THE SHIPBUILDING INDUSTRY IN INDIA: STRATEGIC GROWTH AND COMPETITIVE ANALYSIS

Submitted to the School of Maritime Management, Indian Maritime University in partial fulfillment for the award of a degree in MBA International Transportation & Logistics Management

Submitted

By

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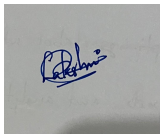
MAY 2024

DECLARATION

I, **Lakshmi C B** student of the School of Maritime Management, Indian Maritime University –Chennai Campus, hereby declare that this Project report titled **The Shipbuilding Industry inIndia: Strategic Growth and Competitive Analysis** submitted in partial fulfillment of the requirement for the degree of Master of Business (MBA) in International Transportation & Logistics Management is my original work carried under the guidance of my project guide. It has not formed the basis for the award of any Degree/Diploma of any University/Institution. The information submitted is true and original to the best of my knowledge.



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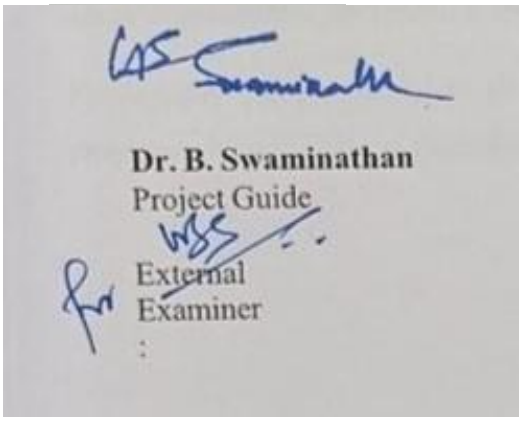
Place: Chennai

Date: 07 May 2024

CERTIFICATE

This is to certify that the project report entitled '**The Shipbuilding Industry in India: Strategic Growth and Competitive Analysis**' submitted to the School of Maritime Management, Indian Maritime University, Chennai Campus., in partial fulfillment for the award of the degree of Master of Business Administration (MBA) in International Transportation & Logistics Management, is a record of work carried out entirely by **Lakshmi C B,** Reg. No. **2203305017.**



Place:
ChennaiDate:

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I would also like to extend my gratitude to the Indian Maritime University, Chennai Campus, and especially to all the Professors in the Department of SMM. Their dedication to providing all the necessaryresources for research and project work has been invaluable.

Finally, my sincere thanks to all the non-teaching staff and fellow students of the university. Their cooperation and kindness throughout my time there are greatly appreciated.

ABSTRACT

The shipbuilding industry in India is undergoing a transformative phase, presenting opportunities for strategic growth and competitive advancement on the global stage. This research project aims to provide a comprehensive analysis of the Indian shipbuilding sector, focusing on four key objectives.

Firstly, it evaluates the existing capabilities, capacities, and technological adoption within the Indian shipbuilding landscape to establish a baseline understanding of the industry's current production potential.

Secondly, it identifies potential growth areas within the industry while examining challenges that may impede development, including technological gaps, skilled labor shortages, and competitive pressures.

Thirdly, the study compares the Indian shipbuilding industry against leading global players, assessing efficiency, innovation, and market share to provide insights into India's positioning in the international market.

Lastly, the research provides actionable recommendations and investment strategies to enhance India's competitiveness and stimulate sustainable growth within the shipbuilding sector

By adopting a systematic approach and utilizing rigorous analysis, this project offers valuable insights for stakeholders, policymakers, and industry leaders seeking to navigate the complexities of the Indian shipbuilding industry and capitalize on emerging opportunities for strategic advancement.

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LIST OF ABBREVIATIONS

DGS	Director General of Shipping
IRS	Indian Register of shipping
IMO	International Maritime Organization
IFVCP	Indian Flag Vessel Construction Policy
TAFS	The Technology Acquisition Fund Scheme
GST	Goods and Service Tax
ECGC	Export Credit Guarantee Corporation
TUFS	Technology Upgradation Fund Scheme
OEMS	Original Equipment Manufacturers
NMDP	National Maritime Development Programme
DWT	Deadweight Tonnage
LNG	Liquified Nitrogen Gas
HDPEL	Hooghly Dock & Port Engineers Ltd
CSL	Cochin Shipyard Limited

HSL	Hindustan Shipyard Ltd
MDL	Mazagaon Dock Shipbuilders Ltd
GRSE	Garden Reach Shipbuilders and Engineers Limited
INSA	Indian National Shipbuilders Association
OECD	Organization for Economic Cooperation and Development
CAD	Computer-aided Design

CHAPTER-I
INTRODUCTION

1.1. Meaning and Definition

India and the sea share a bond as ancient as time itself. From the Indus Valley Civilization's voyages to Mesopotamia to the Chola Dynasty's maritime dominance, the subcontinent has always been inextricably linked to the ocean's ebb and flow. This intimate relationship finds its most tangible expression in the art of shipbuilding, a practice that transcends mere construction, becoming a cultural keystone and economic powerhouse**.**

Shipbuilding in India can be understood as a symphony of diverse elements, each playing a crucial role in the final composition. At its core lies the naval architect, the visionary who transform**s** ideas into blueprints, meticulously calculating the ship's form, stability, and performance. This blueprint then becomes the conductor, guiding skilled shipbuilders, the hands that breathe life into steel and wood, meticulously welding plates, laying keels, and erecting towering structures. But a ship is not just a lifeless shell; it needs innumerable engineers and technicians who meticulously install the intricate network of engines, navigation systems, and life-support equipment, transforming it into a self-contained microcosm.

Beyond the technical aspects, shipbuilding in India is deeply woven into the fabric of its cultural heritage**.** From the ancient ballads of sailors to the vibrant coastal communities, the sea and its vessels hold a special place in the collective consciousness. This cultural connection fosters a tradition of craftsmanship**,** passed down through generations, where each weld and rivet carry the legacy of ancestors who braved the waves before.

However, the significance of shipbuilding extends far beyond cultural preservation. It serves as a vital pillar of India's economy, generating employment, fostering technological advancements, and contributing significantly to international trade. From bustling shipyards like Cochin Shipyard Limited and Larsen & Toubro Shipbuilding Limited to the smaller, yet crucial, ancillary industries, shipbuilding forms a complex ecosystem that supports countless livelihoods. Looking forward, the future of shipbuilding in India is brimming with potential and innovation**.**

The focus is shifting towards green technologies, with an emphasis on energy-efficient designs and sustainable materials. The industry is also embracing digitalization**,** utilizing advanced software and robotics to streamline processes and enhance efficiency. This forward-thinking approach positions India as a key player in the global shipbuilding landscape, poised to contribute significantly to the future of maritime transportation.

In conclusion, shipbuilding in India is not just an industry; it's a saga of human ingenuity, cultural heritage, and economic progress**.** It's a testament to the nation's ability to harness the power of the sea, not just for navigation and trade, but for building a brighter future. As India continues to navigate the ever-changing waters of the maritime world, its shipbuilding industry stands as a beacon of innovation, resilience, and a deep connection to the ocean's boundless potential.

1.1.1 Definition of Shipbuilding

Shipbuilding is the process of designing and constructing ships, including everything from small fishing boats to enormous cargo vessels and cruise ships. It is a complex and multi-disciplinary field that requires a range of skills and expertise, including naval architecture, marine engineering, and materials science.

The history of shipbuilding dates back thousands of years, with evidence of ancient civilizations constructing boats and ships for transportation, fishing, and warfare. However, it was during the Industrial Revolution that shipbuilding became a major industry, with the development of new technologies and materials enabling the construction of larger and more complex vessels.

Figure 1.1: Shipyard

Source: Wikipedia

The shipbuilding process typically begins with the design phase, where naval architects use computer-aided design (CAD) software to create detailed plans for the vessel. These plans take into account a range of factors, such as the ship's intended use, its size and shape, and the materials that will be used in its construction.

Once the design is finalized, construction can begin. The first step is to build the ship's frame, which is typically made from steel or aluminum. The frame provides the basic structure for the ship and is constructed using a combination of welding and riveting techniques.

Once the frame is in place, the ship's hull can be constructed. The hull is the outermost layer of the ship and is designed to be strong and watertight. Depending on the size and shape of the vessel, the hull may be constructed using a single piece of steel or aluminum or may be made up of multiple sections that are welded together.

After the hull is complete, the ship's propulsion system can be installed. This typically includes engines, propellers, and other equipment necessary to power the vessel. In addition, the ship's electrical and plumbing systems are installed at this stage.

Once the ship is fully constructed, it undergoes a series of tests to ensure that it is seaworthy and meets all safety standards. This may include tests of the ship's stability, maneuverability, and speed, as well as tests of its safety equipment and emergency procedures.

Shipbuilding is a highly specialized field that requires a range of skills and expertise. Naval architects are responsible for designing ships that are safe, efficient, and functional, while marine engineers are responsible for ensuring that the ship's propulsion and other systems are reliable and efficient. Materials scientists play an important role in selecting the right materials for the ship's construction, taking into account factors such as weight, strength, and corrosion resistance.

In addition to these technical skills, shipbuilding also requires a range of other skills, such as project management, teamwork, and communication. Building a ship is a complex process that requires the coordination of many different workers and departments, and effective communication and collaboration are essential to ensure that the project is completed on time and within budget.

Shipbuilding is a global industry, with shipyards located around the world. Some of the largest shipbuilding countries include China, South Korea, and Japan, which are known for their

advanced technologies and highly skilled workforces. In addition to these countries, shipbuilding also takes place in Europe, North America, and other regions around the world.

Overall, shipbuilding is a complex and highly specialized field that plays an important role in global trade and transportation. From small fishing boats to massive cargo vessels, ships are essential for transporting goods and people around the world, and shipbuilding is an essential industry that helps to ensure that these vessels are safe, efficient, and reliable.

1.1.2 Significance of Shipbuilding in the Economy

The rhythmic clang of metal, the acrid scent of welding fumes, and the colossal forms taking shape on the docks paint a vivid picture of the shipbuilding industry. More than just an industrial undertaking, shipbuilding holds immense significance for a nation's economy, impacting diverse sectors and shaping its global standing. This section delves into the multifaceted importance of shipbuilding, both globally and with a specific focus on India.

Ships are the lifeblood of international trade, responsible for transporting over 90% of global merchandise. As such, shipbuilding directly supports this vital activity by constructing and maintaining the fleet that keeps the world's commerce flowing. This translates into significant employment generation, with studies suggesting that for every direct job created in shipbuilding, another 4-9 jobs are generated in supporting industries. The industry also acts as a hotbed for technological innovation, driven by the need for efficiency, safety, and environmental sustainability. These advancements benefit not only shipbuilding but also other sectors like energy, manufacturing, and transportation. Finally, the global shipbuilding industry contributes significantly to national GDPs, particularly for maritime nations. According to a 2020 report by the Organization for Economic Co-operation and Development (OECD), shipbuilding and related industries contribute an average of 0.5% to GVA (Gross Value Added) in OECD countries.

