technological constraints, policy restrictions, infrastructure shortage, and competitiveness levels in the markets.

¹⁴ Faisal Mir, Establishment of Gwadar Shipbuilding Industry: Road to Maritime and Economic Prosperity (MPhil thesis, Bahria University, 2020), <https://www.researchgate.net/publication/367236099>.

Additionally, we have used HAZOP (Hazard and Operability) analysis to systematically identify probable hazards and operational issues in the designated work areas besides, several focus group discussions (FGDs) were organized with the industry experts and former officers of the maritime industry to obtain different viewpoints concerning the strategic limitations. Secondary data was taken from various sources of reputable sources which include both the government owned reports and administrations such as the Ministry of Maritime Affairs, the annual reports of KS&EW, international standards such as the UNCTAD Review of Maritime Transport, the OECD Shipbuilding Statistics and other market research reports in addition to the academic literature on shipping building trends at South-Asian and global level.

1.5 Scope of Research

This study will explore:

- a. Pakistan's shipbuilding industry, its current capacity, and its economic significance.
- b. Financial, technological, and policy constraints limiting industry growth.
- c. Comparative analysis with China, South Korea, Bangladesh, and India.
- d. Potential for Gwadar Port as a future shipbuilding hub.
- e. Adoption of green technologies in shipbuilding.
- f. Policy recommendations to develop a self-sustaining industry.

CHAPTER 2

GLOBAL SHIPBUILDING TRENDS AND ROLE IN THE MARITIME ECONOMY

2.1 Introduction

Shipbuilding industry is a critical sector which is able to stimulate economic growth, generate employment, advance in technology, and national maritime security in both developed and developing countries. Shipbuilding as a segment of the wider maritime economy, sometimes called the blue economy, promotes industrial clustering, encourages trade, and links economies into world value chains. Waterborne industries are centrally focusing on both environmental sustainability and digital transformation in the 21st century, with the combination of the two creating new trends in this sector, generally denoted as both green shipbuilding and smart maritime infrastructure.

Most of the maritime countries have classified shipbuilding as a strategically significant industrial sector owing to the fact that it triggers a broad range of support industries such as steel making, metallurgy, electric systems, propulsion techs, and maritime logistics.¹⁵ Due to concentration, the cluster of shipyards in certain areas frequently forms the industrial agglomeration that produces the local economic ecosystems and positively affects the Gross Domestic Product (GDP). An example is the Ulsan, Busan, Geoje industrial belt of South Korea where Hyundai Heavy Industries, Samsung Heavy Industries, and Hanwa Ocean Company Ltd. (formerly known as Daewoo Shipbuilding & Marine Engineering) are headquartered, and have been referred to as one of the world most modern shipbuilding clusters employing tens of thousands of workers with thousands of subcontractors to support them.¹⁶

The Technavio has estimated that the global shipbuilding industry will grow by a magnitude of about USD 26.1 billion in the duration of the forecast period (2025-2029), a compound annual growth rate (CAGR) of 4.4 % per annum. The growth in seaborne trade continues to be the greatest factor driving this to be accompanied with increased demand of eco-friendly vessels. However, the fluctuation of the prices of raw materials is likely to strain the sector critically. Figure 3 illustrates the projected global shipbuilding market trend for the period 2025–2029.¹⁷

¹⁵ Kim, Yong-Jeong, Sang-Gun Lee, and Silvana Trimi. "Industrial linkage and spillover effects of the logistics service industry: an input–output analysis." *Service Business* 15, no. 2 (2021): 231-252.

¹⁶ Rich, Motoko. "At the World's Largest Shipyard, U.S. Courts an Ally to Face Up to China." *Wall Street Journal*, September 23, 2024. <https://www.wsj.com/world/asia/us-south-korea-shipyard-china-30aa2b11>.

¹⁷ Technavio. Shipbuilding Market Size Is Set to Grow by USD 26.1 Billion from 2025–2029: Increasing Seaborne Trading Boost the Market. PR Newswire, August 5, 2025. <https://www.prnewswire.com/news-releases/shipbuilding-market-size-is-set-to-grow-by-usd-26-1-billion-from-2025-2029--increasing-seaborne-trading-boost-the-market--technavio-30236088>.



Figure 3: Global Shipbuilding Market 2025–2029

Shipbuilding industry is flourishing through innovations and expansion, energized by the progress in the manufacturing technology and designing technologies. There is a strong demand of used floated vessels to be used in trading operations and maintenance activities but there is a need to ensure technical improvement and upgradation. The import-export businesses have remained to sustain the growth in the industry, and the international seaborne trade and industrialization have increased demand of fuel-efficient vessels and multi-fuel engine imports.

The shipping firms are interested in the latest designs of vessels including its manufacturing plans, including cut and processing, assembly and launching, outfit and cruises. The future of the industry looks good, as industry trends include 3D printing, drones, autonomous ships, and big data.¹⁸ Container, tanker, multipurpose, and specialized cargo ships are highly demanded to transport goods by means of cargo vessels. Geopolitical issues impact the distribution of fleets whilst old design tankers of oil and commodity ships are upgraded to new generations to conform to the contemporary standards. The agreements of trade and transportation through waterway are also influencing the industry.

Figure 4 outlines an analytical breakdown of the entire shipbuilding industry of the present day and the future of the industry to outline the investment opportunities available in the future. Through analysis of the profitable trends in the market, it understands the areas that the stakeholders should improve in terms of enhancing their competitive standing. The analysis also provides information about major opportunities, drivers, and restraints affecting the industry with supporting information concerning their effects. As well, the

¹⁸ StartUs Insights. "The Future of Shipbuilding Technology in 2025 & Beyond." StartUs Insights (blog). Accessed August 11, 2025. <https://www.startus-insights.com/innovators-guide/shipbuilding-technology/>.

shipbuilding market receives a quantitative evaluation over 2020-2030, which serves as a standard of financial progress.¹⁹

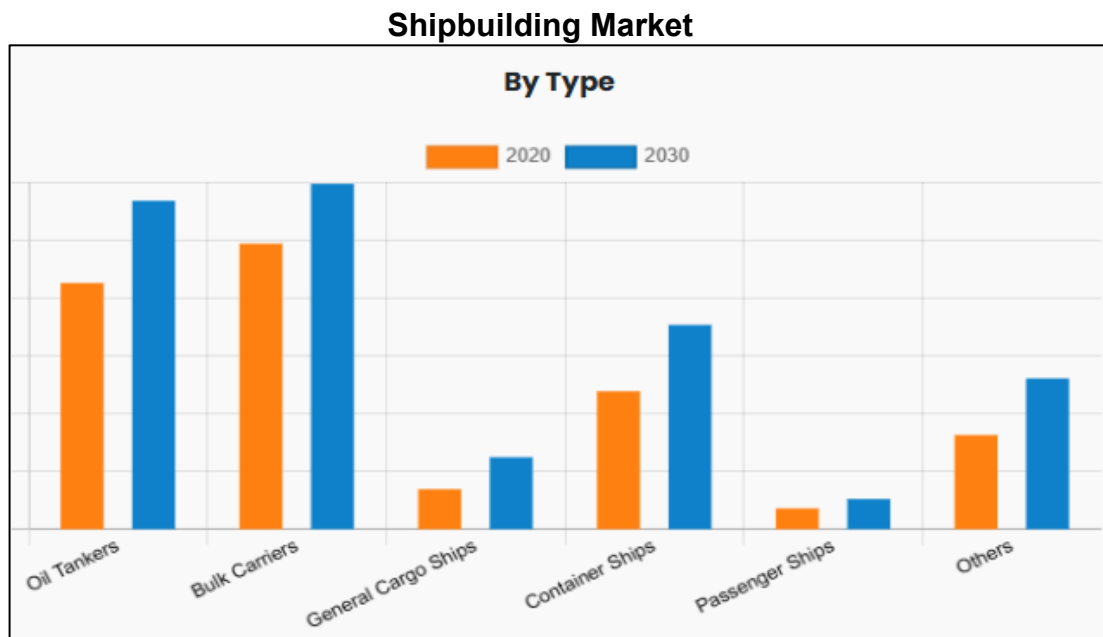


Figure 4 Oil Tankers segment is projected as the most lucrative segment

2.2. Global Shipbuilding Output and Emerging Market Dynamics

Global shipbuilding market structure is consolidated with three regions in China, South Korea and Japan producing more than 85 percent of all vessels produced worldwide. China is the leader in respect of market share of around 44 percent as it specializes in container ships, oil tankers and bulk carriers. This supremacy is being supported by high-state investments, integrated supply chains of shipyards, and strong demand of exports.^{20 21} South Korea takes second place with slightly more than 30 percent of the market which is quite strong in technological advanced ships, and they include Liquefied natural gas (LNG) carriers, offshore drilling platforms, and the high-specification cruise ships. Hyundai Heavy Industries, Samsung Heavy Industries, and Hanwha Ocean (previously known as DSME) are the leading South Korean shipbuilders that are distinguished by engineering accuracy and the adoption of innovative shipbuilding systems and practices. The state makes strategic investments in the sphere of shipbuilding due to the fact that it maintains over twenty collateral industries, such as metallurgy, electrical devices, technologies of propulsion systems, and logistics.^{22 23}

¹⁹ Allied Market Research. Shipbuilding Market Size, Share, Trends | Analysis Report – 2030. Allied Market Research. Accessed August 11, 2025. <https://www.alliedmarketresearch.com/shipbuilding-market-A08511>.

²⁰ Clarksons Research. Clarkson World Shipyard Monitor 2024. London: Clarksons Research, March 2024.

²¹ UNCTAD. Review of Maritime Transport 2024. Geneva: United Nations Conference on Trade and Development, October 22, 2024.

²² OECD. The Shipbuilding Industry in 2024: Market Trends and Industrial Policies. Paris: OECD Publishing, 2024.

²³ IHS Markit. Maritime Industry Outlook 2024. London: IHS Markit, 2024.

The integration of shipyards within industrial clusters creates localized economic ecosystems that contribute significantly to GDP. Japan accounts for about 14%, mainly constructing mid-sized vessels, including ferries, tankers, and high-value niche ships. European nations contribute a modest 6%, but they specialize in luxury cruise liners, naval vessels, and environmentally compliant ferries. Other players like Vietnam, India, and Turkey are emerging regional contributors, focusing on auxiliary ships, defense contracts, and ship repair facilities.²⁴

In 2024, the worldwide shipbuilding sector showed a very robust demand as new ship orders stood at around 65.8 million compensated gross tonnage (CGT), that is, a 34 percent rise compared to 2023 and the highest since 2007.²⁵ The global orderbook total some 208.7 million deadweight tons (DWT) by the end of the year and shows a significant year-on-year rise of 49.7 percent. The total amount of ship deliveries in 2024 was approximately 48.18 million DWT which corresponds to a 13.8 percent increase in comparison with the last year. The Chinese ship building industry controlled major supply of newbuilding contracts in the world market with 74.1 percent of the total newbuilding orders, comprising 113.05 million DWT and occupied 55.7 percent of total World Production (48.18 million DWT). There are also Chinese shipyards that possessed 63.1 percent of the total world order book as the year 2024 ended.²⁶

An eminent trend in 2024 was the noteworthy growth of green and dual-fuel vessels. The world order book was estimated by gross tonnage around 50 percent of ships designed to operate on alternative fuels, with 36.1 per cent on LNG-capable and 9.3 per cent on methanol-capable new ships and more than 14 percent of order book is alternative-fuel-ready at the start of the year.²⁷ The Chinese yards were especially strong in this market and secured 78.5 percent of all the world orders on green vessels in 2024. Such advancements are indicators of robust market dynamics, especially the shrinking of environmental regulations like decarbonization rules through the International Maritime Organization, which are promoting the re-fueling and updating of fleets by ship-owners. Moreover, technological innovations, such as two fuel potentials and intelligent efficiency systems, are turning out to be standard methods so as to meet the emissions expectations, in addition to optimizing performance.²⁸

The market of ship building in the world tends to divide the vessels according to the type into bulkers, tankers (including LNG carriers), container ships, cruise and ferry ships, other special ships because this division is common in

²⁴ OECD. (2022). Shipbuilding Market Developments Report. Available at: oecd.org.

²⁵ iMarine. 2025. "China Dominates Global Shipbuilding: 70 % Market Share in 2024 as Top 10 Builders Include 7 Chinese Firms." iMarine News, March 28, 2025. Accessed August 12, 2025. iMarine News.

²⁶ Si, Katherine. "Chinese Shipyards Booked 74% of All Newbuilding Orders in 2024." Seatrade Maritime, January 17, 2025.

²⁷ UNCTAD. 2024. Chapter II, Review of Maritime Transport 2024: World Shipping Fleet and Services. United Nations Conference on Trade and Development (UNCTAD). Accessed August 12, 2025. https://unctad.org/system/files/official-document/rmt2024ch2_en.pdf.

²⁸ Si, Katherine. "Chinese Shipyards Booked 74% of All Newbuilding Orders in 2024." Seatrade Maritime, January 17, 2025.

industry.²⁹ In the freight ship industry, container ships continue to dominate with some claims of the market share reaching above 35 percent in 2023.³⁰ The LNG carrier market is recording a robust performance especially due to a steep growth in the world demand of cleaner transport of energy and the growth of LNG infrastructure investments particularly on the European-Asian axis. Though the exact numbers regarding the market share may not be reported on a regular basis, several sources indicate the segment experiencing the skyrocketing growth and a strong impulse.³¹

The global shipbuilding industry is undergoing a series of trends that are changing the industry and one of the most noticeable of these trends is in the increased emergence of green ship building as a feature of the worldwide regulatory trend in the industry, on the one hand by the International Maritime Organization (IMO) and ultimately by the European Union. With an estimated 50 percent of the total tonnage to be ordered worldwide, vessels capable of operating on alt fuels such as liquefied natural gas (LNG), methanol, ammonia, hydrogen, and liquefied petroleum gas (LPG) were targeted in 2024. The LNG dual-fuel new construction orders were mainly ordered in this category where it took up most tonnage of alternative-powered fuel ship orders (not including LNG carriers) making about 70 percent of the tonnage at about 245 ships, followed by methanol, ammonia and hydrogen powered ships. The move mirrors stronger environmental standards such as compliance with the Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII) under the International Maritime Organization (IMO) and under the EU Fuel EU Maritime and Emissions Trading Scheme (ETS). Large players such as Maersk, CMA CGM and COSCO are putting major bets on dual-fuel ships to hedge against the uncertainties of regulation and long-term fleet decarbonization standards.^{32 33 34}

²⁹ The Business Research Company. Ship Building Global Market Report. Accessed August 12, 2025. <https://www.thebusinessresearchcompany.com/report/ship-building-global-market-report>.

³⁰ MarketResearch.com. Ship Building Market Outlook 2025-2034: Market Share, and Growth Analysis By Product (Bulkers, Tankers, Containers, Cruise And Ferry, Other Products), By Application (Passenger Transportation, Goods Transportation), By End-User. MarketResearch.com. Accessed August 12, 2025.

³¹ Rich, Motoko. "Japan's Shipbuilders Look to Consolidation to Take on China: US Ally Mounts Most Ambitious Push in Decades to Revitalise Sector Dominated by Chinese and South Korean Groups." Financial Times, August 5, 2025. <https://www.ft.com/content/63021c76-5f67-4f58-aec0-3032718886f9>.

³² Clarksons Research. Green Technology Tracker: Record Investments in Alternative Fuel. London: Clarksons, January 2025. <https://www.clarksons.com/home/news-and-insights/2025/green-technology-tracker-record-investments-in-alternative-fuel/>.

³³ Lloyd's Register. "Alternative-Fuelled Ship Orders Grow 50% in 2024." Lloyd's Register, January 15, 2025. <https://www.lr.org/en/knowledge/insights-articles/alternative-fuelled-ship-orders-grow-50-in-2024/>.

³⁴ Reuters. "Container Shippers Hedging Green Transition with Dual-Fuel Vessel Orders." Reuters, November 21, 2024. <https://www.reuters.com/sustainability/climate-energy/container-shippers-hedging-green-transition-with-dual-fuel-vessel-orders-2024-11-21/>.