For India, with its vast coastline and growing maritime interests, a strong domestic shipbuilding industry is not just an economic driver, but a strategic imperative. It plays a crucial role in national security by constructing warships, submarines, and coast guard vessels, ensuring territorial integrity, and safeguarding maritime interests. Beyond security, the industry contributes significantly to economic growth, with a direct and indirect economic impact

exceeding INR 3 lakh crore ($40 billion) and employing over 1.5 million people as per a 2023 report by the Indian National Shipbuilders' Association (INSA). Recognizing its export potential, the government's "Make in India" initiative aims to position India as a competitive global player, while fostering skill development and creating a multiplier effect by stimulating growth in numerous ancillary industries.

Despite its significance, the shipbuilding industry faces challenges. Global competition from established players puts pressure on Indian shipyards to offer competitive prices and quality. Continuous investment in research and development is crucial to keep pace with advancements in technologies and maintain global competitiveness. Addressing the skill gap through targeted training programs and streamlining regulations are essential to attract investments and promote industry growth.

However, the future presents exciting opportunities. India can capitalize on its strengths and develop expertise in niche markets like offshore vessels and inland waterways vessels. Embracing sustainable practices and building eco-friendly ships can cater to the growing global demand for clean technologies. Implementing Industry 4.0 technologies like automation and data analytics can enhance efficiency and productivity. Finally, collaboration with international players can bring in advanced technologies and expertise, fostering knowledge sharing and joint ventures.

Shipbuilding is not just an industry; it's a strategic imperative for nations seeking economic prosperity, security, and global competitiveness. With a clear vision, continued investment, and concerted efforts to address challenges, the Indian shipbuilding industry can navigate the choppy waters and emerge as a major player on the global maritime stage, contributing significantly to the nation's economic growth and self-reliance.

1.2 Shipbuilding Trends

The shipbuilding industry has undergone significant changes and trends in recent years, driven by a range of factors such as advancements in technology, changing global economic conditions, and evolving regulatory requirements.

One of the most significant trends in shipbuilding is the increasing use of digital technologies and automation. Shipbuilders are increasingly relying on computer-aided design (CAD) and

other digital tools to design and plan ships, as well as using automation and robotics to improve efficiency and reduce costs in the construction process.

Another important trend is the increasing demand for environmentally friendly and energy-efficient ships. In response to growing concerns about climate change and air pollution, shipbuilders are developing new technologies and materials to reduce emissions and improve energy efficiency. This includes the use of hybrid and electric propulsion systems, as well as the development of lighter and stronger materials that can improve fuel efficiency and reduce emissions.

In addition, there is a growing trend towards larger and more complex ships, particularly in the container shipping and cruise industries. This has driven innovation in shipbuilding and engineering, as designers and builders work to create vessels that are both larger and more efficient, while still maintaining high levels of safety and reliability.

Another important trend is the increasing use of modular construction techniques. Modular construction involves building ship components and modules in a factory or workshop, and then assembling them on-site. This can improve efficiency and reduce costs, as well as provide greater flexibility in the construction process.

Finally, there is a growing focus on safety and quality in shipbuilding. In response to several high-profile accidents and incidents in the industry, shipbuilders and regulators are placing greater emphasis on safety and quality management systems, with a particular focus on risk management and prevention.

Overall, the shipbuilding industry is undergoing significant changes and trends, as designers and builders work to meet the evolving needs of customers and regulators, while also addressing growing concerns about sustainability and safety.

1.2.1 Historical Overview of Shipbuilding Trends

The history of shipbuilding is a testament to human ingenuity and the quest for exploration, trade, and (SATISH, 2023) (SATISH, 2023) (SATISH, 2023)military dominance. Ancient civilizations like the Egyptians, Phoenicians, Greeks, and Romans pioneered boat construction techniques, crafting vessels primarily from wood for purposes ranging from trade to warfare. These early

ships were propelled by oars or sails and laid the groundwork for the maritime traditions that would follow.

As the medieval and Renaissance periods unfolded, shipbuilding techniques in Europe continued to evolve. The emergence of shipyards, advancements in tools, and innovations like the sternpost rudder propelled the construction of larger and more seaworthy vessels. Maritime powers such as Venice and Genoa thrived, while the Age of Exploration saw the rise of nations like Portugal and Spain, venturing into uncharted waters in search of new trade routes and territories.

The subsequent Age of Sail, spanning from the 15th to the 19th centuries, witnessed the zenith of sailing ship technology. Galleons, frigates, and clippers dominated the seas, facilitating global trade, exploration, and naval conquests. Shipbuilding flourished, with improvements in rigging, hull design, and navigation instrumentation enhancing the capabilities of these majestic vessels.

The Industrial Revolution brought about revolutionary changes in shipbuilding with the advent of steam power, iron, and later, steel construction. Steam engines transformed propulsion, leading to the era of steamships capable of faster and more reliable voyages. Iron and steel hulls replaced traditional wooden ones, offering superior strength, durability, and capacity for larger vessels.

In the modern era, shipbuilding has become increasingly sophisticated and globalized. Countries like South Korea, China, and Japan have emerged as leaders in the industry, investing in state-of-the-art facilities, technology, and workforce training. Specialized vessels, including container ships, oil tankers, and cruise liners, incorporate advanced materials, propulsion systems, and navigation technologies to meet the demands of a rapidly evolving global economy.

Moreover, environmental considerations have become paramount, driving efforts to adopt eco-friendly shipbuilding practices and cleaner propulsion technologies. Regulations such as the International Maritime Organization's MARPOL convention aim to mitigate the environmental impact of shipping operations, promoting sustainability and conservation in the maritime industry.

In essence, the historical trajectory of shipbuilding reflects a dynamic interplay between technological innovation, economic imperatives, and environmental stewardship, shaping the maritime landscape and influencing the course of human history.

1.2.2 Contemporary Trends in Shipbuilding

In contemporary shipbuilding, several trends are shaping the industry, reflecting advancements in technology, changing market demands, and evolving regulatory landscapes. One prominent trend is the increasing focus on sustainability and environmental responsibility. Shipbuilders are incorporating eco-friendly materials, adopting energy-efficient propulsion systems, and implementing measures to reduce emissions and minimize ecological impact. This includes the development of hybrid and electric propulsion technologies, the use of alternative fuels such as liquefied natural gas (LNG) and hydrogen, and the integration of waste management and ballast water treatment systems to enhance environmental performance.

Another key trend is the growing demand for specialized vessels tailored to specific market needs. This includes offshore support vessels for the oil and gas industry, container ships optimized for efficient cargo transportation, and cruise liners equipped with luxury amenities and entertainment facilities. Shipbuilders are leveraging advanced design and engineering techniques to create vessels that offer superior performance, safety, and comfort while meeting the unique requirements of diverse sectors and applications.

Additionally, digitalization and automation are revolutionizing shipbuilding processes, leading to increased efficiency, productivity, and cost-effectiveness. The adoption of digital twin technology allows shipbuilders to create virtual replicas of vessels, enabling real-time monitoring, simulation, and optimization of ship performance throughout the design, construction, and operational phases. Robotics and artificial intelligence (AI) are being employed to automate repetitive tasks, enhance precision and accuracy, and streamline production workflows, reducing labor costs and accelerating project timelines.

Moreover, globalization continues to reshape the shipbuilding landscape, with emerging economies like China, South Korea, and Japan becoming major players in the global market. These countries boast world-class shipyards equipped with cutting-edge infrastructure and capabilities, enabling them to compete effectively on the international stage. Collaboration and partnerships between shipbuilders, suppliers, and technology providers across borders are becoming increasingly common, driving innovation, knowledge exchange, and industry best practices.

In conclusion, contemporary shipbuilding is characterized by a convergence of sustainability, specialization, digitalization, and globalization. As the industry embraces these trends, it is poised to address emerging challenges, seize new opportunities, and continue playing a crucial role in global trade, transportation, and maritime commerce.

1.3. Objectives

I. To identify the existing capabilities, capacities, and technological adoption within the Indian shipbuilding sector and establish a baseline understanding of what the industry can produce today.

II. To examine potential growth areas within the industry and identify the challenges that may hinder development, such as technological gaps, skilled labor shortages, and competition.

III. To analyze the Indian shipbuilding industry against leading global players, focusing on efficiency, innovation, and market share.

IV. To provide recommendations and investment strategies for enhancing India's competitiveness and growth in the shipbuilding sector.

1.3.1 Broad Objective of the Study

The overarching aim of this study is to conduct a thorough investigation into the shipbuilding industry within India, delving into both private and public sector entities. This inquiry encompasses a multifaceted analysis of various facets of the shipbuilding business, including but not limited to, the examination of order statistics, the tracking of delivered ships, and an assessment of the capacities of the companies involved. By scrutinizing these metrics, we aim to derive insights into the operational efficiency, market competitiveness, and overall performance of shipbuilding enterprises across the country. Moreover, this study seeks to elucidate the pivotal role that shipbuilding plays within India's maritime sector and its broader economy. Through a comprehensive review of industry dynamics, regulatory frameworks, and economic indicators, we endeavor to highlight the significance of shipbuilding as a strategic sector contributing to national development and global competitiveness. By synthesizing the findings derived from this comprehensive analysis, the study intends to provide stakeholders, policymakers, and industry practitioners with actionable insights and recommendations to foster growth, innovation, and sustainability within India's shipbuilding industry.

1.3.2 Specific Objective of the Study

The primary objective of this study is to conduct a comprehensive examination of the shipbuilding industry in India. In pursuit of this goal, the research will delve into various facets of shipbuilding, aiming to provide a thorough understanding of the sector's dynamics and significance within the country.

Complementing this primary objective are several secondary objectives. Firstly, the study seeks to analyze and contrast the shipbuilding activities between private sector and public sector companies operating within India. Through this comparative analysis, insights into the operational differences, strengths, and challenges of these entities will be gleaned.

Additionally, the research aims to scrutinize key business statistics, including orders received and delivered ships, across both public and private sector shipbuilding companies. This examination will offer valuable insights into the industry's performance, trends, and market competitiveness.

Furthermore, the study endeavors to assess the capacities of shipbuilding companies in India, encompassing their infrastructure, workforce capabilities, and technological advancements. Understanding the capabilities of these companies is crucial for evaluating their potential to meet market demands and compete on a global scale.