2.3. Digital Transformation in Shipyards and Vessels (Industry 4.0)

The process of digitalizing shipyards and vessels is another major trend in the global shipbuilding. Digital twins, Internet of Things (IoT) sensors, artificial intelligence (AI) and robot welding systems are just some of the Industry 4.0 technologies being used in major shipyards, especially those in South Korea and Japan, to make their operations more efficient, to reduce the number of errors, and to decrease construction time.³⁵

Digital twins are a computer model of a ship or assembly process, which allows detecting clashes, simulating assembly sequence, and modelling performance without building a physical object. Major ship builders have adapted to use PLM systems and digital-twin environments to centralize design and production information and enable an iterative optimization process.³⁶ Figure 5 illustrates the phases of digital twin development.³⁷

Sensors built into the yard keep track of advancement, straightness, temperature, and quality of the welds by IoT. The visibility of KPIs helps managers to act faster with corrective action and to make quicker data-based scheduling, which comes only with real-time dashboards. According to market reports, there is a wide adoption of IoT through quality assurance and logistics.³⁸

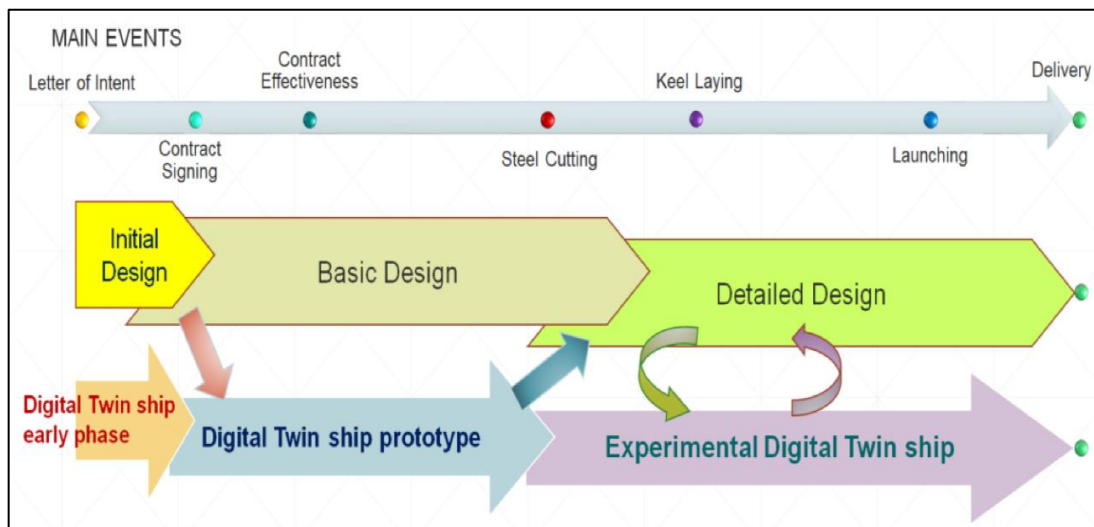


Figure 5: The Phases of Digital Twin Development ³⁹

Robotic welding, overhead welding robots, and mobile material handling robots eliminate monotonous work, ensure that high-quality welds are consistent, and

³⁵ Houston Chronicle. Persona AI Looks to Bring Humanoid Robots to Shipyards. January 2025. <https://www.houstonchronicle.com/news/houston-texas/trending/article/persona-ai-humanoid-robots-shipyards-20319212.php>.

³⁶ Siemens Digital Industries Software. 2024. World's Largest Shipbuilder Creates First Digital Shipyard Environment to Improve Productivity in Korea. Case study. Accessed August 18, 2025. <https://resources.sw.siemens.com/en-US/case-study-hyundai-heavy-industries-shipbuilding/>

³⁷ MDPI. 2022. "Using Digital Twin in a Shipbuilding Project." Applied Sciences 12 (24): 12721. <https://doi.org/10.3390/app122412721>.

³⁸ Fortune Business Insights. 2024. Digital Shipyard Market Size & Share. Fortune Business Insights.

³⁹ MDPI. 2022

keeps workers safe. South Korean shipyards and firms are rapidly developing robots for the specialized welding and humanoid robots for ship blocks and challenging joints.^{40 41}

The AI algorithms process the sensor streams and the past production data to forecast inaccuracy, streamline processes, and predict maintenance. Automated non-destructive inspection, and detection of anomalies within welds and coatings can also be supported using AI.

Hyundai heavy industry has partnered with software companies such as Siemens to implement PLM and Tecnomatix-based digital frameworks that aid in centralizing information on designing, simulation, and production processes, resulting in enhanced information sharing and efficacy in assembling and outfitting the blocks.⁴²

New partnerships such as ABS and HD Hyundai on an AI-led vision of a smart shipyard and NEURA Robotics collaborations on robotic technologies indicate a surge in the ecosystem of established shipbuilders, classification societies and robotics distributors co-creating the shipbuilding industry with customized Industry 4.0 tools.^{43 44} Figure 6 represents the robotics in shipbuilding market size, growth, and forecast up to 2032.⁴⁵

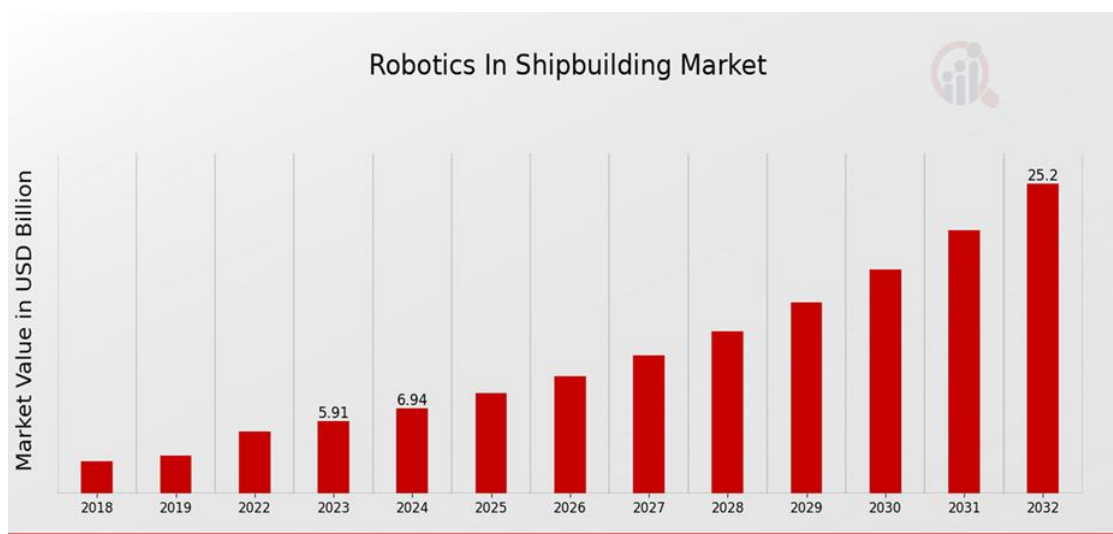


Figure 6: The Robotics in Shipbuilding Market Size, Growth, and Forecast Up to 2032

40 Korea Times. 2025. "Competition Heats Up to Develop Welding Robots for Shipyards," July 12, 2025.

41 The Maritime Executive. 2025. "HD Hyundai Tests Out a Humanoid Welding Robot in a Real Shipyard." The Maritime Executive, July 13, 2025.

42 Siemens. 2024. "World's Largest Shipbuilder Creates First Digital Shipyard Environment." Siemens Resources (case study).

43 Offshore-Energy. 2025. "ABS, HD Hyundai Join Forces on AI-Backed Smart Shipyard Vision." Offshore-Energy.

44 StartUs Insights. Artificial Intelligence and Robotics Report. Accessed August 18, 2025. <https://www.startus-insights.com/innovators-guide/artificial-intelligence-and-robotics-report/>.

45 Robotics in Shipbuilding Market Research Report: Information by Type, Application, and Region Forecast till 2032. Pune: Market Research Future, 2024. <https://www.marketresearchfuture.com/reports/robotics-in-shipbuilding-market-41223>.

2.4. Environmental and Regulatory Drivers

The present and future direction of the shipbuilding industry is characterized by environmental regulation. The Revised GHG Strategy (2023) of the IMO is highly ambitious in terms of decarbonization with its aim to reduce the carbon intensity of maritime transport at least by 40% by 2030 and move towards the net-zero emissions target by or near 2050.⁴⁶ Such targets are driving investment in energy-saving technologies, emission control technologies and green propulsion systems. The European Union regulatory system, called the Emissions Trading System (ETS), has also become applicable to shipping since 2024 and requires shipping companies to trade in emission allowances against CO₂ emissions, starting with methane and nitrous oxide in 2026 with the phased compliance schedule (40% in 2025, 70% in 2026, and 100% in 2027).⁴⁷ ⁴⁸ Such regulatory environment stimulates building low- or zero-emission ships and has shipbuilders incentivizing them to innovate faster.⁴⁹

Due to the need to have compliance and safety, major classification societies, like DNV, ABS, and Lloyds Register have started revising their standards and certification rules, including environmental and energy-efficiency parameters. These institutions are demanding more and more evidence of the sustainability of their life cycle, carbon reductions and energy performance on their new constructions. This means that, although the green technologies used in shipbuilding have a green premium that has to be paid, the cost is being offset at an increasing rate by long-term fuel savings, regulatory compliance, and brand reputation benefits, turning environmentally friendly ships into a cost-effective economically gaining and operationally beneficial solution.^{50 51 52}

2.5. Progress towards Green Shipbuilding

As concerns about the environment increased, the shipbuilding industry has taken a drastic turn in favor of green and sustainable technologies. A key driver in the fuel-efficient design, carbon-neutral propulsion systems and the eco-friendly retrofitting options has been the International Maritime Organization (IMO) 2030 and 2050 decarbonization targets.

46 International Maritime Organization (IMO). 2023. 2023 IMO Strategy on Reduction of GHG Emissions from Ships. London: IMO. <https://www.imo.org/en/OurWork/Environment/Pages/2023-IMO-Strategy-on-Reduction-of-GHG-Emissions-from-Ships.aspx>.

47 European Maritime Safety Agency (EMSA). 2023. Extension of the EU Emissions Trading System to Maritime Transport. Lisbon: EMSA. <https://www.emsa.europa.eu/reducing-emissions/extension-ets.html>.

48 Maersk. 2023. "EU Emissions Trading System (ETS)." Maersk News, September 15, 2023. <https://www.maersk.com/news/articles/2023/09/15/eu-emissions-trading-system-ets>.

49 Reuters. 2024. "Can Shipping Industry Chart a Course That Delivers for the Planet?" Reuters, June 26, 2024. <https://www.reuters.com/sustainability/decarbonizing-industries/can-shipping-industry-chart-course-that-delivers-planet-2024-06-26/>.

50 DNV. 2025. Rules and Standards Explorer. Accessed August 18, 2025. <https://www.dnv.com/rules-standards/>.

51 Lloyd's Register. 2025. Classification and Certification Services. Accessed August 18, 2025. <https://www.lr.org/en/services/classification-certification/>.

52 Jia, H. 2024. "Green Premium and the Role of Financial Investors in Eco-Ships." Science Direct. <https://www.sciencedirect.com/science/article/pii/S1366554524002497>.

Various research studies highlighted that green shipbuilding is not optional anymore but structural mandate. The trend in shipyards is the use of dual-fuel engines, fuel systems based on hydrogen, LNG propulsion, and energy-saving coatings of hulls. The move to zero-emission container vessels has begun in European yards, and Asia-Pacific nations have already increased the speed of retrofitting. The retrofitting market in itself is anticipated to increase by 35 percent by 2025 with China, Singapore, and South Korea leading.⁵³

In South Korea, work has begun on the K-Ship Zero, the world's first commercially viable bulk carrier to run on hydrogen, with an expected launch date of 2025. This transition has necessitated huge investments in research and development and a close interaction between states owned enterprises and private shipyards. In a similar direction, Singapore has embarked on autonomous electric vessels programmes, which are encouraged by the Maritime and Port Authority of Singapore.⁵⁴

The green shipbuilding is also influencing policy tools and regulatory frames. The Fit for 55 plan of the European Union, which lays stress on carbon accounting, smart controls of emissions, and market-based measures like the expansion of the EU Emissions Trading System (ETS) and the Carbon Border Adjustment Mechanism (CBAM), have a direct impact on the maritime sector.^{55 56 57} China ranks similarly: its 14th Five-Year Plan on Green Maritime Transport and its plan (2023) on the modernization of its shipbuilding industry prioritize clean-energy vessels, shore power, and investment all to encourage green shipyard redevelopment and innovation.^{58 59 60} These policies demonstrate that regulation and market forces are working hand in hand in bringing about transformation in the various sectors in the world.

53 Jafarzadeh, S., & Rismanchi, B. (2024). Technological Advancements in Green Shipbuilding. *Journal of Cleaner Production*, 433, 140928. <https://doi.org/10.1016/j.jclepro.2024.140928>

54 Lee, C. (2025). Maritime Tech Clusters in Singapore: Lessons for Emerging Shipbuilding Nations. *Ocean Engineering*, 297, 114302. <https://doi.org/10.1016/j.oceaneng.2025.114302>

55 Green Shipping in a Changing Political Climate. *Synergy Marine Group*, June 24 2025. Discusses Fit for 55 and CBAM charging polluting ships.

56 Reducing emissions from the shipping sector." *European Commission*. Accessed August 2025. EU MRV rules for ship emissions (CO₂, CH₄, N₂O) mandatory reporting since 2018 and expanded in 2024.

57 Fit for 55 – *Consilium.europa.eu*. Accessed August 2025. EU Fit for 55 package aiming for –55 % GHG by 2030, including ETS and CBAM.

58 Zhang, Qiang, Chen Chen, Jian Zheng, and Liang Chen. "Quantitative evaluation of China's shipping decarbonization policies: The PMC-Index approach." *Frontiers in Marine Science* 10 (2023): 1119663.

59 Xinhua. 2023. "China Releases Action Plan to Foster Green Development in Shipbuilding Industry." *English.gov.cn*, December 29, 2023. Accessed August 23, 2025. *English editions of official announcements by the State Council of the People's Republic of China*.

60 Carbon Brief. 2021. "Q&A: What Does China's 14th 'Five-Year Plan' Mean for Climate Change?" *Carbon Brief*, March 12, 2021. Accessed August 23, 2025. <https://www.carbonbrief.org/qa-what-does-chinas-14th-five-year-plan-mean-for-climate-change/>

CHAPTER 3

CASE STUDIES OF REGIONAL COMPETITORS IN SHIPBUILDING

3.1. Introduction

The shipbuilding market has now become highly concentrated in the Asia-Pacific region, with China, South Korea, and Japan having over 85 % share of new orders and controlling over 90 % of the shipbuilder market by 2022.^{61 62}

Pakistan is difficultly competing with global as well as regional emerging shipbuilding economies. China, South Korea, and Japan are the global leaders in shipbuilding ships (China holds more than 50 percent of the total orders and Korea and Japan specialize in highly advanced and value added vessels (e.g. LNG carriers, smart ships, energy efficient designs) due to the state-backed R&D, large scale production capabilities, and innovation systems.⁶³ Figure 7 illustrates the global shipbuilding trend analysis.

These countries are not direct competitors of Pakistan in its near markets, but they are points of reference when it comes to technological advances, size of scale and their market pull. Table 6 presents a comparative analysis of Pakistan's shipbuilding sector in relation to its regional competitors.

India, a neighboring country to Pakistan has developed a fast-growing shipbuilding industry that illustrates its up surging maritime capacity. The Indian shipbuilding sector increased its output between 2022 and 2024, emerging as a potential future global player in maritime design and shipbuilding-from the US\$90 million in 2022 to the US\$1.12 billion in 2024 with a planned increase to US\$8 billion in 2033-assured by promising policies such as the Shipbuilding Financial Assistance Policy (2016 - 2026), Sagarmala Programme (Phase 2 implemented with the investment of 40,000 crore).

61 iCrowdNewswire. 2025. "Shipbuilding Market Overview, Key Drivers, Competitive Landscape, Segmentation & Regional Analysis By 2030." iCrowdNewswire, May 29, 2025. Accessed August 23, 2025. <https://icrowdnewswire.com/2025/05/29/shipbuilding-market-overview-key-drivers-competitive-landscape-segmentation-regional-analysis-by-2030>.

62 Global Information Inc. 2025. *Shipbuilding – Market Share Analysis, Industry Trends & Statistics, Growth Forecasts (2025–2030)*. March 18, 2025.

63 National Institute of Maritime Affairs. 2025. "Shipbuilding Industry to Be Explored under CPEC." *CPECinfo*, July 25, 2025. Accessed August 23, 2025. <https://cpecinfo.com/shipbuilding-industry-to-be-explored-under-cpec>

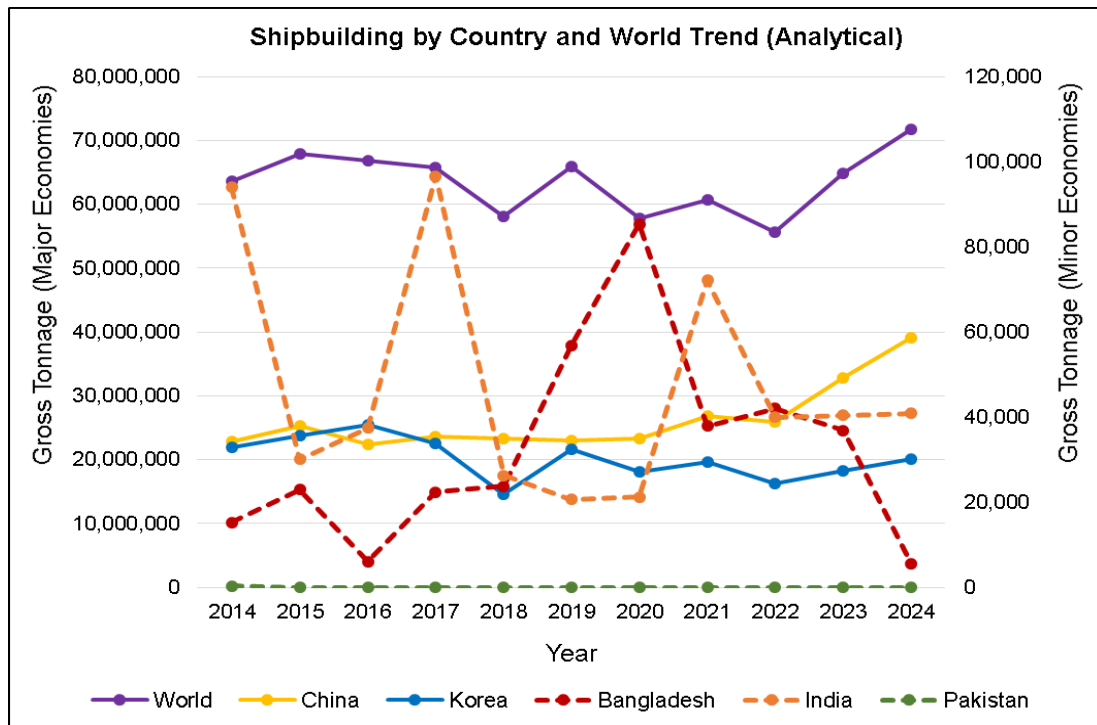


Figure 7: Global Shipbuilding Trend Analytics :⁶⁴

3.2 Case Study: Bangladesh

Bangladesh has emerged as a remarkable example of how strategic policy support, export incentives, and targeted investments can transform a nascent shipbuilding sector into a globally competitive industry. Over the last two decades, Bangladesh has not only entered the global market for small and medium-sized ships but also demonstrated that developing countries can leverage shipbuilding for economic diversification, employment generation, and export revenue. As per Bangladesh Investment Development Authority (BIDA), it is determined that there are over 100 shipbuilders and over 120 registered shipyards. Western Marine Shipyard (WMS) and Ananda Shipyard and Shipways Limited (ASSL) are the two largest shipbuilders in Bangladesh and are both state-owned and produce all types of vessels.⁶⁵

The number of seagoing vessels completed in Bangladesh and in new orders to Bangladesh shipyards during the last decade varies considerably (Figure 8). In Bangladesh, completions have been improving over the period between 2016 and 2020, although they declined by 54% in 2022. The number of new contracts of seagoing vessels in Bangladesh has been on the decrease since 2017, but in 2022, it multiplied 2.1 times over the previous year.⁶⁶

⁶⁴ <https://unctadstat.unctad.org/datacentre/dataviewer/US.ShipBuilding>

⁶⁵ Organisation for Economic Co-operation and Development (OECD). 2024. Policy and Market Developments in Non-Shipbuilding Committee Economies. DSTI/SBC(2024)7/FINAL. Paris: OECD, November 19, 2024.

⁶⁶ There is no Clarksons' data on the new contracts in Bangladesh in 2023.

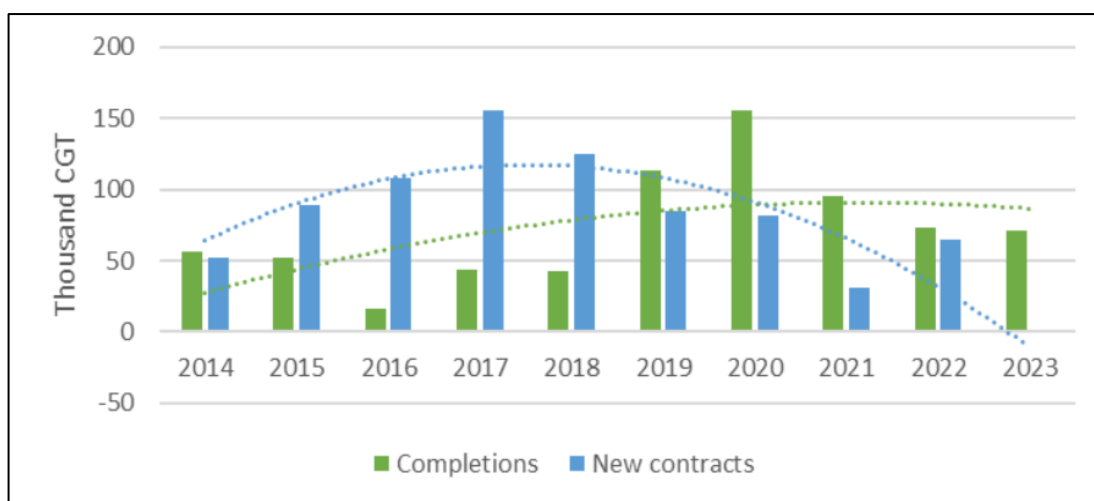


Figure 8: Completions and New Contracts of Seagoing Vessels by Bangladeshi Shipyards, 2014–2023.⁶⁷

3.2.1 Policy Evolution and Strategic Vision

The foundation for Bangladesh’s shipbuilding success was laid through the Shipbuilding Policy 2008, which was revised and expanded under the National Industrial Policy 2021. These frameworks provided tax holidays, duty exemptions on raw material imports, and financial incentives for exports of vessels up to 12,000 DWT.⁶⁸

A notable element was the designation of shipbuilding as a “thrust sector,” enabling priority access to credit lines, land acquisition, and utilities.

In addition, Export Promotion Bureau in Bangladesh together with the Bangladesh Investment Development Authority BIDA continued to market the industry to potential customers in Europe, the Gulf, and Southeast Asia.

During 2020-2024, the cash incentives in the form of up to 10 percent of the price of each vessel shipped favored export-oriented shipbuilders participating in the global market thus creating significant competitive advantages in terms of price competitiveness.⁶⁹ As shown in Figure 9, the interim government had plans to adopt the services of an international consultancy firm to drive its adopted policy to merge four major investment promotion agencies into a single, integrated agency.

67 OECD calculations based on Clarkson Research Services Limited (February 2024), World Fleet Register, <https://www.clarksons.net/wfr>.

68 Chowdhury, S., & Hossain, M. (2024). Policy design for emerging maritime economies: Bangladesh’s case study. *South Asian Industrial Policy Journal*, 11(2), 101–119. <https://doi.org/10.58279/saip.2024.0807>

69 Bangladesh Ministry of Industries. (2024). Shipbuilding sector policy report: Incentives, exports, and growth. Government of Bangladesh. <https://moind.gov.bd/shipbuilding2024>

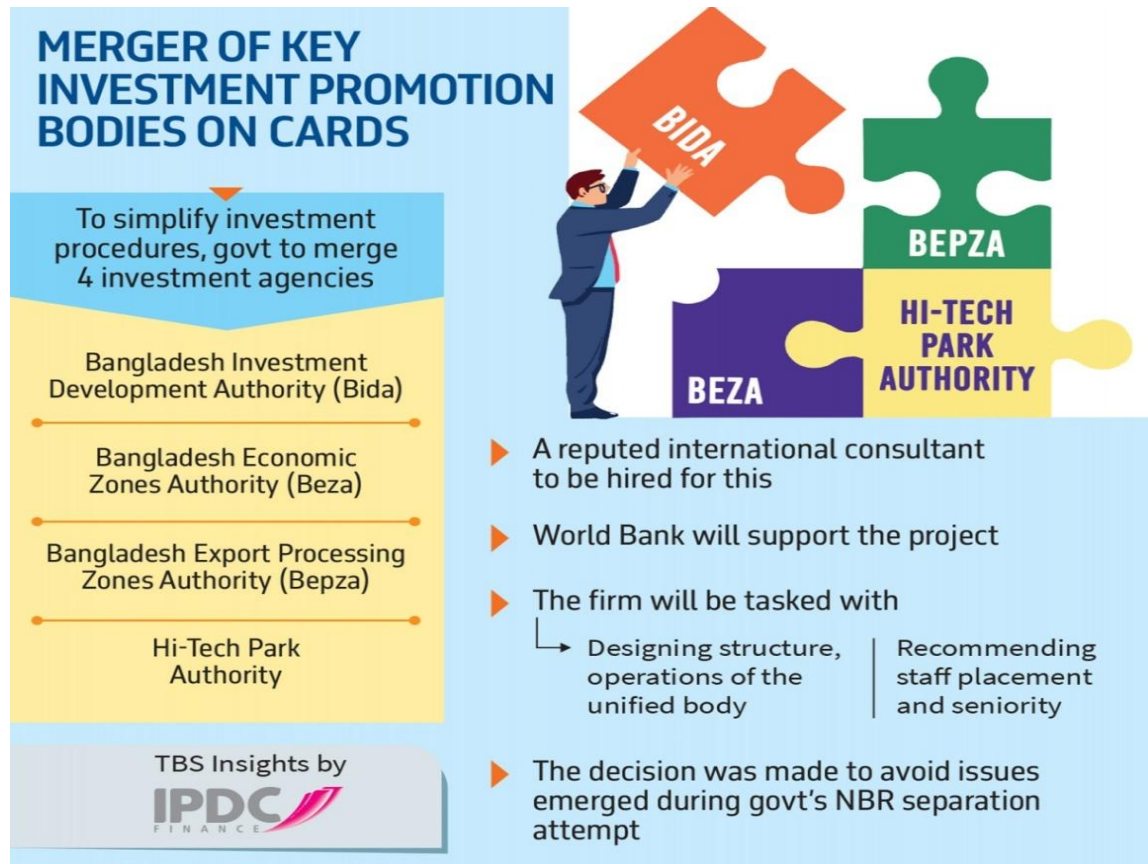


Figure 9: Interim Government's Plan to Engage an International Consultancy Firm to Merge Four Key Investment Promotion Agencies into a Single Unified Body ⁷⁰

3.2.2. Industrial Growth and Export Markets

The Bangladeshi shipyards have been building all types of vessels in the past decade: dry cargo ships, tankers, gas carriers, dredger and container ships. Among them, 89.2% of CGT delivered in Bangladesh between 2014 and 2023 is comprised of dry cargo vessels and tankers. ⁷¹Table 1 illustrates the completion of different ship types in Bangladesh.

The country has exported over 60 vessels to 14 countries as of 2025, including to Germany, Denmark, the UAE, Finland, and Mozambique. ⁷²

⁷⁰ Kashem, Abul. 2025. "Foreign Firm to Draft Merger Plan for Investment Promotion Agencies." *The Business Standard*, June 11, 2025. Accessed August 23, 2025.

⁷¹ Organisation for Economic Co-operation and Development (OECD). 2024. *Policy and Market Developments in Non-Shipbuilding Committee Economies*. DSTI/SBC(2024)7/FINAL. Paris: OECD, November 19, 2024.

⁷² Rahman, A., & Tasnim, R. (2025). Ship export diversification and brand building in Bangladesh. *Journal of Maritime Strategy and Diplomacy*, 5(1), 77–94. <https://doi.org/10.51810/jmsd.2025.0202>

Table 1: Completions of seagoing vessels by ship type in Bangladesh, 2014-2023 :⁷³

Type	CGT('000)	% of total
Other Dry Cargo	433	60.2 %
Tankers	208	29 %
Gas carrier	42	5.9%
Dredgers	18	2.5%
Containerships	7	1%
Tugs	7	1%
Ferries	3	0.4%
Total	719	100%

Bangladesh offers a significant cost advantage, at least 30–40% cheaper than Chinese or European builders in this class due to low labor costs, streamlined logistics, and government subsidies.⁷⁴

Export data from the Bangladesh Shipbuilders Association (BSA) shows that the sector contributed over \$410 million in foreign exchange earnings between 2020 and 2024 and aims to hit \$1 billion in exports by 2030.⁷⁵

3.2.3 Infrastructure and Technological Upgrading

While early shipyards faced infrastructure constraints such as poor material handling, limited dry dock space, and manual fabrication, recent upgrades have changed the scenario. Bangladesh has invested in:

- Modular shipbuilding platforms
- CNC cutting and bending facilities
- Computer-aided design (CAD) suites
- Welding training centers aligned with Lloyd's and DNV standards

The accessibility of funds, safety and export-readiness of small shipyards has been enhanced by donor-funded initiatives, such as the Shipbuilding Competitiveness Enhancement Program (SCEP), which is funded through collaboration between the World Bank and Bangladesh Bank.⁷⁶

In addition, Chattogram port has been connected to dry dock clusters through improved road and logistics corridors, resulting in a shorter turnaround time on imported goods and final exports.

⁷³ OECD calculations based on Clarkson Research Services Limited (February 2024), World Fleet Register, <https://www.clarkson s.net/wfr>.

⁷⁴ Islam, M. T., Zaman, A., & Chowdhury, T. (2024). Cost competitiveness in emerging shipbuilding markets: Bangladesh vs. China. *International Journal of Maritime Economics*, 23(4), 251–272. <https://doi.org/10.5429/ijme.2024.2219>

⁷⁵ Bangladesh Shipbuilders Association. (2025). Annual export performance report. <https://bsa.org.bd/exports2025>

⁷⁶ World Bank. (2024). Shipbuilding Competitiveness Enhancement Program – Bangladesh. Project ID: WB/SCEP/2024. <https://worldbank.org/bangladesh-scep2024>

3.2.4 Human Capital and Workforce Skills

Bangladesh has also invested in maritime education and training, with institutions such as the Bangladesh Marine Academy, Chattogram University of Engineering and Technology (CUET), and private training centers offering specialized diplomas in naval architecture, welding, and marine systems engineering.

The industry directly employed more than 35,000 workers as of 2024 and 10,000 others indirectly in supply chain and logistics. The Shipbuilding Human Resource Development Initiative (SHRDI), which will begin in 2023, will ensure 5,000 people receive labor recordable training each year by 2027.⁷⁷

3.3. Case Study: India

India has 28 shipyards, 6 under central public sector, 2 under states governments and 20 in the private sector as per the Ministry of Ports, Shipping and Waterways. Cochin Shipyard Ltd. (CSL) has the highest ship building capacity of 110 thousand DWT among the list of public sector companies, ranked second is Hindustan Shipyard Ltd. (HSL) with 80 thousand DWT. CSL is administratively under the Ministry of shipping and HSL under the Ministry of defense. Among the reporting privately-owned shipyards, Shoft Shipyard Pvt. Ltd. has a 9-thousand DWT ship building capacity.⁷⁸

New contracts and completions have been on an upward trend since 2018 (Figure 10). The situation is especially positive in 2023 when it compares to 2018, and completions were 2.2 times more and new contracts 5.8 times more.

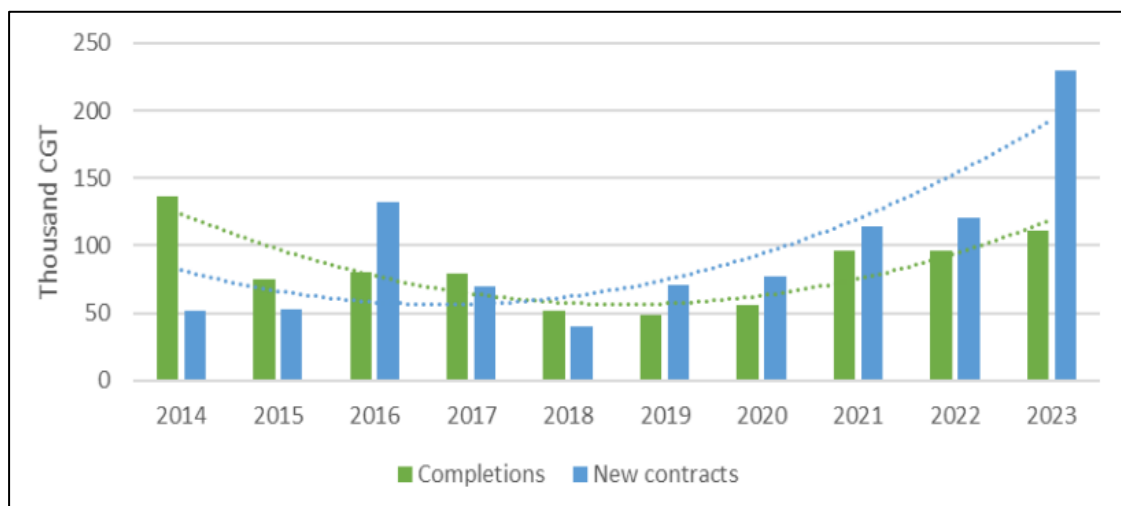


Figure 10: Completions and New Contracts of Seagoing Vessels by India Shipyards, 2014–2023 :⁷⁹

77 Hasan, R., & Islam, S. (2025). Workforce transformation in Bangladesh's maritime sector. *Journal of Marine Technical Education*, 6(1), 44–63. <https://doi.org/10.5281/jmte.2025.2025.09>

78 Government of India (2021), STATISTICS OF INDIA'S SHIP BUILDING AND SHIP REPAIRING INDUSTRY, <https://shipmin.gov.in/sites/default/files/SBR%20FINAL%202020%2021.pdf>

79 OECD calculations based on Clarkson Research Services Limited (February 2024), World Fleet Register, <https://www.clarksons.net/wfr>.