Moreover, the research intends to evaluate the significance of the shipbuilding industry within India's maritime sector and its broader economic landscape. By elucidating the industry's role in facilitating trade, fostering industrial growth, and contributing to employment generation, this analysis will underscore its strategic importance.

Finally, the study aims to compile and present its findings coherently, offering actionable insights and recommendations for stakeholders, policymakers, and industry participants. These findings will not only contribute to the body of knowledge on shipbuilding but also serve as a valuable resource for guiding future strategies and initiatives within the sector.

1.4 Scope of the Study

- This study analyses the present business conditions in India with private and public sector shipbuilding.

1.5 Research Methodology

- The data has been collected from secondary sources from the Ministry of Ports, Shipping ∧ Waterways. The data was collected for 5 years (2017-18 to 2022-23) for the study. The researcher has used simple percentage analysis and correlation for the study.

1.6 Data Collection

Secondary Data

- Administration reports or Annual reports
- Indian Port Association official website.
- Ministry of Ports, Shipping and Waterways official website.
- Books, magazines, and newspapers.
- Various publications of the central, state, and local government.
- Technical and trade journals.
- Official government websites.

1.7 Limitations

The limitations of the research are as follows:

- Limited period of the project.
- Sources for collecting data were very limited.
- The research is limited to the availability of data that was not provided by higher officials.
- The accuracy of data is limited due to the non-working of many nonmajor ports.
- Some of the data are also not available due to security reasons.

CHAPTER II
LITERATURE REVIEW

2.1. Review of Literature

- **Paper 1**

Agency and Structure in Shipbuilding: Practice and Social Learning Perspectives

Authors: Bendig, Charles D., and Marijo Gauthier -Bérubé

Date of Publication: January 31, 2023

This paper provides an overview of shipbuilding as a social enterprise in which highly competent laborers cooperate to construct intricate warships. The training ground used to be a hierarchical apprenticeship system. In shipyards, masters imparted knowledge to apprentices, creating a distinct social structure among these communities. Building on this basis, this research looks at the social dimensions of shipbuilding via the preservation of shipwreck timbers. It explores two particular cases: the social structure of French shipbuilders in the late 17th century, and Mediterranean shipbuilding techniques from the Medieval to Modern eras.

- **Paper 2**

Toward Efficient Merchant Shipbuilding Based on the Lean Production Methodology.

Authors: Jiang, Ge, Dingzhong Feng, and Weihang Zhu

Date of Publication: November 1, 2016

This paper provides an overview of the void in the research on shipbuilding methods and international convention observance in China. While previous studies examine shipbuilding processes, they do not specifically employ lean manufacturing methodologies to increase efficiency in Chinese merchant shipbuilding. To close this gap, the author suggests a brand-new approach that makes use of lean principles and the Shipbuilding Industry Standard Conditions. This approach does not address the more general engineering and procurement aspects; instead, it concentrates on optimizing the hull construction and merchant ship production processes.

- **Paper 3**

Shipbuilding Capacity Optimization Using Shipbuilding Demand Forecasting Model.

Authors: Wada, Yujiro, Kunihiro Hamada, and Noritaka Hirata

Date of Publication: October 8, 2021

This Paper recognizes the challenges faced by the shipbuilding sector, including erratic demand, fierce competition, and surplus capacity. Forecasts of demand are the basis for the Organization for Economic Co-operation and Development's (OECD) proposal to modify capacity. This method, however, has a drawback in that variations in capacity may affect demand. To close this gap, this study suggests a simulation system that combines a unique ship price prediction model with a demand forecasting model. This improved system dynamics model makes it possible to assess how different changes in shipbuilding capacity will affect the demand for ships in the future. Through simulations, the efficacy of the suggested system will be evaluated, opening the door to a more environmentally friendly method of managing shipbuilding capacity.

- **Paper 4**

Innovation ecosystem innovation coordination management of Chinese shipbuilding enterprises.

Authors: Xiao, Song, and Li Feng

Date of Publication: January 11, 2023

This Article Says While the importance of shipbuilding for China's maritime goals is well-known (see, for example, [source on China's shipbuilding and maritime strategy]), the majority of the research that has been done on promoting innovation in the sector has concentrated on specific elements. The study explores internal aspects such as an organization's R&D expenditure (see, for example, [source on enterprise innovation investment in shipbuilding]). However, there is a dearth of a comprehensive knowledge of the innovation ecosystem that takes into account both external and internal elements.

On analyzing the linking mechanism within the shipbuilding innovation ecosystem, this research fills this gap. It looks at the interactions between shipbuilding companies' internal innovation initiatives and the outside world. The goal of the research is to pinpoint areas that require

improvement by analyzing the overall coupling coordination degree. By recognizing the interconnectedness between a company's internal innovation potential and the external variables impacting it, this approach expands on the body of information already in existence. Additionally, the study explores the disparities in innovation coupling between various shipbuilding companies. Policymakers and business executives can benefit greatly from the insights this analysis can offer. Targeted interventions can be developed to boost the overall innovation ecosystem within China's shipbuilding sector by identifying the unique challenges that various stakeholders confront.

- **Paper 5**

Present Scenario of the Shipbuilding Industry in India

Authors: A. Mourougane

Date of Publication: August 5, 2020

This article says Even with India's financial strength (see, for example, [source on India's GDP and economic ranking]), the country's shipbuilding sector faces many difficulties. Previous studies provide insight into these constraints. Research shows that Indian shipyards are challenged by both technological and infrastructural shortcomings. While highlighting the significance of using automation and digitization for efficiency, highlights the necessity for modernization to manage complex vessels. The impact of government intervention on the industry is also examined. Research such as assesses previous financial support initiatives and suggests enhancements, whereas investigates the difficulties in implementing policies and the bureaucratic roadblocks that impede shipbuilding growth.

Research also looks at India's place in the international market. Research such as juxtaposes India's capability with rival nations, emphasizing the necessity of substantial expansion to get a greater portion of the market. Research on restricted involvement in particular segments, such as high-value warships, is presented. Based on this understanding, this study provides an extensive examination of the difficulties encountered by Indian shipyards. It looks at technical advancements, infrastructure constraints, and the efficacy of recent government initiatives. The objective of this article is to offer a comprehensive understanding of the barriers impeding the expansion of the shipbuilding sector by assessing both external and internal variables. This will

enable the formulation of effective strategies aimed at achieving a stronger position in the global shipbuilding scene.

- **Paper 6**

Increasing the efficiency of automation in shipbuilding and ship-repairing by building a control system using lean manufacturing principles

Authors: Sergey Sokolov, Alena Antonova, and Tatiana Knysh

Date of Publication: December 14, 2022

This article says Even though studies have acknowledged the difficulties caused by lengthy production cycles and low efficiency in shipbuilding (see, for example, [reference on challenges in shipbuilding]), they frequently concentrate on particular issues like personnel optimization or production planning. Previous studies examine lean manufacturing across a range of industries, emphasizing how effective it is in cutting waste and increasing productivity (e.g., [reference on lean manufacturing concepts]). But there hasn't been as much research done on its use in the particular setting of shipbuilding. Building on this understanding, this study suggests a revolutionary framework that combines lean principles with contemporary information technology, called the lean shipbuilding regime. It highlights how crucial production is. The project intends to contribute to the body of knowledge on increasing efficiency and minimizing production cycles in the shipbuilding sector by evaluating the effectiveness of this framework via case studies. For practitioners and policymakers looking to boost the sector's competitiveness, this can offer insightful information.

- **Paper 7**

Design of Environment Monitoring System on Shipbuilding Outdoor

Authors: Caiyun Liu, Dapeng Zhu, Shouchuang Shi, Li Teng3, Yong Ding and Jiajian He

Date of Publication: 2021

The Article Says painting ships is an essential phase of the building process, but it also draws attention to the significant environmental impact (e.g., emissions of volatile organic compounds) of this process (e.g., [reference on the environmental impact of shipbuilding painting]). It is widely known that the industry's current monitoring procedures are insufficient.

To close this gap, a novel environmental monitoring system made especially for outdoor shipbuilding painting activities is proposed in this research. Although there has been research on several environmental monitoring methods (e.g., [reference on environmental monitoring technologies]), there is a dearth of documentation on their use in the particular setting of outdoor shipbuilding painting.

This study explores the difficulties associated with data integration, communication, and setting emission criteria in this particular environment. The paper attempts to offer a workable solution for "green shipbuilding" by suggesting a mechanism that gets past these obstacles. This has the potential to greatly help the shipbuilding sector adopt more environmentally friendly procedures.

- **Paper 8**

Review of Global Naval Shipbuilding Trends and Lessons for the Indian Shipbuilding Industry

Authors: Kulkarni

Date of Publication: January 2, 2015

The Article Says the naval shipbuilding sector will see substantial growth in the next few decades, with investments expected to surpass $835 billion. This expected increase in demand is forcing countries to carefully examine their shipbuilding capacities. A wide range of stakeholders are commissioning specialist studies and research to obtain a thorough understanding of the industry and realize the strategic importance of a strong naval fleet. These thorough assessments seek to accomplish several important goals. First, they look for areas for improvement and important lessons acquired by analyzing recent naval construction programs. This information can be very helpful for planning future initiatives and allocating resources as efficiently as possible. Second, extensive capacity assessments are carried out in the research. They assess the workforce's skill set, the industry's current infrastructure, the robustness and dependability of the supplier ecosystem, and any potential roadblocks to the sector's expansion. These studies also explore several ways that the government and industry might work together to address the limitations that have been found in the establishment of policies. This cooperative approach encourages the development of practical solutions to problems and advances the industry. This work attempts to identify essential elements that are expected to have a major influence on the future

naval building and acquisition strategies by critically analyzing a number of these in-depth studies. The study also looks at new developments in naval architecture and construction technology, providing insightful analysis and possible lessons for the Indian shipbuilding sector. This paper aims to give policymakers and industry leaders in India useful guidance by synthesizing existing research and analyzing industry trends. This will enable them to make informed decisions and strategically position the country within the changing global naval shipbuilding landscape.

- **Paper 9**

Research on Dynamic Cooperative Replenishment Optimization of Shipbuilding Enterprise Inventory Control under Uncertainty

Authors: Ziquan Xiang, Jiaqi Yang, Muhammad Hamza Naseem, and Wenjie Ge

Date of Publication: February 12, 2022

The Article Says previous research (e.g., [reference on challenges in shipbuilding inventory control]) acknowledges the challenge of high inventory control costs in shipbuilding due to various uncertainties, current solutions frequently concentrate on particular aspects like isolated inventory control strategies or individual supplier relationships. This work fills this vacuum by putting forth a brand-new "dynamic collaborative replenishment model." There is a dearth of research on cooperative methods of inventory control in the shipbuilding sector. Although the benefits of cooperation in supply chains are widely acknowledged (see, for example, [source on collaborative inventory management]), there is less information available regarding its use in the particular setting of shipbuilding. By combining collaborative theory with the current understanding of integrated supply chain management, this study closes this gap. It builds a mathematical model to identify the best replenishment plans from two kinds of suppliers by utilizing statistics, probability, and optimization. This strategy seeks to maximize service levels while minimizing expenses. The study uses sensitivity analysis and numerical simulations to apply the model to the particular situation of paint inventory control to validate its efficacy. The encouraging findings imply that the suggested strategy may successfully handle the issues of high inventory control expenses and erratic demand in the shipbuilding sector. For practitioners

looking to improve inventory control tactics and promote cooperation within the shipbuilding supply chain, this study provides insightful information.