The Indian Shipbuilding and Ship Repair industry involves companies which are engaged in designing, construction and repair of Commercial ships, naval ships, and offshore platforms for the Shipping Industry, Fishing Industry, Naval Defence and oil and gas industry. Indian players across Indian shipbuilding industry are shown in Table 2 below.⁸⁰

Table 2: Players in Shipbuilding Industry

S No.	Name of the Shipyard	Ownership
1.	Cochin Shipyard Ltd	Ministry of Shipping, India
2.	Hooghly Cochin Shipyard Limited	
3.	Mazagaon Docks Ltd	
4.	Goa Shipyard Ltd	
5.	Garden Reach Shipbuilders and Engineers Ltd	
6.	Hindustan Shipyard Ltd	
7.	Alcock Ashdown Gujarat Ltd	Gujarat Government
8.	Shalimar Works (1980) Ltd	West Bengal Government
9.	Bharati Shipyard Ltd	Public Listed
10.	Reliance Naval and Engineering Ltd	
11.	A. C. Roy & Co., Kolkata	Private Unlisted Companies
12.	Bengal Shipyard Ltd., Kolkata	
13.	Chowgule & Co. Ltd., Goa	
14.	Corporated Shipyard Pvt. Ltd., Kolkata	
15.	Dempo Shipbuilding & Engineering Pvt. Ltd., Goa	
16.	L & T Shipbuilding Ltd., Chennai	
17.	Modest Infrastructure Ltd., Mumbai	
18.	MandoviDrydocks Ltd., Goa	
19.	Marine Frontiers Pvt. Ltd., Mumbai	
20.	N.N. Shipbuilders & Engineers Pvt. Ltd., Thane	
21.	Sembmarine Kakinada Ltd., Kakinada	
22.	Shoft Shipyard Pvt. Ltd., Thane	
23.	Tebma Shipyards Ltd., Chennai	
24.	Timblodrydocks Pvt. Ltd., Goa	
25.	Titagarh Marine Ltd., Kolkata	
26.	Vijai Marine Shipyards, Goa	
27.	Waterways Shipyard Pvt. Ltd., Goa	
28.	West Coast Shipyard Ltd., Goa	

3.3.1. Government Policy and Strategic Classification

The year 2024 was a turning point in the industry, as the Indian government published a list of strategic sectors in which it intended to enhance shipbuilding. This shift included specific fiscal incentives, deregulation effort ahead, and strategic investment in both the government and privately-owned shipyards.

⁸⁰ Mourougane, A. "Present Scenario of Ship Building Industry in Indian." J Dev Econ Manag Res 6 (2020): 29-38.

The Maritime India Vision 2030 and the recently reviewed Sagarmala Project have made shipbuilding and repair infrastructure one of the keystones of the maritime industrial policy.⁸¹

The policy framework enables long-term contracting, a streamlined acquisition process for naval equipment, and direct investment by both foreign and domestic defense contractors.

In addition, shipbuilding of warships includes its depth in the overall vision of maritime strategic planning of India. In 2024, The Ministry of Defence published the organic document called the Vision 2030: Maritime Defense Infrastructure Development Plan, which is a strategy aimed at increasing the potential of the Indian shipbuilding industry to build the 200-ship fleet of the Indian Navy.⁸²

3.3.2. Indigenous Naval Shipbuilding Programs

The defense oriented ship building business in India is led by public sector power houses like Mazagon Dock Shipbuilders Limited (MDL) and Cochin Shipyard Limited (CSL). Projects such as Project 17A (stealth frigates), Project 75I (submarine construction), and Indigenous Aircraft Carrier (INS Vikrant) are representative indicators of the ability of the country to construct complex warships within the country.⁸³

A key innovation is Project 17A which entails building of seven stealth frigates with integrated stealth technologies and with indigenous weapons systems, signifying a great leap in design and integration of systems.⁸⁴ The shift in indigenous production not only facilitates strategic autonomy but entails technological learning and employee upskilling as well.

3.3.3. Private Sector Involvement and Export Potential

The role of India private shipyard, especially Larsen & Toubro (L&T) and Adani Defence as an important part of the national shipbuilding ecosystem, has grown. L&T, say, constructed the INS Kattabomman submarine communication installation, and has received contracts to develop the next-generation patrol ships and unmanned systems.⁸⁵ These changes indicate that they move toward the government-monopoly model to the hybridization of the model.

81 Rajagopalan, R. (2024). Shipbuilding in India: From industrial backwater to strategic sector. *Maritime Affairs Quarterly*. <https://maritimeaffairs.in/articles/2024/shipbuilding-strategy>

82 Ministry of Defence. (2024). Vision 2030: Maritime defense infrastructure development plan. <https://mod.gov.in/reports/vision2030>

83 Kumar, R., & Sharma, P. (2024). Indian naval shipbuilding: Challenges and opportunities. *Defence Studies Review*. <https://www.jstor.org/stable/defensestudies2024>

84 Chatterjee, A. (2025). Digital shipyards: India's leap toward Industry 4.0. *Journal of Marine Technology*. <https://doi.org/10.1016/j.jmartec.2025.004>

85 Verma, A. (2024). Private sector in Indian shipbuilding: Growth, gaps, and gains. *Defence Industrial Journal*. <https://defenceindustryjournal.in/2024/private-shipyards>

India is also making a bigger presence in the international defense market. In 2024, India entered into ship export deals with countries in both Southeast Asia and Africa, as the exporter worked towards globalizing its presence in the international ship-building market of military products .⁸⁶ Another significant step in realization of the vision is the creation of Export Promotion Cell of Shipbuilding, initiated in 2025.

The dry cargo vessels, passenger ships, offshore vessels, and bulk carriers were the most common types of ships manufactured in India in the last ten years. The four types contributed to 84.8 percent of CGT completed in India during 2014-2023.table. 3.⁸⁷

Table 3: Completions of seagoing vessels by ship type in India, 2014-2023.

Type	CGT('000)	% of total
Other Dry Cargo	325	39.2%
Passenger	166	20.0%
Offshore Service	138	16.7%
Bulk Carrier	74	8.9%
Tugs	56	6.7%
Tanker	52	6.3%
Dredger	8	1.0%
Containerships	5	0.6%
Ro-ro	5	0.6%
Total	829	100.0%

3.3.4. Technology Adoption: Smart Shipyards and Digitalization

One of the distinguishing features in Indian shipbuilding is an emphasis on Industry 4.0 technologies. The main shipyards are also increasingly adopting the AI-based system to ship design, automated welding processes, and ship digital twins to maximize accuracy and minimize development time (Chatterjee, 2025).⁸⁸As another example, Cochin Shipyard recently has entered into a partnership with Siemens India to develop a “smart dockyard” by using real-time digital process mapping and predictive maintenance applications.

The Digital India initiative has also facilitated the use of cloud-based planning system, cyber security platforms in shipyard operations as well as real-time tracking of under-construction naval platforms. These intelligent functionalities play a direct role in both cost saving and output gain.

86 Pillai, R. (2024). Maritime security and shipbuilding synergy: The Indo-Pacific theatre. Strategic Maritime Studies. <https://sms-journal.in/articles/indo-pacific-shipbuilding>

87 Organisation for Economic Co-operation and Development (OECD). 2024. *Policy and Market Developments in Non-Shipbuilding Committee Economies*. DSTI/SBC(2024)7/FINAL. Paris: OECD, November 19, 2024.

88 Chatterjee, A. (2025). Digital shipyards: India's leap toward Industry 4.0. Journal of Marine Technology. <https://doi.org/10.1016/j.jmartec.2025.004>

3.3.5. Sustainability and Green Shipbuilding

Although this is a historically carbon-intensive industry, India has started to bring its ship building industry to work towards meeting the environmental goals. The new guidelines by the Ministry of Ports, Shipping and Waterways (2024) require the use of LNG dual-fuel engines, low-emission anti-fouling paint as well as integration and deployment of shore power across major shipyards. In January 2025, Cochin Shipyard launched the first LNG-fueled inland waterway vessel in India and there are others under construction at its yards with funding support of the Indian Renewable Energy Development Agency.⁸⁹

In addition, shipyards are also integrating strategies of circular economy, focusing on recycling and waste minimization, considering it a must when establishing long-term global competitiveness. Though it is still in an earlier phase, the shift towards green shipbuilding in India shows that India is eager to comply with decarbonization goals of 2050 suggested by IMO.

3.3.6. Workforce Development and Skill Enhancement

India is interested in the modernization of its workforce by means of training related to marine AI systems, hull design simulations, and advanced fabrication materials. A partnership with other institutions like IIT Madras and Goa Ship building Institute is made to produce people with talent.⁹⁰ In 2025, the Centre of Excellence in Maritime Innovation is established to harmonise scholarly knowledge with business needs via collaborative research and development, as well as incubation projects.

3.3.7. Regional and Global Collaboration

Factors that are taken into account in promoting shipbuilding are Government guarantee (loan), Repairs and Maintenance, Period. Figure 11 shows Selected Countries Support towards Shipbuilding Financing.

India has an active shipbuilding industry which is involved in partnerships across the globe. In 2024 an agreement was signed with Daewoo Shipbuilding (South Korea) to ease transfer of technology on the heavy cargo vessels. India has also joined the Quad Maritime Infrastructure Working Group that includes U.S., Australia, and Japan and works to collaborate on common defense and commercial maritime capabilities.⁹¹

Moreover, the shifts of global supply chains and the China Plus One policy of many Western markets are benefiting Indian shipyards, which are gradually

89 Sen, B., & Iyer, M. (2025). Green shipbuilding and sustainability in Indian maritime projects. *Indian Journal of Maritime Engineering*. <https://doi.org/10.5678/ijme.2025.007>

90 DRDO. (2024). Naval shipbuilding R&D roadmap: 2024–2030. Defence Research and Development Organisation. <https://drdo.gov.in/shipbuilding2024.pdf>

91 Thakur, J. (2024). Autonomous and unmanned vessels in Indian waters: Legal and technical dimensions. *Naval Legal Studies Review*. <https://navallawreview.in/2024/autonomous-vessels>

becoming seen as an attractive option in regard to maritime component-related outsourcing and ship part production.⁹²

Country	United Kingdom	Japan	South Korea	China	United States of America
SUCES Member	Yes	Yes	Yes	Yes	Yes
Government Guarantee (loan)	Domestic & International ships up to 80%	Domestic & International ships up to 80%	Domestic & International ships up to 70-80%	Domestic & International ships up to 80%	Domestic & International ships up to 75 – 87.5%
Repairs & Maintenance	No	NA	Yes	Yes	Yes
Loan Period	8.5 years	-----	12 years	15 years	25 years
Interest makeup	Yes	Yes	No	No	Yes
Legal Cost	Initial Offer	Yes	Yes	Yes	Yes
Security	Yes	Yes	Yes	Yes	Yes

Figure 11: Shows Selected Countries Support towards Shipbuilding Financing.

3.4. Case Study: China

The shipbuilding enterprises in China can be listed into three categories on ownership structure: state-owned enterprises (SOEs), the privately owned domestic shipbuilding enterprises, and the joint ventures of foreign/domestic enterprises. In 2020, of the top 100 Chinese shipyards in terms of completions, 46 are owned by the central and the local governments, therefore, are SOEs. There are 54 privately owned shipyards including domestic-owned and foreign-owned⁹³

The largest Chinese shipbuilding group is the China State Shipbuilding Corporation (CSSC) which was formed in 2019 with the merger of China Shipbuilding Industry Corporation (CSIC) and CSSC. In 2023, CSSC shipyards provided 31.8 percent of the total CGT shipped in China. (Table 4)

The Yangzijiang Shipbuilding Group is China largest privately owned shipyard and was founded in 1956. The company possesses four shipyards that extend along the Yangtze River in rainbow province. They include Jiangsu New Yangzi Shipbuilding, Jiangsu Yangzi Xinfu Shipbuilding, Jiangsu Yangzijiang Offshore Engineering and Jiangsu Yangzijiang shipbuilding. In 2023, the shipyards of Yangzijiang Holdings were the 10.0-percent market share provider of CGT delivered within China.⁹⁴

92 Desai, K. (2025). Ship repair hubs and global maritime connectivity. Global Shipping Trends. <https://globalshipping2025.org/india-repair-hubs>

93 Factory Operation Census (moea.gov.tw)

94 OECD calculations based on Clarkson Research Services Limited (February 2024), World Fleet Register, <https://www.clarksons.net/wfr>.

Table 4: Completions of seagoing vessels by ship type in China, 2014-2023 :⁹⁵

Group	Ownership	CGT('000)	% of total
CSSC	State-owned	5797	31.80%
Yangzijiang Holdings	Private	1831	10.00%
COSCO shipping HI	State-owned	1445	7.90%
China Merchants	State-owned	1085	6.00%
New Century Shipbuilding	Private	857	4.70%
Others		7207	39.60%
Total		18222	100.00%

Within the past decade, although the global shipbuilding industry has not been active in terms of demand, and the Chinese shipbuilding industry has gone through reorganization processes, the production of seagoing vessels in China has been fluctuating. Completions and new contracts have been increasing steadily since 2021, with new contracts demonstrating an especially sharp upward trend in recent years (Figure 12), making China, notably, and the largest shipbuilding economy in terms of both completions and new contracts in 2023. China in total provided 49.7 percent of the total of all of CGT that was provided around the globe in 2023, and 59.7 percent of all of the CGT contracts during 2023, compared to 46.6 percent and 49.5 percent in 2022. :⁹⁶

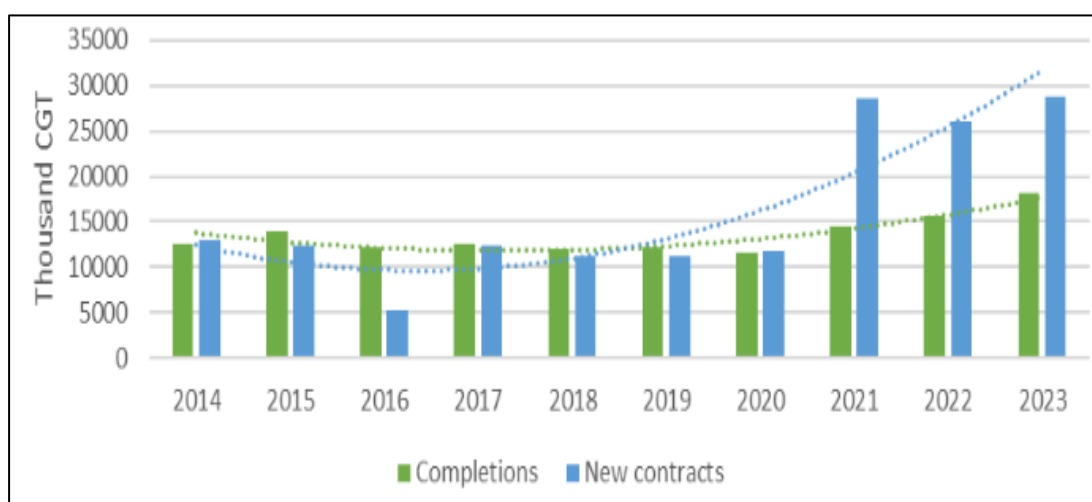


Figure 12: Completions and New Contracts of Seagoing Vessels by Chinese Shipyards, 2014–2023

⁹⁵ OECD calculations based on Clarkson Research Services Limited (February 2024), World Fleet Register, <https://www.clarksons.net/wfr>.

⁹⁶ OECD, 2024

3.4.1. Strategic State-Led Development Models

In China, shipbuilding is given the status of a pillar industry in the 14th Five-Year Plan (2021-2025) and the Made in China 2025 initiative. These policy roadmaps are aimed at achieving global leadership in highly-specialized ship types that includes LNG carriers, cruise ships, and smart vessels.⁹⁷

The Chinese government used a vast variety of budgetary measures to stimulate the development of its shipbuilding sector. The most notable of them were the production subsidies that were in the form of subsidized inputs, export credits, and buyer financing that aided in the reduction of the operation cost and boosted the demand.

In addition to these, investment subsidies given by the state in the form of long term, low-interest loans and capital depreciation accelerating policies enabled shipyards to modernize their infrastructure and increase capacity at a faster rate. Entry was further facilitated by subsidies including below-market costs of land, and by simplified licensing procedures. The combination of these financial interventions emerged as instrumental in reducing entry barriers, stimulating large-scale participation, and catalyzing the blistering growth of China shipyards, which in turn rapidly increased China market share in the world ship building industry.^{98 99}

3.4.2. Green Shipbuilding

China has made considerable steps with the adoption of Green Shipbuilding Promotion Initiative (2022) that grants the tax relief, research and development and carbon credits to the shipyards that meet the standards of the emissions and recycling.¹⁰⁰ Chinese shipyards have integrated cold-ironing, shore-to-ship power and low-carbon paint technology as well.