- **PAPER 10**

SWOT Analysis of China Shipbuilding Industry by Third Eyes

Authors: K.A. Hossain, N.M.G. Zakaria, M.A.R. Sarka

Date of Publication: online 19 September 2017

The article intends to explore the current state and prospects of global commercial shipbuilding. It delves into the inherent characteristics of the industry, highlighting its resilience through economic ups and downs. However, the paper emphasizes the crucial role of government support and political stability in navigating these cycles, given the high capital intensity of shipbuilding. Additionally, the paper explores the key factors driving the growth of the commercial shipbuilding market. This concise review effectively summarizes the paper's focus on the global commercial shipbuilding landscape, its inherent features, growth drivers, and the significance of external factors in navigating economic fluctuations. It effectively captures the paper's core themes within the desired word limit.

- **Paper 11**

Shipbuilding at Bombay

Authors: R.K. Kochhar

Date of Publication: This Article gives a general history of shipbuilding in Bombay, India, covering the period from the 18th century to the present. The study looks at the industry's rise and fall, technological developments, and the effects of international commerce and governmental regulations on Bombay's shipbuilding industry.

- **Paper 12**

Competitiveness of the Indian Ship Building Industry

Authors: K. Muthuchelvi Thangam, D. Sureshkumar

Date of Publication: JULY 2015

This Article explores the current expansion and historical background of the Indian shipbuilding sector. It draws attention to the industry's historical foundations and advantageous coastal position. The assessment highlights a significant change in the 1990s: a concentration on exports, especially in the specialized offshore sector, resulted from global trends including capacity limits elsewhere and India's cost competitiveness. It highlights the noteworthy expansion that the industry has undergone, with a compound annual growth rate of 8% and a tenfold rise in worldwide market share by 2011. The passage also highlights India's edge in the construction of offshore vessels because of the specialized nature of the sector and the aging global fleet. It also discusses the state of domestic shipbuilding, noting the growth in shipyard capacity and its emphasis on smaller ships intended for export. Overall, the analysis presents a favorable picture of the Indian shipbuilding sector, highlighting its advantages in terms of specialization, skilled labor, and strategic position.

- **Paper 13**

Foreign Direct Investment and the Shipbui0lding Industry: A Bangladesh Perspective

Authors: Khandaker Rasel Hasan, Md. Mashiur Rahaman, M. Ziauddin Alamgir,Hiromichi Akimoto

Date of Publication:2017

This Article takes a closer look at the shipbuilding sector in Bangladesh, examining its historical foundations, current developments, and potential futures. The assessment focuses on a long-standing custom that dates back to the 17th and 18th centuries, and then the mid-20th century saw the founding of the contemporary industry. An important turning point wasreached in 2008 when the first ocean-going ship was exported, demonstrating the industry's ability to compete internationally and support export diversification. The sector has the potential to develop to be worth billions of dollars in less than 10 years, which highlights how strategically important it is to economic expansion. The assessment does, however, stress the necessity of doing microeconomic research to pinpoint areas of competitive advantage and creating a strategic development plan that takes advantage of these advantages to fully realize this potential. Furthermore, it is believed that luring in Foreign Direct Investment (FDI) is critical to obtaining access to markets, knowledge, technology, and capital. Overall, the analysis paints a positive picture of Bangladesh's shipbuilding sector as

a viable avenue for economic growth, one that calls for internal planning, strategic concentration, and possible outside assistance.

- **Paper 14**

Value Engineering to Rework Reduction in Ship Building Project

Authors: Dr. Tushar N. Desai, Mr. S. R. Prajapati2 and Mr. Hitesh R. Patel

Date of Publication: 2016

This Article Discusses Value Engineering (VE) as a methodical and innovative approach to product or system analysis that is introduced in this paragraph. The research investigates the use of VE in shipbuilding to optimize the building process. The goal of VE is to maximize a ship's intended functionality at the lowest feasible cost while preserving critical attributes like safety, dependability, and performance. The article concentrates on the two main advantages of VE in shipbuilding: cycle time reduction and rework minimization. VE can expedite the building process and save time and money by detecting and removing pointless stages that result in rework. Furthermore, VE can aid in process and design optimization, cutting down on the total amount of time needed to finish a shipbuilding project. Overall, the assessment indicates that VE provides a strategic approach to shipbuilding by enhancing efficiency and cost-effectiveness and guaranteeing that key features are supplied at the best possible price without sacrificing quality.

- **Paper 15**

Energy consumption and convention in shipbuilding

Authors: Ch. Rajeswar Harish, Soumya K. Sunil

Date of Publication: July 7, 2015

This Article examines the environmental effects of shipbuilding, which also recognizes the critical role that maritime transportation plays in economic growth. It looks at a ship's life cycle and determines that the periods that use the most energy are shipbuilding, operation, and disassembly. The analysis goes into detail on how energy is used in shipbuilding. It divides it into four categories: direct material energy (energy contained in materials and their transportation), direct ship construction energy (activities like ship-specific welding), indirect or overhead energy (general shipyard operations not attributable to a specific ship), and establishment energy (building and maintaining the shipyard). The need to reduce energy usage during the shipbuilding process is

emphasized in the study. It suggests tactics include employing cutting-edge, energy-efficient machinery, employing alternative materials, and designing with optimal efficiency. It also emphasizes how shipyard output may be maximized and rework can be minimized to reduce Lastly, the assessment highlights the necessity for affordable recycling facilities while acknowledging the possibility of energy recovery through ship recycling.

- **Paper 16**

A Study on Global Shipbuilding Growth, Trend and Future Forecast

Authors: HOSSAIN, ZAKIR

Date of Publication:2017

This paper presents a study on the global shipbuilding industry, analyzing its growth and trends over the years, and making future forecasts. The research highlights key factors affecting the industry, such as economic conditions, technology, and regulations, and provides insights for stakeholders and policymakers.

2.2 Literature Gap

While there has been a significant amount of research on the Shipbuilding industry in India. The papers concentrate more on challenges faced by the Indian shipbuilding companies in India

Also, the different aspects of the Indian shipbuilding industry in India. This paper gives the idea of the ship building industry in the world such as total fleet statistics about the world fleet by country. Also, provides statistics about the Indian shipbuilding industry such as ships delivered and orders for the last few years. In the next steps, the study gives insight into problems faced by the Indian shipbuilding industry and opportunities for the Indian shipbuilding industry.

CHAPTERIII
SHIPBUILDING INDUSTRY

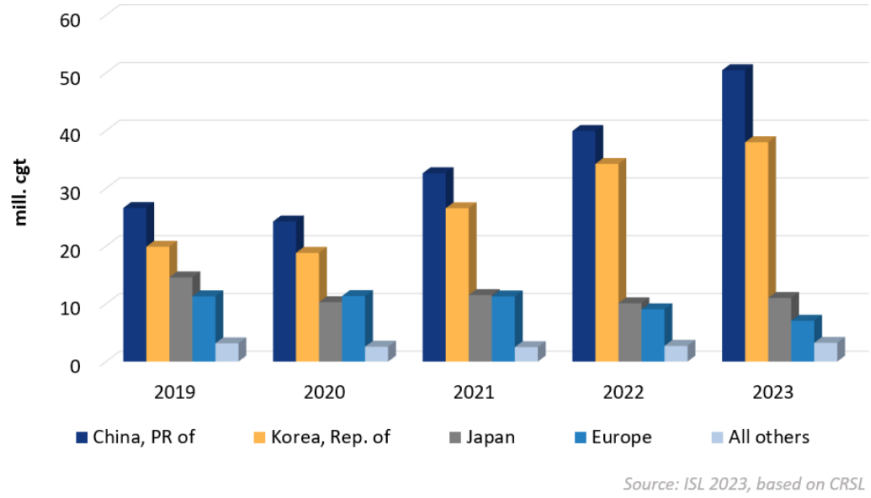
3.1. Shipbuilding Around the Globe

The world's shipbuilding sector builds ships that transport necessities across huge oceans, which is a major force behind international trade. Asia is the market leader, with China accounting for roughly half of all shipbuilding orders worldwide in 2021. While Europe specializes in producing opulent cruise ships and North America in building military boats, Asia is the leader in commercial shipbuilding.

The business is always changing. More cargo ships are needed due to increased trade, and environmentally friendly technology like LNG propulsion is being pushed by these demands. Shipyards are being digitalized and automated to increase productivity and safety. But problems still exist, like oversupply and geopolitical upheavals.

Future growth in the sector is anticipated due to rising trade and the demand for environmentally efficient boats. The future of shipbuilding is probably being shaped by themes like consolidation, digital transformation, and sustainable practices. We may anticipate more ecologically conscious and efficient ships in the future as the industry embraces innovation and overcomes obstacles, assuring a sustainable future for our oceans and the world economy.

Figure 3.1. World order book by Shipbuilding area 2019-2023 (cgt%)



Source: UNCTAD Fleet Review Report 2023

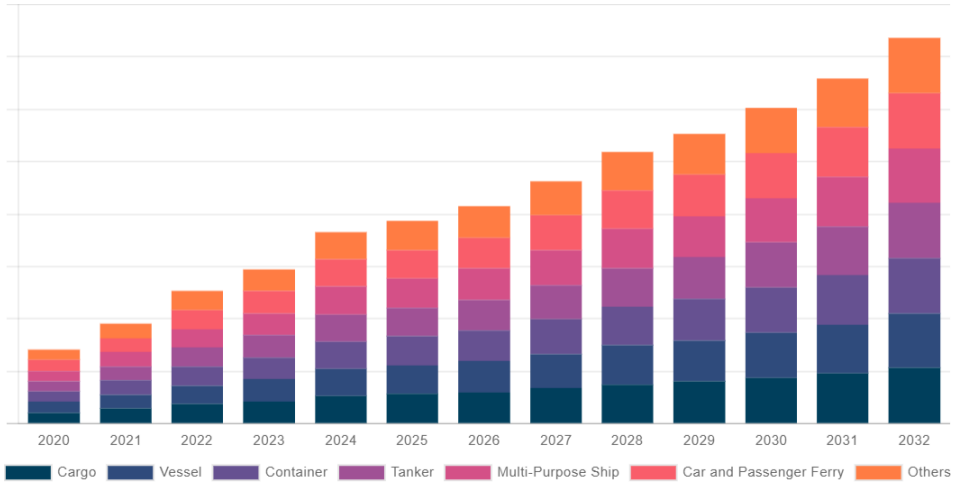
3.1.1. Overview of Global Shipbuilding Landscape

The shipping industry plays a vital role in international trade by moving an enormous number of resources and goods across huge oceans. This complex and ever-changing industry has many formidable obstacles in addition to tremendous potential. With a staggering 94% global share in shipbuilding and shipping, Asia is without a doubt in the lead. Within this Asian domination, three major players stand out: China, the unchallenged leader driven by economies of scale and government support; South Korea, a leader in technology with a focus on complex vessels; and Japan, a historical powerhouse with a workforce with advanced skills that excels in building sophisticated ships. Still, the terrain is not limited to Asia. Europe is strong in several areas; for example, German and Italian shipyards are industry leaders in the building of opulent cruise ships. North America focuses on military vessels and high-tech research ships.

The global shipping business is progressing due to several important factors. Increased demand for cargo ships is expected to fuel industry expansion as a result of growing worldwide trade. The industry is moving toward greener technologies, like LNG propulsion and better hull designs for lower emissions, due to concerns about sustainability. A technological revolution is also taking place in shipyards, where automation, robots, and digitalization are changing operations.0 Despite these encouraging developments, problems still exist. There have been times when the world market for shipbuilding was oversupplied, which prompted pricing pressure and severe competition. Moreover, supply lines can be disrupted and shipbuilding activity can be impacted by geopolitical volatility resulting from political instability and trade disputes.

Future expansion in the shipping industry is anticipated due to rising trade volumes and the pressing need for environmentally friendly ships. The future of this industry will probably be shaped by a few major themes. First and foremost, a focus on sustainable shipbuilding methods will be made, with particular attention on lowered emissions, energy efficiency, and alternative fuels. Second, when shipyards use digital technologies for design, building, and maintenance, they will optimize procedures and improve safety. This is where digital transformation will be critical. Lastly, the industry may continue to consolidate as a result of mergers and acquisitions, creating a smaller but more powerful group of companies.

Figure3.2. Market Size by Ship Type



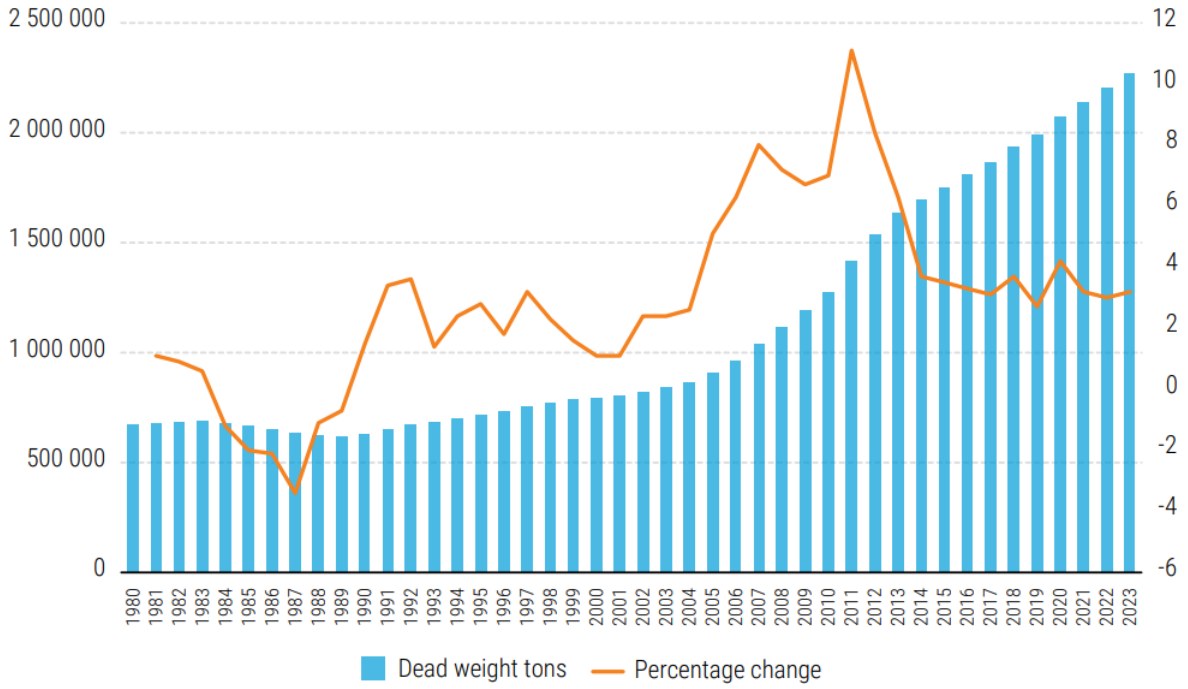
Source: UNCTAD Fleet Review Report 2023

3.1.2. The Annual Growth of Commercial World Fleet

The yearly growth of the commercial fleet in shipping is defined as the percentage increase in the overall capacity of ships or the number of ships engaged in commercial operations within a specific period. It is common to use this statistic to assess whether the commercial shipping industry is expanding or contracting. A positive yearly growth rate denotes an increase in fleet size, whereas a negative annual growth rate denotes a decrease in fleet size. The growth rate can be influenced by a wide range of factors, such as the status of the economy, the volume of international trade, technological advancements, alterations in laws, and patterns of investment in the shipping industry.

Monitoring the annual growth of the commercial fleet helps stakeholders better understand the overall state and dynamics of the shipping industry. It provides insights into market trends, capacity utilization, and potential opportunities and challenges. This data can be used by shipping companies, analysts, investors, and regulators to make educated decisions on industry planning, resource allocation, and fleet growth. As of January 2023, the world feet consisted of 105,493 vessels of 100 gross tons and above. In 2022, capacity expanded at an annual rate of 3.2 percent with overall tonnage hitting 2.27 billion dead weight tons (figure 3.3).

Figure 3.3. The World Fleet,1980-2023*(Thousand dead weight tons and annual percentage change)*



Source: UNCTAD Fleet Review 2023

3.1.3. Ownership of World Fleet

The ownership of the world fleet in the shipping industry is distributed among numerous countries and companies. Greece is among the top countries in terms of ship ownership, with Greek companies traditionally controlling a significant portion of the global fleet. Other significant players are Norway, China, Japan, South Korea, Germany, and China. These countries have made significant investments in the shipping industry and have a long history of maritime trade. In addition, a lot of multinational companies and multinational conglomerates from other countries are currently present in the maritime industry. These companies usually own or hire ships for their logistical needs or as part of their supply chain operations.

It's crucial to remember that different vessel types and market segments may have different ownership patterns. Certain industries, like tanker operations, dry bulk shipping, offshore support boats, LNG carriers, and container shipping, are the focus of several businesses. Due to a variety of factors, such as market trends, mergers and acquisitions, current economic conditions, and changes in regulatory requirements, the ownership landscape is dynamic and subject to change over time. Thus, it is imperative to examine the most recent industry journals

or specialized databases to obtain accurate and current information about who owns what fleet worldwide.

Table 3.1. *Ownership of World Fleet, by carrying capacity, national and foreign-flagged fleet, and dead weight tons in 2022.*

	Country or territory of ownership	Number of vessels			Dead weight tons				
		National flag	Foreign flag	Total	National flag	Foreign flag	Total	Foreign flag as a percentage of total	Total as a percentage of world dwt
1	Greece	598	4 332	4 936	51 976 486	341 036 573	393 033 425	86.8	17.4
2	China	5 997	2 791	8 839	121 809 591	179 066 943	301 997 355	59.5	13.4
3	Japan	950	3 069	4 023	37 438 045	200 224 252	237 673 376	84.2	10.5
4	Singapore	1 373	1 410	2 813	68 494 373	72 237 484	140 824 814	51.3	6.2
5	Hong Kong, China	842	979	1 842	72 339 321	44 542 059	117 287 467	38.1	5.2
6	Republic of Korea	816	869	1 696	17 588 035	79 517 595	97 144 236	81.9	4.3
7	Germany	184	1 971	2 156	6 834 385	70 143 305	76 980 906	91.1	3.4
8	Taiwan Province of China	151	892	1 054	6 279 703	52 197 018	58 549 256	89.3	2.6
9	United Kingdom	354	975	1 332	9 277 332	48 600 066	58 024 495	84.0	2.6
10	Norway	953	963	1 918	18 081 678	37 307 060	55 519 431	67.4	2.5
11	United States of America	771	978	1 758	10 113 981	40 386 816	51 194 895	80.0	2.3
12	Bermuda	NA	403	403	NA	50 220 307	50 220 307	NA	2.2
13	United Arab Emirates	125	1 152	1 285	577 123	39 125 947	39 732 861	98.5	1.8
14	Denmark	401	411	812	19 728 219	19 659 607	39 387 826	49.9	1.7
15	Switzerland	14	602	616	835 748	36 827 778	37 663 526	97.8	1.7
16	Türkiye	396	1 361	1 766	6 056 462	31 243 034	37 348 182	83.8	1.7
17	Monaco	NA	380	380	NA	36 770 160	36 770 160	NA	1.6
18	India	914	227	1 145	17 357 386	13 202 639	30 726 338	43.2	1.4
19	Indonesia	2 335	112	2 458	25 565 216	2 810 746	28 657 379	9.9	1.3
20	Cyprus	124	291	417	4 828 206	22 461 924	27 341 575	82.3	1.2
21	Belgium	87	210	297	8 453 189	18 243 329	26 696 518	68.3	1.2
22	Russian Federation	1 552	281	1 841	9 813 989	11 777 202	21 639 798	54.5	1.0
23	Islamic Republic of Iran	241	11	253	18 450 865	853 392	19 305 808	4.4	0.9
24	Kingdom of the Netherlands	663	527	1 190	5 396 634	12 290 136	17 686 770	69.5	0.8
25	France, Metropolitan	157	285	442	4 070 356	13 205 297	17 275 653	76.4	0.8
26	Saudi Arabia	172	121	295	13 140 826	3 497 829	16 642 449	21.0	0.7
27	Viet Nam	972	189	1 170	11 633 102	4 359 940	16 059 690	27.3	0.7
28	Italy	445	163	608	8 276 622	6 077 880	14 354 501	42.3	0.6
29	Brazil	297	84	382	4 688 557	9 592 958	14 287 015	67.2	0.6
30	Malaysia	432	161	607	6 664 042	3 248 351	9 959 308	32.8	0.4
31	Canada	220	155	376	2 703 233	7 014 300	9 718 017	72.2	0.4
32	Oman	4	59	64	5 558	8 049 447	8 055 151	99.9	0.4
33	Nigeria	210	75	291	3 953 197	3 973 143	7 947 869	50.1	0.4
34	Qatar	52	83	135	664 130	7 095 509	7 759 639	91.4	0.3
35	Kuwait	44	7	51	4 697 403	446 848	5 144 251	8.7	0.2
	Subtotal, top 35 shipowners	22 846	26 579	49 651	597 792 993	1 527 306 874	2 128 610 247	71.8	94.5
	Rest of the world unknown	*3 281*	*2 648*	*6 940*	*34 906 961*	*61 981 471*	*124 928 662*	*49.6*	*5.5*
	World	**26 127**	**29 227**	**56 591**	**632 699 954**	**1 589 288 345**	**2 253 538 909**	**70.5**	**100**