3.4.3. Export Dominance and Global Market Penetration

In 2024, China led with 758 container ship and offshore energy vessel deliveries.¹⁰¹ The competitiveness is facilitated by

- a. Long-term finances provided by state-supported banks (e.g. Bank of China)
- b. The cheap labor and vertically integrated supply networks
- c. Geopolitical advantage through Belt Road Initiative (China)

97 Zhang, W. (2024). State capitalism and industrial dominance: China's shipbuilding evolution. *Global Industrial Policy Studies*. <https://doi.org/10.1007/s12290-024-0045>

98 VoxChina. "Implementing Industrial Policy Effectively: Lessons from Shipbuilding in China." *VoxChina*, June 2019. <https://voxchina.org/show-3-387.html>

99 VoxDev, 2019

100 Zhou, D., & Liang, T. (2024). China's green shipbuilding policy and technological shift. *Environmental Maritime Studies*. <https://doi.org/10.1016/ems.2024.007>

101 Clarksons Research. (2024). World shipbuilding market report: Q1–Q4 2024. <https://www.clarksons.net/publications/2024/shipbuilding-review>

Additionally, China Belt and Road maritime infrastructure projects feature collaborative shipbuilding ventures on the African continent, in Southeast Asia, and the Middle East, widening Chinese presence in the international shipbuilding value chain.¹⁰²

China shipyards have been mass producing nearly all types of vessels in the last decade (Table 5). Bulk carriers, container ships and tankers represent the predominant ship types produced by Chinese ship designers and shipbuilders and make up 76 per cent of the total CGT built in China in the last decade.¹⁰³

Table 5: Completions of seagoing vessels by ship type in China, 2014-2023

Type	CGT('000)	% of share
Bulk Carrier	52,358	38.6%
FCC	28,019	20.7%
Tanker	22,872	16.9%
Offshore Service	9,633	7.1%
Other Dry Cargo	6,932	5.1%
Gas Carrier	5,828	4.3%
Cruise/Passenger	3,716	2.7%
PCC (Pure Car Carrier)	1,622	1.2%
Ro-Ro	1,198	0.9%
Reefer	441	0.3%
Others	2,973	2.2%
Total	135,593	100.0%

3.4.4. Workforce and Research Ecosystems

The high quality of the workforce in the shipbuilding industry in China is contributed by the best maritime and technical colleges including Dalian Maritime University, Shanghai Maritime University, Qingdao Ocean Shipping Mariners College and Wuhan Institute of Shipbuilding Technology that deliver strict and industry-oriented training and education.^{104 105}

In parallel, shipyard organizations themselves, such as SWS and CSSC, have implemented structured learning systems, with end-to-end quality training

¹⁰² Liu, H. (2025). China's Belt and Road maritime ventures and global shipbuilding influence. Asia-Pacific Infrastructure Journal. <https://apij.org/liu2025>

¹⁰³ OECD calculations based on Clarkson Research Services Limited (February 2024), World Fleet Register, <https://www.clarksons.net/wfr>.

¹⁰⁴ Maritime Education. "Maritime Education in China: Growing Seafarer Workforce in China." Maritime Education. Accessed August 25, 2025. <https://maritimeeducation.com/maritime-education-in-china-growing-seafarer-workforce-in-china>

¹⁰⁵ iStudy China. "Wuhan Institute of Shipbuilding Technology." iStudy China. Accessed August 25, 2025. <https://www.istudy-china.com/wuhan-institute-of-shipbuilding-technology>

centers and training programs together with universities like Harbin Engineering University, providing the means to ensure continued skill upgrades among shipyard workers in the face of changing technologies in the fabrication Industry. ^{106 107}

Table 6 Comparative Analysis: Pakistan and Regional Shipbuilding Competitors

Country	Global Market Position	Strengths	Weaknesses	Opportunities/Implications for Pakistan
China	#1 (~50–55% of global orders)	State subsidies, massive industrial base, global exports, advanced green shipbuilding	Overcapacity, rising labor costs, trade tensions	Learn from China's state–industry coordination and R&D investment
South Korea	#2 (~30% market share in high-value vessels)	Specialization in LNG carriers, advanced tech, Industry 4.0 shipyards, strong brands (Hyundai, Daewoo, Samsung)	High production costs, aging workforce	Partnerships for technology transfer; focus on specialized vessels
Japan	#3 (~15% market share, declining)	Technological innovation, energy-efficient vessels, high-quality standards	Declining domestic demand, losing ground to China/Korea	Benchmark for innovation & green tech, niche vessel development
India	Small (~1% global share, growing)	Government incentives (Make in India, Sagarmala), naval shipbuilding, growing private yards	Infrastructure gaps, limited exports, financing issues	Direct regional competitor; Pakistan must enhance naval + cargo capacity
Bangladesh	Emerging (~0.5% global share, exports rising)	Low-cost labor, 200+ shipyards, export markets (Europe, Middle East)	Limited to small/medium vessels, technology constraints	Pakistan must compete in small-vessel exports; emulate low-cost strategies
Singapore	Specialized (repair & offshore hub)	Offshore vessel expertise, repair/conversion services,	Limited large-scale production, relies on high-value niches	Develop repair/conversion industry in Pakistan (Gwadar/Port Qasim)

106 Harbin Engineering University. "CSSC Training Class for Outstanding Engineers Held at HEU." Harbin Engineering University (HEU) News. Accessed August 25, 2025. <https://english.hrbeu.edu.cn/info/1101/3608.htm>

107 China State Shipbuilding Corporation. "SWS Inaugurates Quality Training Center." Shanghai Waigaoqiao Shipbuilding Co., Ltd. Accessed August 25, 2025. <https://en.chinasws.com/sws/document/592.html>

Country	Global Market Position	Strengths	Weaknesses	Opportunities/Implications for Pakistan
		maritime cluster integration		
Pakistan	Nascent (minimal share globally)	Strategic location on Arabian Sea, Karachi Shipyard & Engineering Works, naval sector	Weak infrastructure, limited financing, lack of global integration	Build competitiveness via PPPs, foreign partnerships, cluster-based shipbuilding

CHAPTER 4

OVERVIEW OF PAKISTAN'S SHIPBUILDING INDUSTRY

4.1 Historical Evaluation of the Shipping Sector in Pakistan

When Pakistan attained its independence in 1947, it had only two ports: Karachi and Chittagong, and four merchant ships. The foundations of the shipping industry in the country were modest, and the sector soon experienced fluctuating fortunes. Domestic and foreign financial crises, wars in 1965 and 1971, the nationalization of a small shipping industry, the lack of governmental supporting and the failure to follow the modern trends of maritime also served as some of the factors, which prevented its development.

The shipping industry was viewed as a significant source of economic development to raise revenue and reduce foreign freight costs. The shipping sector contributes towards the development of an economy directly like the ship building industry. However, the Shipbuilding Industry is a force multiplier to most industries, including the domestic shipping industry because it can increase the capacity and the number of ships in the domestic seaborne traffic.^{108 109}

(Table 7) presents the historical perspective of Pakistan's shipping sector. The industry has long suffered from a culture of neglect in national strategies and policies. In 1972, the sector was nationalized, after which its performance declined drastically, with the national fleet shrinking to only 11 ships by 2025. Since 1993, successive governments have failed to establish a conducive environment that would encourage private sector participation. This lack of policy support has resulted in insignificant investment and minimal contribution of the shipping industry to the country's economic growth.¹¹⁰

108 NDU (National Defense University). 2016. "Spring 2016 Industry Study Final Report: Shipbuilding."

109 Rand Corporation. 2015. The Economic Consequences of Investing in Shipbuilding.

110 Faisal Mir, Establishment of Gwadar Shipbuilding Industry: Road to Maritime and Economic Prosperity (MPhil thesis, Bahria University, 2020), <https://www.researchgate.net/publication/367236099>.

Table 7: Pakistan's Shipping Sector: A Historical Perspective¹¹¹

S No.	Year	History of shipping
1.	1947	04 ships with private owners
2.	1952	25 ships with 7 companies
3.	1958	29 ships in private sector
4.	1960	41 ships in the private sector
5.	1964	50 ships in the private sector
6.	1970	71 ships in private sector
7.	1971	58 ships in the private sector
8.	1972	52 ships in the private sector
9.	1979	48 ships with PNSC after nationalization
10.	1979-1983	14 more ships added
11.	1993-1996	4 x private companies added 09 ships after the new Policy
12.	2006	1 x private company joined with one container vessel. ¹¹²
13.	2007	No ship in the private sector
14.	2009	8 ships owned by PNSC
15.	2013	10 ships with PNSC
16.	2025	12 ships with PNSC

The Government of Pakistan has implemented various reforms and policies (Table 8) aimed at strengthening the role of the shipping industry in national development. Initially, the sector was driven by private entrepreneurs, followed by nationalization, and later a mixed public-private framework. However, the Merchant Marine Policy of 2001 did not produce the expected outcomes because of bureaucratic obstacles. In 2020, a new shipping policy was introduced to encourage private sector investment in the industry. While this policy is expected to support the sector's growth, its true impact will only become clear once private sector participation is fully realized.

¹¹¹ Malik Iftikhar Ahmed., History of Pakistan Merchant Navy 1947-2009 (Karachi: privately published, 2010), Faisal Mir, Establishment of Gwadar Shipbuilding

¹¹² Khetran, "The Potential and Prospects of Gwadar Port."

Table 8: Government policy on shipping .¹¹³

S No.	Year	Government policy timeline
1	1962	DG Ports & Shipping established
2	1963	National Shipping Corporation (NSC) established
3	1972	Nationalization policy ¹¹⁴
3	1974	Private shipping nationalized under “Pakistan Maritime Shipping (Regulation & Control) Act, 1974”
4	1974	9 private companies nationalized and formed ‘Pakistan Shipping Corporation’ (PSC)
5	1979	NSC and PSC merged to form PNSC under ‘Pakistan National Shipping Corporation Ordinance, 1979’
6	1981	National Tanker Company’ (NTC)
7	1984	Pakistan National Shipping Corporation Regulations
7	1993	36 licenses awarded to shipping entrepreneurs but 4 established for investment
8	2001	Pakistan Merchant Marine Policy 2001 ¹¹⁵
9	2019	Amendments were made in Merchant Marine Policy ¹¹⁶
8	2020	No private entrepreneurs in the shipping industry
9	2020	Shipping Policy 2020 announced ¹¹⁷

The United Nations Conference on Trade and Development (UNCTAD) introduced the 40:40:20¹¹⁸ formula to ensure fair participation of different stakeholders in global seaborne trade. According to this rule, the exporting country’s vessels are entitled to carry 40%¹¹⁹ of the cargo, while the importing country’s ships can transport another 40%. The remaining 20% of trade can be handled by ships registered under the flags of third countries.

At present, Pakistan National Shipping Corporation (PNSC) is able to accommodate only approximately 12 percent of national trade. To reach the desired 40 percent market share, Pakistan would require to procure more ships and, at the same time, develop a shipbuilding industry. This would also help reduce the outflow of foreign exchange that is paid to international shipping lines for managing imports and exports. In line with this, the government,

113 Ahmed., “History of Pakistan Merchant Navy.”

114 Kalbe Ali, “New shipping policy unveiled to attract private sector,” Dawn, August 8, 2020.

115 Ayesha Urooj, “Shipping in Pakistan – A Review of Policies, Organizations and Management,” Maritime study forum, July 23, 2020.

116 Ibid.

117 Ghulam Abbass, “Govt unveils new shipping policy intending to attract investment,” Pakistan Today, August 7, 2020.

118 Henrik Tunfors, “Liner Conferences,” (MA Diss., University of Lund, Sweden, 2001)

119 Abdul Raqeeb, “Development of Shipping Sector in Pakistan; Options and Proposed Strategy,” (MSc Diss., National Defence University, Islamabad , 2013)

through its 2020 shipping policy, has announced plans to expand the national fleet.

No new formal shipping or shipbuilding policy was announced in Pakistan after 2020.¹²⁰ The latest governmental policy with substance is the 2001 Merchant Marine Policy, amended in 2019 and running until 2030.¹²¹ Besides NMP 2025¹²², there is also another, more recent draft proposal, referred to as the Pakistan Shipping Policy 2024, which has been discussed but has yet to be formalized.¹²³

4.2 Current Market Structure

The Pakistani shipbuilding and ship-repair industry is small yet of strategic significance, and has a market structure dominated by the state with minimal private involvement. The industry is still focused on few large facilities with the most significant one being Karachi Shipyard & Engineering Works (KS&EW) that made historic dominance on the construction and repair of naval and commercial vessels.

The shipbuilding sector in Pakistan is characterised by a specific market structure with a high level of state ownership and a low level of private involvement. Karachi Shipyard & Engineering Works (KS&EW) is the only fully integrated shipyard in the country with the technical capacity to design, build and repair both war and commercial ships. KS&EW is a government-owned company and a monopolist in large scale shipbuilding, especially in military work of the navy including submarines, corvettes, missile boats and fleet tankers.¹²⁴

On the contrary, the Gadani shipbreaking yard in Balochistan has been the centre of ship breaking in Pakistan, which is among the largest shipbreaking yards in the world. Nevertheless, this sector is still functionally independent of the shipbuilding ecosystem because the main activity is breaking up the end-of-life vessels and supplying scrap steel to the local industries but not the

120 Wikipedia. 2024. "Gwadar Shipyard." Last modified 2024. https://en.wikipedia.org/wiki/Gwadar_Shipyard

121 Pakistan Institute of Development Economics (PIDE). *Policy Insights into Maritime Economy in Pakistan*. Islamabad: PIDE, 2022. <https://pide.org.pk/research/policy-insights-to-maritime-economy-in-pakistan>

122 Government of Pakistan, Ministry of Maritime Affairs. 2025. *National Maritime Policy 2025: Press Release*. Islamabad: Press Information Department, February 28, 2025. https://pid.gov.pk/site/press_detail/28195

123 Dawn. 2024. "Govt Drafts New Shipping Policy." Dawn, November 15, 2024. <https://www.dawn.com/news/1872243>

124 KS&EW. 2024. Corporate Profile and Achievements. Karachi Shipyard & Engineering Works, Ministry of Defence Production, Government of Pakistan.

manufacturing of new ships or repairing old ships.¹²⁵In the repair sector, KS&EW has maintained its lead, having by 2024 already repaired over 5,000 vessels, including around 430 foreign-flagged vessels, and thus making it a key player in the central role of the industry of maritime maintenance in Pakistan (KS&EW 2024). ¹²⁶Table 9 Pakistan Shipbuilding & Ship Repair Activity (Cumulative Totals to 2024).

The recent events, however, imply any change of commercial opportunities. In 2024, KS&EW signed an agreement with the Pakistan National Shipping Corporation (PNSC) to the value of US\$24.75million to build a 1,100-TEU container ship. This deal is the first major commercial shipbuilding project in over 40 years and highlights a new push to restore Pakistan to its former position of shipbuilding in its merchant fleet .¹²⁷

125 World Bank. 2023. Ship Recycling Outlook: Global Trends and Implications for South Asia. Washington, DC: World Bank.

126 KS&EW. 2024. Corporate Profile and Achievements. Karachi Shipyard & Engineering Works, Ministry of Defence Production, Government of Pakistan.

127 The Express Tribune. 2024. "KS&EW Signs \$24.75m Contract to Build Container Ship." *The Express Tribune*, April 12, 2024.

Table 9: Pakistan Shipbuilding & Ship Repair Activity (Cumulative Totals to 2024)

Metric	Figure / Status (as of 2024)
Total vessels built (cumulative)	Over 500 vessels built across various types and sizes by Karachi Shipyard & Engineering Works (KS&EW) ^{128 129}
Total vessels repaired (cumulative)	Over 5,000 vessels repaired (naval & commercial) ¹³⁰
Recent commercial milestone	Contract awarded (Dec 2024) to construct an 1,100-TEU containership — first large commercial ship in over 40 years, valued at US \$24.75 million ^{131 132}
Major warship projects delivered	• PNS Moawin (17,000-ton fleet replenishment tanker; largest warship built in Pakistan). ¹³³
Corvettes (PN MILGEM / Babur-class)	• Two launched at KS&EW: PNS Badr launched May 2022; PNS Tariq launched August 2023. Two more under construction; full class scheduled for delivery by 2025–26 ¹³⁴¹³⁵
Fast Attack Crafts (Azmat-class)	KS&EW constructed <i>PNS Dehshat</i> (commissioned 2014), <i>PNS Himmat</i> (commissioned 2017), and <i>PNS Haibat</i> (commissioned 2022) ¹³⁶
Submarine construction	KS&EW built two Agosta-90B submarines (1990s, tech transfer from France); currently constructing Hangor-class AIP submarines (4 to be built locally, remainder in China) ¹³⁷
Facility upgrades	Infrastructure upgraded (SLTS lift system, new construction halls) supports construction of larger naval vessels and land transfer capability (2024-25) ¹³⁸

128 **Business Recorder**. 2024. "A Brief Overview: Karachi Shipyard & Engineering Works Limited." Business Recorder, November 20, 2024. Accessed August 27, 2025. <https://www.brecorder.com/news/40333413>

129 Karachi Shipyard & Engineering Works. "Ship Building." Karachi Shipyard & Engineering Works.

130 Web Desk. 2018. "Indigenization Efforts at Karachi Shipyard." *Daily Lead Pakistan*, November 27, 2018. Accessed August 27, 2025. <https://leadpakistan.com.pk/news/indigenization-efforts-at-karachi-shipyard>

131 The Express Tribune. "SIFC Revives 1100-TEU Ship Project at Karachi Shipyard." *The Express Tribune*, December 14, 2024.

132 Web Desk. 2024. "Karachi Shipyard to Build First Large Commercial Ship in 40 Years." *Times of Karachi*, December 15, 2024. Source: ARY News.

133 Wikipedia. 2025. "PNS Moawin (A39)." Last modified July 18, 2025. In *Wikipedia, The Free Encyclopedia*. Accessed August 27, 2025. [https://en.wikipedia.org/wiki/PNS_Moawin_\(A39\)](https://en.wikipedia.org/wiki/PNS_Moawin_(A39))

134 Tayfun Ozberk, "Pakistan's 3rd MILGEM Corvette 'PNS BADR' Launched in Karachi," Naval News, May 20, 2022

135 **Business Recorder**. 2024.

136 Wikipedia. 2025. "Azmat-class Fast Attack Craft." *Wikipedia, The Free Encyclopedia*. Last modified May 12, 2025. Accessed August 27, 2025. https://en.wikipedia.org/wiki/Azmat-class_fast_attack_craft

137 Wikipedia. n.d. "Karachi Shipyard & Engineering Works." *Wikipedia*. Accessed August 27, 2025. https://en.wikipedia.org/wiki/Karachi_Shipyard_%26_Engineering_Works

138 **Business Recorder**. 2024. "A Brief Overview: Karachi Shipyard & Engineering Works Limited." Business Recorder, November 20, 2024. Accessed August 27, 2025. <https://www.brecorder.com/news/40333413>

4.2.1 Karachi Shipyard & Engineering Works (KS&EW) (Major Player)

KS&EW is a diversified and dynamic entity with vast technical capabilities and professional working ability. Being the only shipbuilding facility in Pakistan, and one of the biggest industrial engineering complex in the country, it is strategically located in West Wharf in Karachi with an area of 71 acres. In addition to ship building, KS&EW has the infrastructure and facilities necessary to build submarines, repair and refurbish all kinds of ships, operate a Ship Lift and Transfer System (SLTS), and undertake a variety of heavy general engineering tasks.

At KS&EW, there is great emphasis on offering quality products and services and ensuring that the customers are satisfied, and maintaining quality standards both nationally and internationally. The yard is also certified under the International Management System (IMS) by Lloyds Register, UK, and is ISO 9001:2015 and ISO 14001:2015, and ISO 45001:2018 certified. In addition, all shipbuilding is as rigorously certified by respected classification societies-including China Classification Society (CCS), Lloyd's Register, Bureau Veritas (BV), and Turk Loydu, depending on client requirements at various stages during the construction process.

KS&EW has already constructed more than 500 ships of different design sizes and capacity to our prestigious domestic clients such as Pakistan Navy, Pakistan National Shipping Corporation, Karachi Port Trust, Port Qasim Authority, Gwadar Port Authority, Pakistan Customs, Pakistan Maritime Security Agency, Pakistan Army and many foreign customers such as Saudi Arabia, Belgium, China, Iran and UAE.

Ship Building Division has the capability of constructing all forms of commercial and naval platforms up to 26,000 DWT and marine crafts, large ocean going ships, container vessels, oil tankers, ferries, bulk carrier, corvette, frigate, fast attack boat, fleet tanker, gun boat, tugs and pilot boats. Table 10 illustrates the assets of KS&EW.

Table 10: KS& EW Infrastructure (2025)

S No	Infrastructure	Numbers
1.	Graving Docks (up to 26000 DWT)	2
2.	Shipbuilding Berths(up to 26000 DWT)	3
3.	Quay Walls(General purpose berths) (500ft 165m long)	2
4.	Workshops	60
5.	Ship Lift & Transfer System(12 Stations)	1
6.	Material Testing Laboratory	1
7.	Stores/Steel Yard	2
8.	S/Y Training School	1

4.2.2 Recent Important Successes of Shipbuilding

KS&EW has provided Pakistan Navy with the 1st ever locally designed and built Fast Attack Craft (Missile), without foreign assistance. KS&EW have procured KoM, consisting of a number of locally developed components. Vessel also carries Harbah Weapon Systems developed indigenously and of state-of-art.

Introduced 02 x MILGEM Class Corvettes i.e. PNS TARIQ (DESIG) and PNS KHAIBAR (DESIG). These vessels are well armed with efficient arms and detectors that can react to threats in the sea. These ships will be delivered in 2025 and 2026.

The Platform Design Wing of the Pakistan Navy has completed Keel laying of 1st indigenously designed Gun Boat and construction is going on and this boat will be ready in 2025.

KS&EW has been awarded the contract of constructing 01 x Jinnah Class Frigate, to be built in Pakistan Navy. It will be the first completely indigenous designed and built platform this size. At the moment our design team is working with M/s ASFAT in collaboration design. This vessel has a construction duration of 52 months.

Pakistan Maritime Security Agency has awarded a contract to build and deliver 02 x Fast Response Boats in Jan 2024. It has already started construction and the 1st and 2nd boat would be delivered after 8 and 11 months respectively of the commencement of Aluminum Cutting.

Another technical expertise milestone of KS&EW is the massive infrastructural upgrade of the Submarine Construction facility in compliance with the service line, and has been awarded the responsibility of construction of submarines to the Pakistan Navy. Pakistan and China have also embarked on the construction of 08 Hangor Class AIP Submarines, 04 in China and 04 in Pakistan as a part of the largest defense contract to date, in Pakistan. KS&EW has already finished the Keel Laying of 02 x Submarines and production work is underway on schedule.

4.2.3 Ship Repair

Ship Repair division also has a complete facility to repair, rebuild and overhaul naval and commercial vessels to full quality requirements. These combined services are delivered by highly qualified and trained workforce. There are 02 Drydocks, 02 Quay Walls and luffing cranes / lifting equipment and the latest tools to carry out the aforementioned and underwater repair. Some other works KS&EW does include steel renewal, major structural repairs, machinery-overhauls and repairs on our domestic consumers i.e. Pakistan Navy, Pakistan Maritime Security Agency, Karachi Port Trust, Port Qasim Authority and other international consumers such as China, Turkey, Singapore, Korea and UAE. Up to the present, KS&EW has already repaired over 5000 vessels out of which more than 250 vessels are also of foreign flag.

Table 11: Shows ships repaired during last 10 years.

S.No	Customers	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	TOTAL
1	Pakistan Navy	6	7	20	13	6	7	12	18	7	19	115
2	Karachi Port Trust	4	6	1	4	3	2	2	1	3	2	28
3	Maritime Security Agency	5	4	5	4	4	6	4	3	2	2	39
4	Port Qasim Authority	1	1	2	0	1	1	2	1	3	0	12
5	Foreign Ships / LOCAL	1 x Cyprus 1 x China	2 x China	2 x China	0	0	0	3	1	1	1	12
Yearly Total		18	20	30	21	14	16	23	24	16	24	206

To improve ship repair and refurbishment capacity to suit the regional demands, a state-of-the-art Ship Lift and Transfer System (SLTS) have been ordered at KS&EW by M/s Syncrolift (OEM), Norway. The system is well functional and can raise ships up to 7300 tons on 12 dedicated under-water repair parking stations

4.2.4 The General Engineering

The Division of General Engineering can work on marine structural fabrication (Dams/Barrage Gates), cranes and lifting equipment (Electric overhead, Luffing and Gantry cranes etc.), stadiums flood lights towers (football / cricket / hockey) and wind turbine towers. Also machining work involves manufacture of forged steel shafts, sugar rollers and hoisting system on dams / barrage, sugar plant rollers, foundry products manufactured by GE uses steel billets, sugar rollers and alloy casting.

The installation and commissioning of 06 River Barrage Gates at Sukkur Barrage, on M/s Sindh Barrage Improvement Projects, Sindh Irrigation Dept.

(Govt. of Sindh); with Project Consultant M/s ACE-NDC (JV) Australia; under the overall project management by World Bank is one of the biggest milestone achievements of the General Engineering Division.

Recently KS&EW manufactured 01 x River Barrage Gate on emergency basis within less than one month which involved complete fabrics of 50 tons gate, removal of damaged gate (Bay 47) at Sukkur Barrage and installation and commissioning of new gate within less than one month. This demonstrates the ability of KS&EW to act in case of emergency in the country.

4.2.5. Import-Driven Supply Chains

The shipbuilding sector in Pakistan is highly reliant on the import-based supply chains, over 70 percent of its core materials and systems are being supplied by foreign suppliers with China, Germany, Turkey, and South Korea being the main suppliers.¹³⁹ Most of the marine-grade steel plates are also imported in China and propulsion engines and gearboxes are mostly imported in Germany and South Korea. Japan and the Netherlands provide most of the navigation and communication systems, and China and Turkey provide most of the fire control, radar, and sophisticated electronics.¹⁴⁰ Even special marine paints and corrosion resistant finishes are normally imported via Dubai freeports. Notably, simple items like pumps, piping systems and HVAC modules that can withstand international ship-class standards are oftentimes locally unavailable. This dependence on imports leads to time-delays in the process of procurement and customs clearance, which in turn adds six to nine months on the average construction time of a commercial ship in Pakistan compared to local competitors.¹⁴¹ Moreover, there are no certified marine grade foundries, sophisticated fabrication units, and integrated manufacturing units, which can be used to manufacture ship blocks or hull modules, which greatly restricts the self-sufficiency of the country in terms of industry. Therefore, in some of the projects that are considered domestic builds, about 50-60 percent of the overall value of the vessel is paid to foreign suppliers, which highlights the structural issues of the shipbuilding industry in Pakistan.^{142 143}

4.3. Pakistan's Shipbuilding Landscape: Saltwater Dominance and the Absence of Freshwater Yards

Pakistan's shipbuilding sector provides an instructive regional case within the broader global comparison of freshwater and saltwater shipyards. Unlike countries with extensive inland waterways such as the United States or parts

¹³⁹ World Bank. 2023. *Ship Recycling Outlook: Global Trends and Implications for South Asia*. Washington, DC: World Bank.

¹⁴⁰ UNCTAD. 2024. *Review of Maritime Transport 2024*. Geneva: United Nations Conference on Trade and Development.

¹⁴¹ KS&EW. 2024. *Corporate Profile and Achievements*. Karachi: Karachi Shipyard & Engineering Works, Ministry of Defence Production, Government of Pakistan.

¹⁴² UNCTAD. 2024. *Review of Maritime Transport 2024*. Geneva: United Nations Conference on Trade and Development.

¹⁴³ World Bank. 2023. *Ship Recycling Outlook: Global Trends and Implications for South Asia*. Washington, DC: World Bank.

of Europe, Pakistan's geography and hydrology offer little scope for true freshwater shipyard development. In Pakistan, the location of all known and active shipyards is along the salty shores of the Arabian Sea. Karachi Shipyard and Engineering Works (KS&EW) is the oldest and has been the main shipbuilding and repair yard in the country since 1950s and has built naval combatants, naval auxiliaries, submarines, and merchant ships. Large-scale coastal development projects are underway with the most notable being the proposed Gwadar Shipyard which is a joint venture between the federal government and the provincial government of Balochistan to construct and repair large ocean-going ships in the immediate vicinity of the strategically important Gwadar Port.

Similarly, the federal government has given the development consent of another integrated shipyard at Port Qasim, Karachi, where a plot of about 700 acres has been designated to an Integrated Maritime Complex which will comprise of dry docks, fabrication facilities and naval support infrastructure.¹⁴⁴ There are also smaller coastal yards close to Karachi Fish Harbor and Korangi Fish Harbor which mostly serve repair and maintenance of fishing trawlers and artisanal vessels.¹⁴⁵

Interestingly, there are no verifiable sources which point out freshwater shipyards in Pakistan. Large-scale inland shipbuilding and repair infrastructure is not concentrated in the Indus River system, the largest inland waterway of the country, due to variable river hydrology and the lack of large-scale barge or inland cargo shipping cultures. This places the Pakistani shipbuilding industry squarely in the saltwater segment, which is opposite to other areas such as the U.S. Great Lakes or European river yards with focused industrial purposes of freshwater yards. Pakistan is losing freshwater yards and this highlights its strategic access to deepwater via the coast in supporting both modernization of the navy and the commercial shipping ambitions, which makes it more in line with the saltwater yard model that is prevalent in Asia in global shipbuilding connection.

4.4 Integrated Maritime Industrial Complex at Port Qasim

4.4.1 Government Vision and Rationale

The Government of Pakistan has moved to revive and expand the country's shipbuilding and maritime industrial capacity by planning an Integrated Maritime Industrial Complex adjacent to Port Qasim. This project, which is debated on high level between Pakistani government and Chinese investors, is projected to have a vast area of land allocated to a multi-purpose maritime cluster. The complex will be geared towards integrating shipbuilding, ship-

¹⁴⁴ Khaleej Times, "Pakistan Government Approves Plan for Two Shipyards," Khaleej Times, October 17, 2020, <https://www.khaleejtimes.com/business/pakistan-government-approves-plan-for-two-shipyards>

¹⁴⁵ Riaz Haq, "Pakistan Shipbuilding Industry and Blue Economy," South Asia Investor Review, December 2020, <https://www.southasiainvestor.com/2020/12/pakistan-shipbuilding-industry-and-blue.html>

repair, ship-recycling and supporting industrial clusters, including fish and date processing, logistics and value-added marine services.¹⁴⁶

4.4.2 International Cooperation and Transfer of technology

Recent government and media briefings highlight those Chinese maritime and industrial groups, notably Shandong Xinxu Group, have expressed strong interest in financing and delivering advanced technologies for the complex. Plans include a “green” ship-recycling yard, modern shipbuilding and repair facilities, and training and certification centers to upskill the local workforce. These efforts align with global best practices, integrating lessons from international shipbuilding nations, while also serving as part of a broader Port Qasim expansion program that covers new terminals, coastal economic-zone development, and improvements to road and rail connectivity.¹⁴⁷

4.4.3 Land Allocation and Capacity Development

Media reports vary regarding the land footprint of the complex. In previous descriptions, they had cited around 700 acres but in more recent briefings in August-September 2025, they have made 1000 acres the standard allotment. This higher number is an indicator of the desire by the government to build large capacity of vessel construction that can build large ships way beyond the capacity of the country currently. Additional goals include reduced vessel build times through modernized infrastructure and the attraction of significant foreign direct investment to support Pakistan’s blue economy.¹⁴⁸

4.4.4 Implementation Model and Benefits to be expected

The government has indicated its strategy as a model that involves public-private partnership where a lead investor or consortium is allocated land and incentives, although Chinese companies are the most prominent in this case.¹⁴⁹ The Integrated Maritime Industrial Complex will be equipped with the advanced facilities, such as shipbuilding halls, dry docks, berths, repair yards, and the environmentally enhanced recycling areas, as well as the supporting industrial clusters.¹⁵⁰ One of the key pillars is employment generation, whereby blue-collar and technical jobs are likely to be created in tandem with new training and certification systems, which will increase competency in the workforce.¹⁵¹

¹⁴⁶ Pakistan Today. “Pakistan, China to Develop Maritime Industrial Complex at Port Qasim.” August 29, 2025. <https://www.pakistantoday.com.pk/2025/08/29/pakistan-china-to-develop-maritime-industrial-complex-at-port-qasim/>.

¹⁴⁷ Port Qasim Authority. “Port Qasim Authority Is Taking Bold Steps to Make Pakistan’s Maritime Trade Globally Competitive.” June 24, 2025. <https://www.pqa.gov.pk/en/news/port-qasim-authority-is-taking-bold-steps-to-make-pakistans-maritime-trade-globally-competitive>

¹⁴⁸ The Nation. “Govt Plans to Allocate 1,000 Acres to Chinese Investors for Integrated Maritime Industrial Complex.” September 1, 2025. <https://www.nation.com.pk/01-Sep-2025/govt-plans-to-allocate-1-000-acres-to-chinese-investors-for-maritime-industrial-complex>

¹⁴⁹ Pakistan Today. “Pakistan, China to Develop Maritime Industrial Complex at Port Qasim.” August 29, 2025.

¹⁵⁰ INP (Independent News Pakistan). “Shipbuilding, Recycling, and Industrial Cluster Planned at Port Qasim.” August 30, 2025.

¹⁵¹ X (formerly Twitter), reporting from Ministry of Maritime Affairs briefing, August 2025.

In a strategic manner, the complex will revive the shipbuilding industry in Pakistan, decrease the dependence on imports, improve the export prospects of repair and construction services, and boost the pace of industrialisation in the Port Qasim coastline.¹⁵²

4.5 Research and Development as Academic Support to Shipping Industries

The academic institutions have been playing an important role in the past in supporting the use of shipping and ship building industries by conducting research, training and technological invention. This academic assistance can be followed in Pakistan with the opening of the Pakistan Marine Academy in the year 1962 which has been a pillar of seafarer training and sea education. Gradually, Pakistani institutions have become increasingly maritime oriented, and provided the possibility to research in marine engineering, logistics, and port management. As an example, the Bahria University with assistance of Higher Education Commission (HEC) conducted international workshops in 2018 to streamline academic research and industry needs with specific reference to shipping business, logistics and naval architecture.

The biggest breakthrough in institutional maritime research was the formation of National Centre of Maritime Policy Research (NCMPR) in 2009 that became the first maritime concerns think tank in Pakistan. In 2017, this centre was reorganised into the Institute of Maritime Affairs (IMA), expanding its fields of interest to applied maritime research as well as industry connections. Only two years after that, in 2019, the institute further developed to become the National Institute of Maritime Affairs (NIMA), the main maritime research institution in Pakistan today. NIMA has broadened its research desks to encompass various areas such as ship recycling, maritime trade, industrial cooperation and blue economy strategies and has remained important in supporting policymaking and capacity building at the national and international scales.

Along with that, new specialized centers have been established as well. In 2021, the Centre of Research and Innovation in Maritime Affairs (CRIMA) was established at Minhaj University and focuses on applied research in the area of shipbuilding policy, maritime economics, and shipping management. There has also been scholarly work in academic contributions to coastal and ocean management, such as Lasbela University of Agriculture, Water and Marine Sciences (LUAWMS) has published scholarly literature on marine spatial planning (MSP) and the blue economy (2022). More recently, in 2024, the modernisation of the Pakistan Marine Academy was a sign of novel investment in academic infrastructure in aid of industry-based training.