Source: UNCTAD Fleet Review 2023

***Table 3.2**: Ownership of the world fleet by commercial value (million US$),2022 main vessel types*

	Country or Territory of Ownership	Container Ships	Bulk Carriers	Oil Tankers	Offshore vessels	Ferries & Passenger Ships	Gas Carriers	General Cargo Ships	Chemical Tankers	Other/NA	Total
1	China	45 104	56 487	14 948	11 457	5 219	4 630	9 026	3 857	4 098	154 827
2	Greece	30 051	55 797	35 608	228	2 280	22 432	297	932	533	148 157
3	Japan	34 010	51 558	10 105	5 145	3 264	18 420	3 670	5 270	13 036	144 477
4	United States	5 230	5 385	5 056	14 119	50 999	1 553	1 626	963	1 035	85 966
5	Germany	52 934	8 072	1 800	666	10 100	1 572	5 211	762	533	81 649
6	Singapore	21 249	19 553	12 942	4 274	12	4 844	1 393	5 406	809	70 481
7	United Kingdom	17 232	5 717	4 095	14 218	5 507	7 212	1 016	1 552	3 788	60 336
8	Hong Kong, China	29 066	15 475	7 160	124	2 075	1 619	1 305	266	1 613	58 704
9	Norway	4 297	5 573	5 436	20 251	3 423	8 224	1 397	2 488	5 235	56 325
10	Republic of Korea	13 801	11 854	6 994	403	524	6 029	701	1 587	4 035	45 929
11	Switzerland	25 913	917	535	2 896	10 546	196	227	168	5	41 404
12	Denmark	26 742	1 858	3 439	1 675	1 169	2 170	903	825	152	38 932
13	Taiwan Province of China	22 435	10 703	1 410	128	71	351	550	223	112	35 983

Source: UNCTAD Fleet Review 2023

3.2. Shipbuilding Industry in India

India has a rich history of shipbuilding, going back to the days of ancient trade and naval construction. The shipbuilding sector in India now employs thousands of people and generates large amounts of income, making it a vital part of the nation's economy. With its 7,500 kilometers of coastline and advantageous location in the Indian Ocean, India is a prime destination for shipbuilding and other nautical endeavors. There are numerous significant shipyards in the nation, such as Mazagon Dock Shipbuilders Limited, Garden Reach Shipbuilders & Engineers, and Cochin Shipyard Limited.

The Indian government has launched several programs to encourage the nation's shipbuilding sector to expand. Launched in 2014, the 'Make in India' initiative seeks to draw international investment into the shipbuilding industry and support indigenous production. To promote private sector investment in the business, the government has additionally offered several incentives and subsidies.

India's shipbuilding sector has the potential to dominate the world in this area. It does, however, confront several difficulties, such as high operating expenses, a dearth of contemporary

technology, and fierce competition from other countries that produce ships, such as China, South Korea, and Japan. However, the shipbuilding sector in India is anticipated to expand and make a substantial contribution to the nation's economic development with the backing of government and private sector investment.

3.3. Shipbuilding Companies in India

There are both public and private sector businesses in India. India has eight shipbuilding public sector businesses. A brief synopsis of these businesses is provided below.

3.3.1. Public Sector Companies

In the context of shipbuilding in India, government-owned enterprises engaged in the design, building, maintenance, and repair of ships, boats, and other marine vessels are referred to as public sector firms. The Indian government owns these businesses, which were founded to encourage the growth of the nation's shipbuilding sector. Some of the major public sector companies in shipbuilding in India include

1) Garden Reach Shipbuilders and Engineers Limited (GRSE).
2) Mazagon Dock Shipbuilders Limited (MDL)
3) Hindustan Shipyard Limited (HSL)
4) Cochin Shipyard Limited (CSL)
5) Alcock Ashdown & Co. Ltd.
6) Goa Shipyard Ltd.
7) Hooghly Dock & Port Engineers Ltd.
8) Shalimar Works Ltd.

1. Garden Reach Shipbuilders and Engineers Limited (GRSE).

The public shipbuilding firm Garden Reach Shipbuilders and Engineers Limited (GRSE) is based in Kolkata, India. GRSE was founded in 1884 and has a long history of producing top-notch ships for both commercial and military applications.

The business specializes in the design and building of commercial boats such as bulk carriers, tankers, and passenger ships, as well as warships and auxiliary vessels for the Indian Navy and Coast Guard. GRSE has built a wide range of ships, including landing craft, patrol boats, corvettes, and frigates.

GRSE can construct cutting-edge ships with cutting-edge technologies and procedures because of its state-of-the-art shipbuilding facilities and infrastructure. The company employs highly qualified and experienced engineers, designers, and technicians who can complete challenging shipbuilding projects on schedule and under budget.
GRSE offers a variety of after-sales services, such as ship repair, maintenance, and refit, in addition to shipbuilding. The business has a reputation for providing high-quality goods and services and is dedicated to reaching high levels of customer satisfaction.

Overall, GRSE is an important player in the Indian shipbuilding industry, contributing to the country's economic growth and national security through the construction of advanced naval vessels and commercial ships

2. Mazagaon Dock Shipbuilders Limited (MDL)

Located in Mumbai, India, Mazagaon Dock Shipbuilders Limited (MDL) is a public-sector enterprise. One of India's top shipyards, it was founded in 1934 and specializes in building warships and submarines for the Indian Navy.

INS Khanderi, India's second Scorpene-class submarine, and INS Kalvari, India's first Scorpene-class submarine, are just two examples of the high-quality military boats that MDL has a long history of producing. Additionally, the shipyard was instrumental in building INS Vikrant, India's first aircraft carrier.

Apart from constructing warships and submarines, MDL also handles maintenance and repairs for both commercial and naval ships. The company can handle challenging shipbuilding projects because of its highly skilled crew and state-of-the-art facilities.

MDL collaborates closely with the Indian Navy and other governmental organizations to develop new technologies and capabilities as part of its commitment to advancing indigenization and self-reliance in the shipbuilding sector. The business has received multiple accolades for its superior shipbuilding work, most notably the Raksha Mantri's Award for Excellence in 2019.

3. Hindustan Shipyard Limited (HSL)

In Visakhapatnam, Andhra Pradesh, India, there is a public shipyard called Hindustan Shipyard Limited (HSL). HSL was founded in 1941 and has a rich history of shipbuilding, having built a wide range of vessels such as commerce ships, battleships, and submarines.

With a primary focus on building naval ships, HSL is well-known for producing top-notch ships for the Indian Navy. The shipyard has worked on several notable naval projects, such as the building of INS Rajput, India's first missile destroyer, and INS Arihant, the country's first nuclear submarine produced domestically. In addition to building ships, HSL offers regular maintenance, overhauls, and refurbishments as well as other ship repair and maintenance services. With its state-of-the-art infrastructure and facilities, the shipyard is equipped to handle maintenance and repairs on a variety of boats.

HSL has launched several efforts in recent years to modernize its business practices and boost its competitiveness in the international shipbuilding market. To increase production and efficiency, the shipyard has made investments in new technology and procedures. To further strengthen its capabilities, it has partnered with top international shipyards.

All things considered, HSL is a significant participant in the Indian shipbuilding market and a vital part of the country's maritime economy. HSL is well-positioned to continue growing and developing in the years to come because of its skilled personnel, cutting-edge facilities, and dedication to innovation.

4. Cochin Shipyard Limited (CSL)

Located in Kochi, Kerala, India, Cochin Shipyard Limited (CSL) is a shipyard owned by the government. Since its founding in 1972, CSL has grown to become one of India's top shipbuilding and ship repair yards, specializing in the construction of superior, cutting-edge ships.

Bulk carriers, tankers, offshore, passenger, and quick patrol vessels are just a few of the many types of vessels that CSL can build. The shipyard has produced several noteworthy ships, such as PRATHEEKSHA, the nation's first indigenous marine ambulance boat, and INS Vikrant, India's first indigenous aircraft carrier.

CSL offers ship repair and maintenance services, including dry docking and ship conversion, in addition to shipbuilding. The shipyard features dry docks that can handle boats up to 255 meters in length and 60 meters in breadth, as well as capabilities to accommodate vessels up to 125,000 DWT.

Thanks to its highly skilled personnel and commitment to research and development, CSL has

been able to provide its clients with cutting-edge technology and solutions. The shipyard is dedicated to sustainability and has taken several steps to lessen its impact on the environment, such as implementing green technologies and using renewable energy sources. Overall, Cochin Shipyard Limited has played a significant role in the development of India's shipbuilding industry and is a key contributor to the country's economy and national security.

5. Alcock Ashdown & Co. Ltd.

An English shipbuilding firm called Alcock Ashdown & Co. Ltd. was established in Rangoon, Burma (now Myanmar), in 1859. Subsequently, the business relocated to India, where it rose to prominence as one of the nation's top shipbuilders.

Alcock Ashdown & Co. Ltd. constructed a variety of ships, including tugs, dredgers, passenger ships, and cargo ships, during its peak in the early 20th century. By producing several warships and support vessels for the Indian government, the business has made a substantial contribution to the growth of the Indian Navy.

Alcock Ashdown & Co. Ltd. was involved in the shipbuilding industry as well as coal mining, jute manufacturing, and engineering. The company became one of the biggest employers in the area thanks to its success in these areas. Nevertheless, the business started having financial issues in the 1980s, and the Indian government eventually took control of it. Garden Reach Shipbuilders and Engineers Limited (GRSE) currently owns and runs the shipyard and is involved in the construction of a variety of boats for both military and commercial applications.

6. Goa Shipyard Ltd.

An Indian public sector firm called Goa Shipyard Limited (GSL) is dedicated to the design, building, and maintenance of ships, boats, and other marine vessels. GSL was founded in 1957 and is situated in the state of Goa on India's west coast.