All these initiatives are pointers to the fact that the value of academic-industrial alliance in further developing the capacity of Pakistan to engage in shipping and shipbuilding at a world scale, and further sustainable maritime practices.

¹⁵² Profit by Pakistan Today. "China Eyes 1,000-Acre Maritime Hub at Port Qasim to Revive Pakistan's Shipbuilding." August 29, 2025. <https://profit.pakistantoday.com.pk/2025/08/29/china-eyes-1000-acre-maritime-hub-at-port-qasim-to-revive-pakistans-shipbuilding>

CHAPTER 5

HAZOP ANALYSIS FOR PAKISTAN SHIPYARDS/SHIPBREAKING

5.1 Introduction

Shipbreaking or ship recycling is among the most environmentally toxic, manual and loosely regulated industries worldwide. One of the largest operations of this kind in the world is the Gadani Ship-Breaking Yard, located at Gadani, in Pakistan, on the Arabian Gulf coast about 50 km west of Karachi, which has over 130 plots and the workers break the ship in the beaching technique.^{153 154}

Although the industry plays an important economic role (scrap metal to supply the domestic market, huge informal jobs, billions in revenue), the industry is ridden with weak regulatory controls, old laws, and various safety and environmental shortcomings.^{155 156 157}

The Pakistani law has little formal recognition of the industry with the existing rules including the Balochistan Ship-Breaking Industry Rules of 1979 not having been revised to reflect the environmental legislation enacted in 1997 or to reflect the modern international standards.¹⁵⁸

The Pakistani shipbreaking industry is traditionally linked to both systemic environmental pollution, namely the unrestricted dumping of the hazardous waste of asbestos, PCBs and residual oils into the coastal ecosystem and exploitative labor practices.^{159 160 161}

The Hong Kong Convention (HKC, 2009) by the International Maritime Organization has become a form of international standard of safe and environmentally friendly ship recycling in recent years. In November 2023, Pakistan officially became a member of the HKC, marking an intent to modernize and regulate the industry.¹⁶²

¹⁵³ Hazard and Operability Study, accessed August 2025, Wikipedia, <https://en.wikipedia.org/>

¹⁵⁴ NGO Shipbreaking Platform, "PAKISTAN," Shipbreaking Platform (accessed August 2025).
NGO Shipbreaking Platform

¹⁵⁵ Naeem Mahmood and Muhammad Tahir, "Shipbreaking in Pakistan – The Need for Aligning with Global Instruments for Sustainable Development," Pakistan Journal of International Affairs 5, no. 3 (December 25, 2022)

¹⁵⁶ Hussain Ahmad Siddiqui, "A Sinking Industry," The News (October 9, 2023).

¹⁵⁷ Amin Ahmed, "ILO launches study to reform ship recycling sector," Dawn (June 29, 2025).

¹⁵⁸ NGO Shipbreaking Platform, "PAKISTAN," Shipbreaking Platform (accessed August 2025).

¹⁵⁹ The problems of shipbreaking in Pakistan," Safety4Sea (July 24, 2025).

¹⁶⁰ Sheikh, Hamna Ghias, and Gul Hameed. 2024. "Maritime Pollution in Pakistan and Its Impact on Marine Life: Challenges and Way Forward." Journal of Water Resources and Ocean Science 13 (3): 84–93. <https://doi.org/10.11648/j.wros.20241303.13>

¹⁶¹ Hameed, Nida. "The Dark Side of the Ship Breaking Industry." Centre for Peace, Security and Developmental Studies (CPSD), June 15, 2025. Accessed August 28, 2025. <https://cpsd.org.pk/the-dark-side-of-the-ship-breaking-industry>

¹⁶² News desk, "Ship Recycling Industry of Pakistan: A Tale of Forgotten Fortunes," Pakistan Observer, October 9, 2024.

The Hazard and Operability (HAZOP) Analysis is an organized, group method that was initially created in the process industries to logically detect hazards and operability problems through the examination of deviation of design intent.¹⁶³

Hazard analysis applied to the shipbuilding /shipbreaking industry of Pakistan HAZOP has the capacity to deconstruct every step of the dismantling process, such as beached grounding to hazardous waste management, systematically shedding light on concealed hazards and inefficiencies of the operation in a multidisciplinary manner.

5.2 Definitions of HAZOP

A hazard and operability study (HAZOP) is a structured and systematic examination of a complex system, usually a process facility, in order to identify hazards to personnel, equipment or the environment, as well as operability problems that could affect operations efficiency. ¹⁶⁴ Wikipedia

A systematic qualitative technique to identify process hazards and potential operating problems using a series of guide words to study process deviations. ¹⁶⁵ AIChE

A HAZOP is a systematic assessment tool used to identify and address potential hazards in industrial processes before an incident occurs. ¹⁶⁶ Sphera

5.2.1 Formula for HAZOP Calculation

HAZOP is a qualitative process, but the results are usually translated into a risk ranking equation in order to determine the importance of the corrective measures. The basic calculation is:

$$\text{Risk Score} = \text{Likelihood} \times \text{Consequence}$$

¹⁶³ Hazard and Operability Study, accessed August 2025, Wikipedia, <https://en.wikipedia.org/>

¹⁶⁴ Wikipedia. s.v. "Hazard and Operability Study." Last modified July 2025. Accessed August 28, 2025.

¹⁶⁵ Center for Chemical Process Safety (CCPS), "Hazard and Operability Study (HAZOP)," AIChE, accessed August 28, 2025. <https://www.aiche.org/ccps/resources/glossary/process-safety-glossary/hazard-and-operability-study-hazop>

¹⁶⁶ Stein Haugen and Marvin Rausand, "9. HAZOP," Risk Assessment; Theory, Methods, and Applications (slides, Version 0.1, RAMS Group, Department of Production and Quality Engineering, NTNU, 2014), 1–46, PDF, NTNU, accessed August 28, 2025.

Table 12: Risk Classification Matrix

Risk Score	Risk Level	Action Guidance
1–4	Low	Acceptable, monitor periodically
5–9	Medium	Mitigate if cost-effective
10–14	High	Immediate corrective action required
15–25	Intolerable	Stop activity until risk reduced

5.3. Hazard and Operability Study (HAZOP) Analysis

A Hazard and Operability Study (HAZOP) is a scientific approach to the process of detecting hazards, their cause, effects and the possible controls available in the industrial processes. In this paper, HAZOP was used on Karachi shipyards with typical hazardous areas concentrating on welding and fabrication bays, confined spaces (tanks and voids), boiler and plant rooms, painting and coating areas, lifting operations, electrical systems, plate handling and structural alignment, waste handling and storage and general fire and emergency response capacity. Every node was analyzed in terms of potential deviation—basically inquiring about what might go wrong. In isolated areas, e.g., the difference between the experimental values of entry without gas testing was emphasized. The likely causes were determined by synthesizing international industry experience with real incidents that had occurred in the Pakistani shipyards, particularly, Karachi Shipyard, Port Qasim, and other maritime facilities in the area.

Consequences were charted in terms of fire, explosions, fatalities, environmental pollution, damage to assets and delays in the project. Engineered solutions like permit-to-work systems, firefighting and use of personal protective equipment (PPE) were taken into consideration. The severity (S) (1 to 5) and likelihood (L) (1 to 5) scores were assigned and then the risk was determined by multiplying the severity (S) and likelihood (L) scores ($S \times L$) wherein risk was categorized as Low (1-5), Medium (6-12), High (13-20), and Critical (21-25). On this basis, solutions were suggested to address safety gaps identified in the past in Karachi.

The HAZOP identified the greatest risks ($R = 15$, High) to be in confined space entry, boiler and plant room operations and plate handling and lifting. Closure areas pose a serious suffocation threat, exposure to toxic gases, or even explosion during refits; which has been experienced in previous fires in naval refits Karachi. The catastrophic potential of boiler rooms can be illustrated by the 2023 Port Qasim boiler explosion that killed workers, and makes boiler rooms a high-risk location. Another area of high risk was lifting and handling of the huge steel plates, indicating the incidences of accidents caused by improper rigging and uncertified lifting plans, which proved fatal. Moderate risks ($R = 10$ -12) were identified in welding and hot work fires on open slips, painting and coating involving volatile organic compounds (VOCs), electrical hazards due to temporary or unsafe wiring, waste management and spills and the overall inadequacy of firefighting infrastructure in Karachi shipyards. Although these

risks may not necessarily be devastating, they may rise quickly when there are no robust controls.

It can be concluded that the Karachi shipyards are not any different in the types of risks they encounter when compared to the global shipbuilding industries, yet there is a greater likelihood of accidents occurring because of the old shipbuilding infrastructure, the inability to enforce permit-to-work, the absence of preventive maintenance, and the inadequate emergency response capabilities. The similar patterns of the accidents reports, especially fires, explosions, lifting accidents, and confined space tragedies, validate that these are the most plausible hazards to shipyards in Karachi.

The major suggestions are continuous gas monitoring and trained rescue team in confined spaces; third party certification, preventive maintenance and operator training in boilers; engineer approved lifting plans and certified rigging crews in heavy lifts; using fixed hydrants, foam systems and joint firefighting drills with Karachi Fire Service; ventilated painting enclosures with lower explosive limit (LEL) monitoring; the use of residual current devices (RCDs) and electrical safety and structured waste segregation, bunding and disposal by licensed contractors. These measures would go a long way in lowering the probability of accidents and bringing the shipyards of Karachi to par with world standards of safety. Table 13.

Table 13: Represents the spreadsheet of Hazard and Operability (HAZOP): A Risk Assessment in the Shipbuilding/ Ship Recycling yards

S. No	Yard	Node/Area	Deviation	Possible Causes	Consequences	Existing Safeguards	R (S×L)	Risk Rating	Recommendations
1.	KS&EW (Karachi Shipyard)	Welding bays / fabrication slips	Improper hot work controls leading to ignition	Aging insulation, simultaneous SIMOPS, inadequate PTW, poor housekeeping	Major fire, damage to hull/build, worker burn injuries, project delays	In-house HSE, some PTW practices	12	Medium	Strict PTW digital logging + independent hot-work permit sign-off; enforce exclusion zones; install fixed hydrant/foam points at slips; emergency drills quarterly.
2.	KS&EW / Private yards (Karachi region)	Confined space entry (tanks/voids during refit)	Entry without adequate gas testing / ventilation	Incomplete gas freeing, lack of continuous monitoring, informal crew	Asphyxiation / fatalities during refit or repair	PTW for confined spaces in some projects; tripods in place occasionally	15	High	Mandatory continuous multi-gas monitors with recording; forced ventilation and documented air quality criteria before entry; trained rescue team on standby; permit + LOTO.
3.	Port Qasim / Private repair yards	Boiler / plant rooms (supporting workshop)	Explosion / fire in boiler or workshop	Poor maintenance, lack of preventive inspection, fuel/steam system faults	Multiple fatalities, facility destruction, business interruption	Basic factory safety checks (varies by yard)	15	High	Implement scheduled preventive maintenance for boilers; third-party inspection certificates; install pressure relief and

S. No	Yard	Node/Area	Deviation	Possible Causes	Consequences	Existing Safeguards	R (S×L)	Risk Rating	Recommendations
									automatic shutoffs; emergency response & training.
4.	Karachi Port (repair berths)	Vessel painting / coatings bays	High VOC / solvent vapour accumulation; nearby hot work	Poor ventilation, simultaneous hot work, use of solvent-based paints	Fire/explosion; worker toxic exposure	PPE, spot ventilation in some yards	12	Medium	Segregated painting enclosures with explosion-proof ventilation; adopt low-VOC coatings where feasible; continuous LEL monitoring; hot work isolation.
5.	Multiple Karachi yards (KS&EW, Port Qasim)	Lifting operations / heavy lifts	Overload, poorly planned lifts, ground instability	No certified lift plan, unknown load weights, improper rigging, soft ground	Crane tip-over; multiple casualties; asset loss	Operator licensing; ad hoc checks	10	Medium	Mandatory engineer-approved lift plans for critical lifts; ground bearing assessments and mats; certified rigging crews; weather/wind cutoffs and exclusion zones.
6.	KS&EW & private yards	Electrical distribution to tools / temporary supply	Exposed conductors, wet conditions, damaged cables	Improvised wiring, lack of RCD/GFCI, absence of PAT testing	Electric shock, fatality, tool damage	Visual checks; basic PPE	12	Medium	Install RCD/GFCI at temporary power distribution; IP-rated connectors; scheduled PAT testing; cable trays and trained electricians.
7.	KS&EW (plate handling)	Plate/structure collapse during alignment or cutting	Improper rigging, lack of exclusion zones, inexperienced crews	No lifting plan, hurried operations to meet schedules	Crushing fatalities; severe injuries; project disruption	Basic slinging & spot checks	15	High	Enforce exclusion zones; certified lift supervisors; pre-lift toolbox talks; use of tag lines and safe blocking methods; incident investigation on any near miss.
8.	Port Qasim / Karachi repair yards	Waste & oily/HAZMAT handling (interim storage)	Mixed hazardous / general waste, spills to water/soil	No segregation, inadequate bunding and containment, informal disposal	Environmental contamination, regulatory fines, reputational damage	Spill kits in some yards	12	Medium	Implement hazardous waste segregation & manifest system; 110% bunding for tanks; licensed hazardous waste contractors; routine audits and training.
9.	KS&EW (general)	Inadequate emergency response capacity for yard fires	Limited firefighting infrastructure at slips; delayed external response	Underinvestment in fixed hydrants/foam, lack of trained crew, remote slips	Escalation of small fire to major incident, loss of vessel sections	Local fire services; ad hoc firefighting trucks	12	Medium	Invest in slipside hydrant/foam systems, dedicated yard firefighting crew & pumps, mutual aid agreements with Port Qasim and Karachi Fire Services; conduct scenario drills.

CHAPTER 6

CHALLENGES IN THE SHIPBUILDING INDUSTRY OF PAKISTAN

6.1 Challenges in Shipbuilding Industry of Pakistan

Taking lead from the success of shipbuilding nations such as South Korea, China, Japan and Vietnam, it becomes clear that development of the shipbuilding sector has transformative potential for Pakistan's economy. Having discussed Pakistan's limited capabilities and aspirations we now turn to the key challenges constraining the sector's growth.

6.2 Limited Shipbuilding/Repair Capacity

Karachi Shipyard & Engineering Works KS EW remains Pakistan's only major shipyard capable of constructing and repairing ships up to around 26 000 DWT (The Maritime Executive 2024). While this capacity suffices for small to medium vessels the market demand is shifting toward large and specialized ships such as LNG and LPG carriers mega container ships and offshore rigs where KS EW lacks the infrastructure and expertise. Currently KS EW operates two aging dry docks and a recently installed Syncrolift (~ 8 000 tons) but it lacks automation high lift systems or digital ship design integration (Quwa 2024). With only one operational yard Pakistan faces bottlenecks in both naval and commercial shipbuilding leaving the bulk of national demand to foreign suppliers. The establishment of new modern shipyards at Gwadar and Port Qasim as announced in 2025 policy workshops is therefore essential (Press Information Department Government of Pakistan 2025).

6.3 Regional Competitors

Pakistan's solitary yard cannot compete with regional giants. Shipyards in the Gulf and Asia including Dubai Dry Docks UAE King Salman Maritime Complex Saudi Arabia Abu Dhabi Shipbuilding UAE and Nakilat Damen Qatar possess state of the art facilities for shipbuilding ship repair offshore rigs and support services. By contrast KS EW focuses narrowly on naval contracts with minimal commercial output (Arab News 2024). Globally China accounted for 75 to 81 percent of vessel orders in 2024 with South Korea and Japan covering most of the remainder (Georgiou 2025). Pakistan has negligible market share leaving it uncompetitive internationally and heavily dependent on government orders domestically.

6.4 Absence of a Strong Ancillary Industry

Pakistan's shipbuilding ecosystem lacks a supporting ancillary industry. Essential inputs including marine grade steel propulsion systems navigation equipment and electronics are almost entirely imported (Quwa 2024). Vendors are located across continents causing long lead times higher foreign exchange costs and frequent project delays. Local industry is unable to supply specialized shipbuilding materials and the weak supplier base deters new entrants from investing in the sector. By contrast regional shipbuilding leaders have vertically

integrated clusters of steel mills machine shops and component manufacturers that lower costs and accelerate timelines.

6.5 Retention of Skilled Workforce

Pakistan faces a chronic skills gap. There is no robust training pipeline for welders naval architects or marine engineers beyond general polytechnic programs (OECD 2024). KS EW staff often rely on training geared to defense fabrication not modern commercial shipbuilding (Pakistan Today 2024). Retention is another major issue skilled workers often migrate to Gulf shipyards where wages and incentives far exceed local pay scales. Without attractive salary packages and structured career progression Pakistan struggles to groom and retain its technical workforce. Analysts warn that unless upskilling and apprenticeship programs are introduced in partnership with foreign shipbuilders Pakistan will remain unprepared for industry modernization (Sustainable Development Policy Institute 2025).

6.6 Lack of Government Support for Shipbuilding

Despite new policies government support remains fragmented and insufficient.

a. **Subsidy:** A 30 percent subsidy to KS EW was withdrawn in 1998 under IMF pressure leaving the industry exposed to unequal competition with no comparable fiscal relief restored since (Express Tribune 2024).

b. **Right of First Refusal ROFR:** The ECC's 1985 decision granting KS EW ROFR on government orders is poorly enforced. In 2024 a feeder ship project was delayed for 277 days due to bureaucratic disputes before the Special Investment Facilitation Council intervened (The Maritime Executive 2024). Weak implementation of ROFR further undermines KS EW's pipeline.

c. **Taxation:** – KS EW faces 16 percent sales tax on services and 34 percent income tax while financing costs exceed 12 percent (Arab News 2024). This renders local builds uncompetitive against regional rivals operating with subsidies and tax holidays.

d. **Tax-Free Imports:** The continued exemption of import duties on foreign-built ships combined with non-implementation of ROFR has directly harmed KS EW's order book. Unless Pakistan rebalances incentives toward domestic construction ship owners will continue purchasing abroad (Express Tribune 2024).

6.7 Lack of Research Development and Design Capability

Modern shipbuilding nations thrive by investing in R and D and design innovation. Pakistan however has no significant in-house design capability at KS EW. Most major naval projects rely on foreign design transfers from China or Turkey (Quwa 2024). There is no indigenous capacity to design LNG-ready hybrid or low emission ships which are the future of global demand. While the Navy has set up a Platform Design House these initiatives are still limited in

scope. Without a dedicated national maritime R and D center and university industry partnerships Pakistan risks lagging further behind.

6.8 Outsourcing Sub-contracting

Globally mature shipyards function as assembly hubs outsourcing complex block construction to subcontractors. KS EW however outsources only basic fabrication tasks while retaining critical block assembly in-house due to lack of qualified subcontractors (Quwa 2024). This places excessive burden on its limited workforce leading to delays and rework. Until Pakistan cultivates a network of specialized subcontractors the shipyard cannot scale production or enter competitive global niches.

6.9 Policy Implications and Recommendations

6.9.1 Develop Training and Workforce Retention

The government must allocate resources to vocational training in welding ship-fitting marine engineering and naval architecture. This includes expanding maritime institute capacity and partnering with foreign shipbuilders for apprenticeship programs and knowledge transfer (Sustainable Development Policy Institute 2025). Competitive remuneration and clear career pathways are essential to retain skilled labor against Gulf competition.

6.9.2 Reintroduce Subsidies and Implement ROFR

A modern fiscal framework should restore partial subsidies for KS EW (e.g. tax credits capital grants). The Right of First Refusal should be codified and enforced across public and key private sector ship procurements (PNSC PQA KPT) to ensure domestic orders.

6.9.3 Tax and Financing Incentives

KS EW and private shipbuilders should be granted exemptions from sales and income tax on domestic builds. Low-interest financing (below 10 percent) must be made available through public institutions or through public-private partnerships to lower cost barriers.

6.9.4 Expand Physical Infrastructure

Fast-track the creation of modern shipyards at Gwadar and Port Qasim with full funding commitments and international joint venture partners. Upgrade existing Karachi dry docks with automated lifting and ERP systems to increase productivity and throughput.

6.9.5 Build Ancillary Industry and Local Supply Chains

Provide incentives for local manufacturers to produce marine-grade steel propulsion components and ship electronics. Encourage the formation of a

cluster zone around Karachi with tax waivers or grants to support machine shops electronics firms and metal fabrication units.

6.9.6 Invest in R and D and Design Capabilities

Establish a National Maritime Research and Design Centre collaborating with universities and the Pakistan Navy's Platform Design House. Fund research on alternative fuels energy efficient hull forms and domestic ship design software.

6.9.7 Support Subcontracting Ecosystem

Create certification programs and subsidies for subcontractors to build capacity in block fabrication and outfitting. This will enable KS EW to outsource more work reliably and reduce burden on its core workforce.

6.9.8 Strengthen Institutional Coordination

Form a Maritime Development Authority bringing together the Ministry of Maritime Affairs Defence Production Commerce and the private sector. Delegate clear authority to streamline project approval and procurement processes to avoid bureaucratic delays.

CHAPTER 7

RECOMMENDATIONS AND WAY FORWARD

7.1 National Shipbuilding & Repair Strategy

The shipbuilding sector in Pakistan needs a coherent roadmap that incorporates international regulatory changes, industrial modernization, and national maritime policies. The current Merchant Marine Policy 2001 (as amended in 2019), the Merchant Shipping Ordinance, and later regulations should all be incorporated into a single, quantifiable plan as part of a dedicated National Shipbuilding and Repair Strategy (2025–2035). Clear goals for shipyard capacity, order books, local content, and adherence to the IMO's updated 2023 GHG strategy which establishes net-zero targets for the middle of the century should all be included in this plan.^{167 168}

7.2 Expand Yard Capacity and Capabilities

It is essential to increase yard capacity. The planned Gwadar Shipyard should be expedited as a commercial and naval hub, while Karachi Shipyard and Engineering Works (KS&EW) has the infrastructure and dual-use experience to support the construction of both military and civilian vessels. Promoting competition and reducing reliance on a single state-owned facility can be achieved by providing incentives for at least two private yards.^{169 170}

7.3 Align Incentives with Supply

Pakistan should offer incentives based on progress milestones like ship delivery, launch, and keel-laying rather than general tax exemptions. Bonuses can be given for training crew members and using local resources. The updated Merchant Marine Policy should keep funding shipbuilding and ship repair directly. It should be mandatory for Pakistani shipping companies to have their ships repaired in local yards. Linking shipping companies to shipbuilding and repair will help create consistent demand for local yards, as incentives are already in place for shipping companies.^{171 172}

¹⁶⁷ International Maritime Organization (IMO). 2023 IMO GHG Strategy on Reduction of GHG Emissions from Ships. <https://www.imo.org/en/ourwork/environment/pages/2023-imo-strategy-on-reduction-of-ghg-emissions-from-ships>

¹⁶⁸ UNCTAD. 2024. Review of Maritime Transport 2024. Geneva: United Nations

¹⁶⁹ Business recorder. 2024.

¹⁷⁰ Nation. 2025. "PM Orders Expansion of PNSC Fleet to Save \$4 b in Annual Maritime Trade Costs." *The Nation*, June 21, 2025 <https://www.nation.com.pk/21-Jun-2025/pm-orders-expansion-of-pnsc-fleet-to-save-dollar-4b-in-annual-maritime-trade-costs>

¹⁷¹ Pakistan National Shipping Corporation (PNSC). 2019. Merchant Marine Policy 2001 (Amended 2019). Karachi: PNSC.

¹⁷² Ali, Kalbe. "Draft Policy Seeks Financial Security for Ship Owners." *Dawn*, November 14, 2024. <https://www.dawn.com/news/1872243>

7.4 Capture Decarbonization Work

Maximizing opportunities in the decarbonization of international shipping is another top priority. In order to comply with the IMO's Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII), Pakistan can specialize in retrofit and repair services. A feasible way to enter low-carbon shipbuilding niches would be to establish a National Green Retrofit Program and give smaller vessels priority – such as tugs, pilot boats, and coastal crafts.^{173 174}

7.5 Build a Repair & Lifecycle Service Cluster

Lifecycle and repair services ought to be prioritized nationally. Channeling the demand for vessel repair and maintenance to domestic yards will stabilize workloads and increase technical capacity as the Pakistan National Shipping Corporation (PNSC) plans to significantly expand its fleet. Pakistan will become more competitive in the regional repair market by creating clusters for rapid-turn hull and propulsion services, floating docks, and electronic systems repair.^{175 176}

7.6 Upgrade Ship Recycling

International compliance became mandatory after Pakistan ratified the Hong Kong Convention, which went into effect in June 2025. In response, PKR 12 billion has been approved by the federal government to turn Gadani into a "model green" shipbreaking yard.¹⁷⁷ By funding necessary improvements like impermeable flooring, stormwater treatment, and hazardous material handling, this investment will help Pakistan bring Gadani into compliance with international standards and integrate ship recycling into a larger sustainable shipbuilding and lifecycle services ecosystem.^{178 179}

¹⁷³ International Maritime Organization (IMO). 2023 IMO GHG Strategy on Reduction of GHG Emissions from Ships. <https://www.imo.org/en/ourwork/environment/pages/2023-imo-strategy-on-reduction-of-ghg-emissions-from-ships>

¹⁷⁴ UNCTAD. 2023. Review of Maritime Transport 2023. Geneva: United Nations.

¹⁷⁵ Ali, Kalbe. PNSC Eyes \$700m Freight Boost with Expanded Green Fleet. <https://www.dawn.com/news/1920707>

¹⁷⁶ Nation. 2025. "PM Orders Expansion of PNSC Fleet to Save \$4 b in Annual Maritime Trade Costs." *The Nation*, June 21, 2025 <https://www.nation.com.pk/21-Jun-2025/pm-orders-expansion-of-pnsc-fleet-to-save-dollar-4b-in-annual-maritime-trade-costs>

¹⁷⁷ Tribune. 2025. "Govt Approves Rs12 b to Transform Gadani Yard." *The Express Tribune*, June 26, 2025

¹⁷⁸ International Maritime Organization (IMO). 2025. Recycling of ships and the Hong Kong Convention <https://www.imo.org/en/mediacentre/hottopics/pages/recycling-of-ships-and-hong-kong-convention.aspx>

¹⁷⁹ Pakistan Approves \$42 Million to Transform Ship-Breaking Yard into 'Model Green Facility'. *Hellenic Shipping News*, June 30, 2025. <https://www.hellenicshippingnews.com/pakistan-approves-42-million-to-transform-ship-breaking-yard-into-model-green-facility>

7.7 Maritime Finance and Risk Sharing

Another weak point is maritime finance. A Green Maritime Window run by the State Bank of Pakistan in conjunction with a Shipyard Performance Guarantee Scheme may lower investor risk and make it easier to enter into contracts for alternative-fuel new construction and retrofits. To draw in foreign buyers, export credit and leasing options that adhere to Shariah should also be extended.¹⁸⁰

7.8 Classifications and Compliance

Pakistan must also improve regulatory compliance and technical standards to maintain competitiveness. Credibility and efficiency will be increased through national technical codes that refer to IMO regulations, partnerships with members of the International Association of Classification Societies (IACS), and digitalized flag administration procedures under the 2021 regulations.¹⁸¹

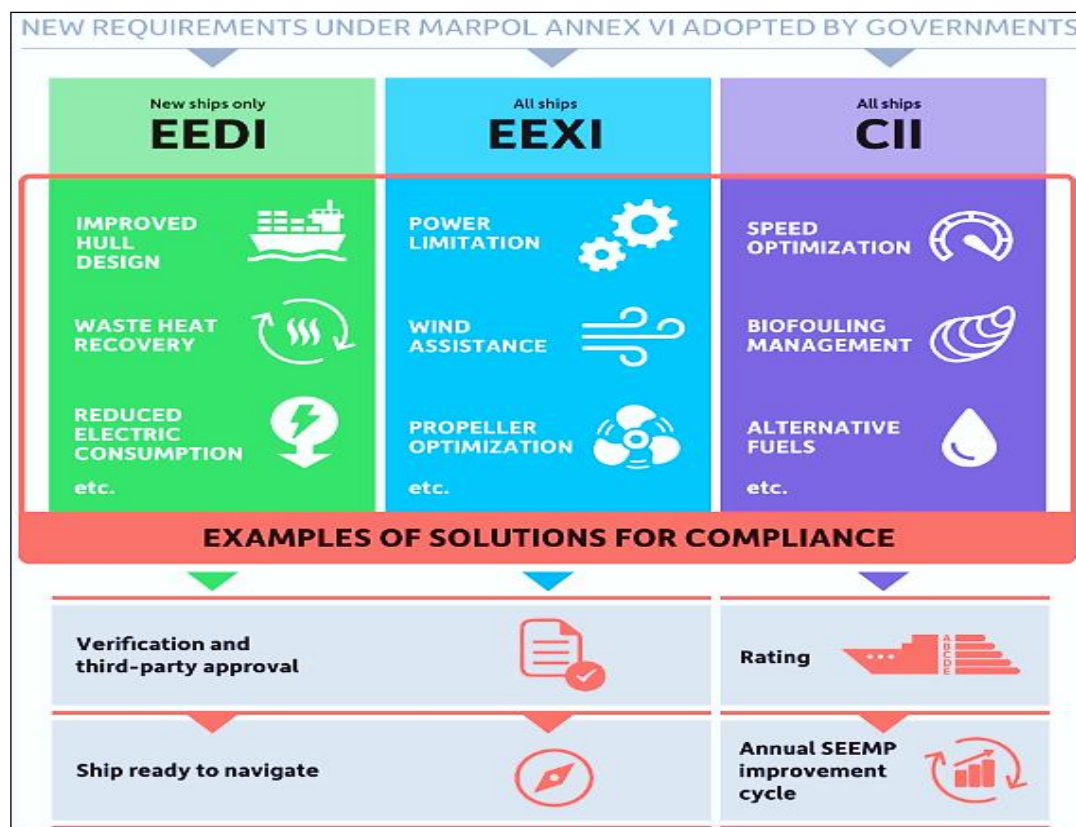


Figure 13: New requirements under MARPOL ANNEX VI adopted by governments

7.9 Workforce and Supplier Development

Development of the workforce and suppliers is equally important. Human capital will be strengthened by investments in welding, coatings, composites, and electrical/automation training facilities, as well as apprenticeship programs

¹⁸⁰ UNCTAD. 2024. Review of Maritime Transport 2024. Geneva: United Nations.

¹⁸¹ Ministry of Maritime Affairs. 2021. Rules under Merchant Shipping Ordinance, 2001. Government of Pakistan

linked to vessel deliveries. Value added connections will also be formed by growing domestic vendor networks for pipe fabrication, outfitting, and steel preparation.¹⁸²

7.10 Demand Creation at Home

Lastly, domestic demand generation is crucial. Domestic shipyards should be linked to the procurement of coastal vessels and small craft by the Pakistan Maritime Security Agency, ports, customs, and fisheries. Policy changes that encourage coastal shipping should require major renovations or domestic construction in order to meet local demand.^{183 184}

7.11 Governance: Delivery Unit and KPI's

A Shipbuilding Delivery Unit under the Ministry of Maritime Affairs should be set up to supervise these reforms. It would provide quarterly reports on key performance metrics like shipyard capacity, delivery schedules, green compliance, local supplier engagement, and workforce development. Reforms should be anchored in a governance framework to guarantee accountability and reduce policy drift.¹⁸⁵

7.12 Conclusion

The shipbuilding sector in Pakistan is at a turning point. The nation has an obligation and an incentive to improve its shipbuilding and repair capabilities because of its extensive coastline, expanding national fleet, and growing participation in international maritime trade. But progress has been slowed by decades of inconsistent policy, an excessive reliance on a single state-owned yard, inadequate funding sources, and a lack of workforce development. The IMO's 2023 GHG Strategy and the Hong Kong Convention's impending enforcement in 2025, in particular, present new opportunities for nations that

¹⁸² Business recorder. 2024. "A Brief Overview: Karachi Shipyard & Engineering Works." Business Recorder, October 2024. <https://www.brecorder.com/news/40333413>

¹⁸³ Pakistan National Shipping Corporation (PNSC). 2019. Merchant Marine Policy 2001 (Amended 2019). Karachi: PNSC

¹⁸⁴ Business Recorder. 2024. "Draft Shipping Levy Relief to Attract New Pakistani Owners." Business Recorder, November 2024.

¹⁸⁵ UNCTAD. 2024. Review of Maritime Transport 2024. Geneva: United Nations.

can offer shipbuilding and repair services that are sustainable, competitive, and compliant.^{186 187 188}

Adopting a thorough National Shipbuilding and Repair Strategy, updating current yards, and encouraging private involvement in the industry are the keys to the future. Pakistan can become a dependable regional hub by prioritizing repair and retrofit services, tying financial incentives to performance, and coordinating domestic practices with international decarbonization standards. According to international conventions, the concurrent development of the Gadani ship recycling sector presents a special chance to incorporate sustainability throughout the vessel lifecycle.

Accordingly, the industry's expansion will rely on the cooperation of human capital, technology, finance, and policy. Stronger technical standards, collaborations with international classification societies, and demand creation through public procurement and coastal shipping revival will all contribute to workload stabilization and the development of international credibility. The shipbuilding and repair industry can transform from a state-subsidized enterprise into a globally acknowledged contributor to employment creation, maritime sustainability, and national economic growth if Pakistan successfully executes these reforms.

¹⁸⁶ International Maritime Organization (IMO). 2025. Recycling of ships and the Hong Kong Convention <https://www.imo.org/en/mediacentre/hottopics/pages/recycling-of-ships-and-hong-kong-convention.aspx>

¹⁸⁷ International Maritime Organization (IMO). 2023 IMO GHG Strategy on Reduction of GHG Emissions from Ships. <https://www.imo.org/en/ourwork/environment/pages/2023-imo-strategy-on-reduction-of-ghg-emissions-from-ships>

¹⁸⁸ UNCTAD. 2024. Review of Maritime Transport 2024. Geneva: United Nations.

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