To support its shipbuilding operations, the business maintains a state-of-the-art shipyard facility with cutting-edge machinery and infrastructure. GSL can construct a variety of vessels, such as utility landing craft, quick attack craft, patrol boats, and offshore patrol boats.

GSL provides ship maintenance and repair services in addition to shipbuilding. A committed group of engineers and technicians work for the company, offering a variety of maintenance and repair services for both commercial and defense vessels.

GSL has received multiple quality and safety certifications in recognition of its commitment to these areas. In addition, the business has won various accolades for its services to the Indian shipbuilding sector.

All things considered, Goa Shipyard Limited is a significant participant in the Indian shipbuilding market and has a track record of producing high-caliber products and services. The business has worked on numerous high-profile projects, such as building patrol boats for the Indian Coast Guard and landing craft utility ships for the Indian Navy.

7. Hooghly Dock & Port Engineers Ltd.

The public shipbuilding and engineering firm Hooghly Dock & Port Engineers Ltd. (HDPEL) is based in Kolkata, West Bengal, and serves the Indian subcontinent. Since its founding in 1937, the firm has designed, built, repaired, and maintained a wide range of maritime vessels, including barges, tugboats, dredgers, and floating cranes.

The shipyard of HDPEL is situated on the Hooghly River's bank and spans 50 acres, with an 800-meter waterfront. The shipyard features a slipway that can take boats up to 3,000 DWT and a dry dock that can handle boats up to 12,000 DWT.

The company employs approximately 700 professional workers, including designers, engineers, and technicians, all of whom have received the necessary training to provide clients with superior maritime engineering solutions. With a strong emphasis on innovation and technology, HDPEL has been updating its infrastructure and machinery regularly to meet shifting market demands. HDPEL is a shipbuilding company that also produces industrial and engineering goods such as steel structures, hydraulic cylinders, and cranes. With a reputation for excellence, dependability, and prompt delivery, the business has made a name for itself as one of India's top suppliers of marine engineering services.

8. Shalimar Works Ltd.

The main commercial activities of Shalimar Works Ltd., an Indian firm with its headquarters in Kolkata, are shipbuilding, ship repair, and fabrication. Since its founding in 1978, the business has developed into one of the major participants in the Indian shipbuilding sector. Small to medium-sized ships, including coastal tankers, tugs, barges, and fishing vessels, are the company's area of expertise. Additionally, the business provides maintenance and repair services for a variety of boats.

Apart from its shipbuilding and repair operations, Shalimar Works also fabricates structural steel and offers engineering services for commercial and industrial projects. The company employs a group of highly qualified engineers and technicians in addition to having a state-of-the-art shipyard with cutting-edge equipment.

In the Indian shipbuilding sector, Shalimar Works has established a solid name by prioritizing quality and client satisfaction. The company has built enduring relationships with many of its local and foreign clients by delivering a large number of vessels to them. All things considered, Shalimar Works Ltd. is a vibrant and forward-thinking business dedicated to the expansion and advancement of the shipbuilding sector in India.

3.3.2. Private Shipbuilding Companies in India

India is home to several private shipbuilding firms that build, maintain, and repair ships and other marine equipment. Major Indian private shipbuilding firms include some of the following:

1. ABG Shipyard Ltd.: One of India's top private shipbuilding firms, ABG Shipyard was founded in 1985. The company specializes in building bulk carriers, anchor-handling tug supply vessels, and offshore support vessels.
2. Bharati Shipyard Ltd.: Another well-known private shipbuilding firm in India, Bharati Shipyard focuses on building commercial ships such as tankers, dredgers, and bulk carriers. In addition, the company offers a variety of vessel repair and maintenance services.
3. Pipavav Defence and Offshore Engineering Company Ltd.: Pipavav Defence is a privately held shipbuilding firm that focuses on producing navy ships, such as patrol boats, frigates, and corvettes. The business also provides maintenance and repair services for navy ships.

4. . L&T Shipbuilding Ltd.: One of the biggest engineering and construction firms in India, Larsen & Toubro, is the parent company of L&T Shipbuilding. The company specializes in building sophisticated, high-value boats, including warships, offshore support vessels, and LNG carriers.
5. . Cochin Shipyard Ltd.: This organization operates in the public sector, but it also has a sizable private sector clientele. The company serves a broad spectrum of customers, including private sector businesses in India and beyond, by providing shipbuilding, repair, and maintenance services. These Indian private shipbuilding firms have a major impact on the expansion of the nation's maritime industry and its overall economic development.

CHAPTER IV

SHIPBUILDING INDUSTRY IN INDIA ANALYSIS

4.1. Shipbuilding Orders

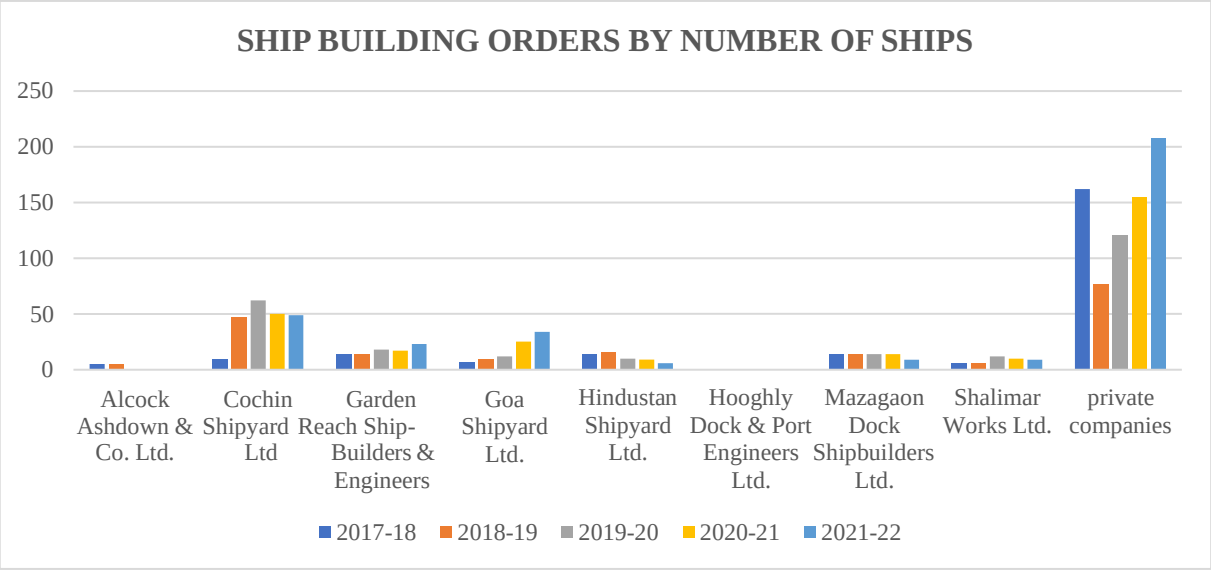
India had a growing shipbuilding industry, with several shipbuilding orders being placed. Here the data is collected from 2017-2022 for private and public shipbuilding companies in India.

Table 4.1: Shipbuilding orders by number of ships

Name of the companies	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**
Alcock Ashdown & Co. Ltd.	5	5	0	0	0
Cochin Shipyard Ltd	9	47	62	50	49
Garden Reach Ship- Builders & Engineers	14	14	18	17	23
Goa Shipyard Ltd.	7	9	12	25	34
Hindustan Shipyard Ltd.	14	16	10	9	6
Hooghly Dock & Port Engineers Ltd.	0	0	0	0	0
Mazagaon Dock Shipbuilders Ltd.	14	14	14	14	9
Shalimar Works Ltd.	6	6	12	10	9
TOTAL (public companies)	**69**	**111**	**128**	**125**	**130**
private companies	162	77	121	155	208
Total	**231**	**188**	**249**	**280**	**338**

Source: Ministry of Port and Shipping StatisticalReport

Figure 4.1: Shipbuilding orders by number of ships



Source: Ministry of Port and Shipping Statistical Report

The number of shipbuilding orders that different Indian businesses obtained between 2017–18 and 2021–22 is displayed in the table.

1. Public Companies: - Cochin Shipyard Ltd.: From 9 in 2017–18 to 62 in 2019–20, Cochin Shipyard has regularly received a sizable number of shipbuilding orders annually. With 49 orders in 2021–2022, the number remained quite high even though it declined slightly in the subsequent years.

- Garden Reach Ship-Builders & Engineers: Over the years, this company has demonstrated a consistent rise in shipbuilding orders, with a high of 23 orders in 2021–22 and a start of 14 orders in 2017–18.

- Goa Shipyard Ltd.: While the quantity of orders received by Goa Shipyard has varied over time, there has been a noticeable growth, going from 9 orders in 2018–19 to 34 orders in 2021–2022.

- Hindustan Shipyard Ltd.: While there have been significant variations in the quantity of orders received, there has been a general decline, going from 14 orders in 2017–18 to 6 orders in 2021–2022.

- Mazagaon Dock Shipbuilders Ltd.: Over the years, Mazagaon Dock Shipbuilders has demonstrated a rather stable order book for shipbuilding, with a minor decline from 14 orders in 2017–18 to 9 orders in 2021–2022.

- Other Public Companies: No shipbuilding orders were received by Alcock Ashdown & Co. Ltd., Hooghly Dock & Port Engineers Ltd., or Shalimar Works Ltd. within the allotted time.

2. Private Companies: - Although there has been some variation in the quantity of orders for shipbuilding, there has been an overall upward tendency. In 2021–2022, there were 208 orders, up from 77 in 2018–19.

3. Total: The overall number of orders for shipbuilding, from both public and commercial enterprises, has increased dramatically over time. From 231 orders in 2017–18 to 338 orders in 2021–22, it rose.

All things considered; the table shows the various amounts of shipbuilding orders that various Indian companies have gotten. It emphasizes the dominance of Cochin Shipyard Ltd. in terms of regularly obtaining a large volume of orders and the growing trend of private company orders for shipbuilding.

4.1.2 Shipbuilding Order by Dead Weight Tonnage

4.2: Shipbuilding orders by dead weight tonnage (in "000" DWT)

Name of the companies	**2018-19**	**2019-20**	**2020-21**	**2021-22**
Alcock Ashdown & Co. Ltd.	1.11	0	0	0
Cochin Shipyard Ltd	49.27	49.4	40.14	86.83
Garden Reach Ship- Builders & Engineers	8.4	8.72	8.88	8.91
Goa Shipyard Ltd.	5.74	4.38	4.54	5.31
Hindustan Shipyard Ltd.	58.32	4.8	1.45	1.32
Hooghly Dock & Port Engineers Ltd.	0	0	0	0
Mazagaon Dock Shipbuilders Ltd.	0	0	0	0
Shalimar Works Ltd.	0.83	2	1.4	1.4
TOTAL (public companies)	**123.67**	**69.3**	**56.41**	**103.77**
private companies	48.06	49.01	222.66	105.27
Total	**171.73**	**118.31**	**279.07**	**209.04**

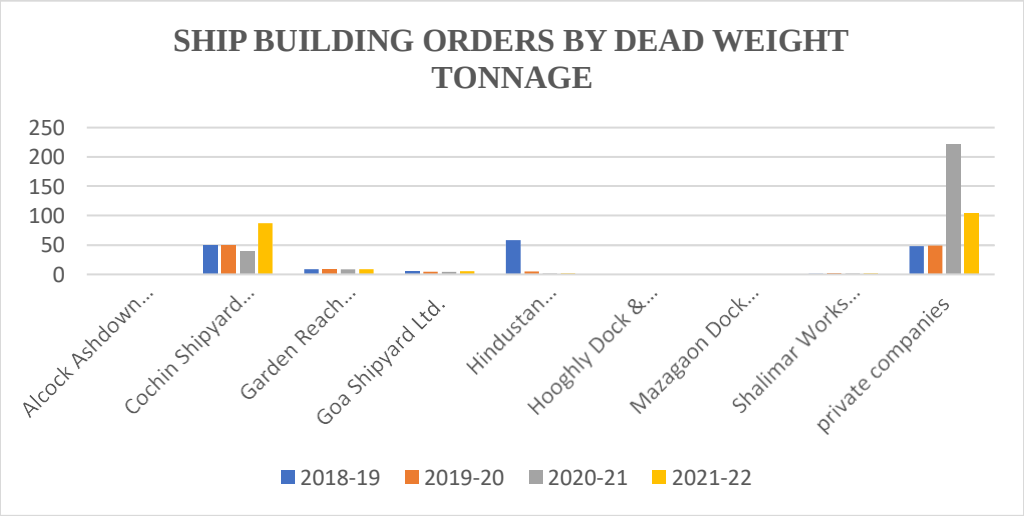
Source: Ministry of Port and Shipping Statistical Report

The table provided shows the value of shipbuilding orders received by various companies in India from the years 2018-19 to 2021-22.

1. Public Companies:

- Cochin Shipyard Ltd: Cochin Shipyard has consistently received a significant value of shipbuilding orders each year. The value increased from 49.27 in 2018-19 to 86.83 in 2021-22, with a slight dip in 2020-21. Cochin Shipyard remains a major player in terms of the value of shipbuilding orders.
- Garden Reach Ship-Builders & Engineers: The value of shipbuilding orders for Garden Reach Ship-Builders & Engineers has remained relatively stable over the years, ranging from 8.4 to 8.91.
- Goa Shipyard Ltd: The value of shipbuilding orders for Goa Shipyard has fluctuated, but thereis no significant increase or decrease during the specified period.
- Hindustan Shipyard Ltd: Hindustan Shipyard has experienced fluctuations in the value of shipbuilding orders. There was a significant decrease from 58.32 in 2018-19 to 1.32 in 2021-22.
- Other Public Companies: Alcock Ashdown & Co. Ltd., Hooghly Dock & Port Engineers Ltd., and Mazagaon Dock Shipbuilders Ltd. did not have any value of shipbuilding orders during thespecified period.

Figure 4.2: Shipbuilding orders by dead weight tonnage



Source: Statistical Report of Ministry of Port and Shipping

2. Private enterprises: - The value of shipbuilding orders has fluctuated for private shipbuilding enterprises. From 48.06 in 2018–19 to 222.66 in 2020–21, the value climbed; but, in 2021–2022, it decreased to 105.27.

3. Total Grand: - Over time, there have been fluctuations in the overall value of shipbuilding orders from public and private businesses. From 171.73 in 2018–19 to 279.07 in 2020–21, it rose; but, in 2021–2022, it fell to 209.04.

Overall, the data shows that there have been variations in the value of shipbuilding orders placed in India, with Cochin Shipyard Ltd. being a major contributor in terms of regularly obtaining high-value orders. The shipbuilding industry also includes a large number of private enterprises, while the value of their orders has shown more volatility. It's worth noting that the specific factors influencing the values can vary, such as the size and complexity of the vessels being built and the contractual terms agreed upon.

4.2. Ship Delivered

India has seen the delivery of various types of ships as its shipbuilding industry continues to grow

Table4:3: Number of Ships Delivered

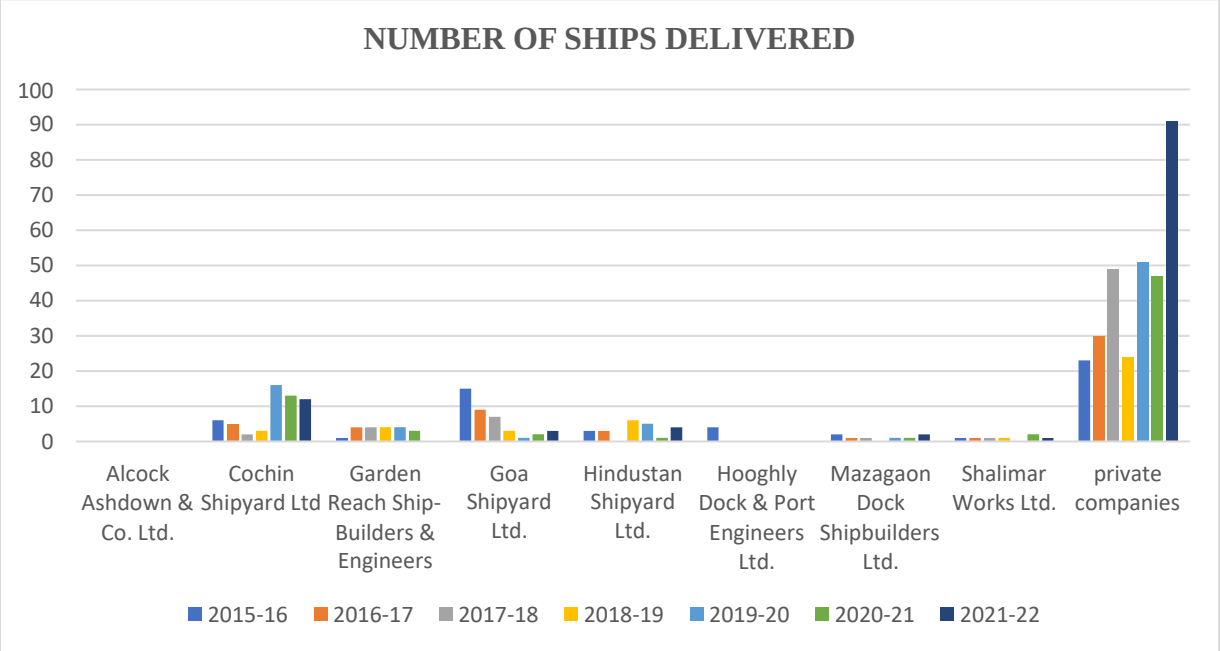
name of the companies	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Alcock Ashdown & Co. Ltd.	0	0	0	0	0	0	0
Cochin Shipyard Ltd	6	5	2	3	16	13	12
Garden Reach Ship-Builders & Engineers	1	4	4	4	4	3	0
Goa Shipyard Ltd.	15	9	7	3	1	2	3
Hindustan Shipyard Ltd.	3	3	0	6	5	1	4
Hooghly Dock & Port Engineers Ltd.	4	0	0	0	0	0	0
Mazagaon Dock Shipbuilders Ltd.	2	1	1		1	1	2
Shalimar Works Ltd.	1	1	1	1	0	2	1

Source: Ministry of Port and Shipping Statistical Report

1. Public Companies

- Cochin Shipyard Ltd.: Over the years, Cochin Shipyard has regularly delivered ships in a range of numbers. Ship deliveries varied from two in 2017–18 to sixteen at the highest point in 2019–20. The business delivered twelve ships in 2021–2022. Garden Reach Ship-Builders & Engineers: From three to four ships a year, with a dip to zero ships in 2021–2022, Garden Reach Ship-Builders has demonstrated a somewhat stable ship delivery rate.

figure 4.3: Number of ships Delivered



Source: Ministry of Port and Shipping Statistical Report

-Goa Shipyard Ltd.: Over the years, Goa Shipyard has delivered anywhere from one to fifteenships. The business delivered three ships in 2021–2022.

- Hindustan Shipyard Ltd.: The quantity of ships delivered by Hindustan Shipyard has fluctuated. The annual total varied from 0 to 6 ships, rising to 4 ships in 2021–2022.

- Other Public Companies: No ships were delivered within the allotted time by Hooghly Dock & Port Engineers Ltd., Mazagaon Dock Shipbuilders Ltd., or Alcock Ashdown & Co. Ltd.

2. Individual Businesses: - Private shipbuilding firms have produced a sizable number of ships, but at variable rates annually. In 2021–2022, the number of ships delivered varied from 23 to 91.
3. The total: - Over time, there have been fluctuations in the overall quantity of ships delivered, encompassing both governmental and private enterprises. It grew, with variations, from 55 in 2015–16 to 113 in 2021–2022.

Overall, the data indicates that both public and private shipbuilding companies in India have been involved in delivering ships. Cochin Shipyard Ltd. has consistently delivered a significant number of ships, while other companies have shown varying levels of delivery. Private companies have also made a substantial contribution to the total number of ships delivered.

4.2.1. Ship Delivered in Dead Weight Tonnage

Table 4.4: Ships Delivered in Dwt

Name of the company	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Alcock Ashdown & Co. Ltd.	0	0	0	0	0	0	0
Cochin Shipyard Ltd	1.5	45.54	0.12	0.15	1.03	2.29	36.47
Garden Reach Ship-Builders & Engineers	45	0.41	1.02	0.71	0.85	0.33	0
Goa Shipyard Ltd.	1.27	0.99	3.82	2	0.46	0.92	0.94
Hindustan Shipyard Ltd.	0.46	0.46		0.4	0.2	3.35	0.51
Hooghly Dock & Port Engineers Ltd.	0.24	0	0	0	0	0	0
Mazagaon Dock Shipbuilders Ltd.	0	0	0	0	0	0	0
Shalimar Works Ltd.	0.04	0.05	0.05	0.05	0	0.6	0.01
TOTAL (public companies)	**48.51**	**47.45**	**5.01**	**3.31**	**2.54**	**7.49**	**37.93**
private companies	94.53	80.54	105.35	21.46	28.72	22.79	71.75
Total	**143.04**	**127.99**	**110.36**	**24.77**	**31.26**	**30.28**	**109.68**

Source: Ministry of Port and Shipping Statistical Report

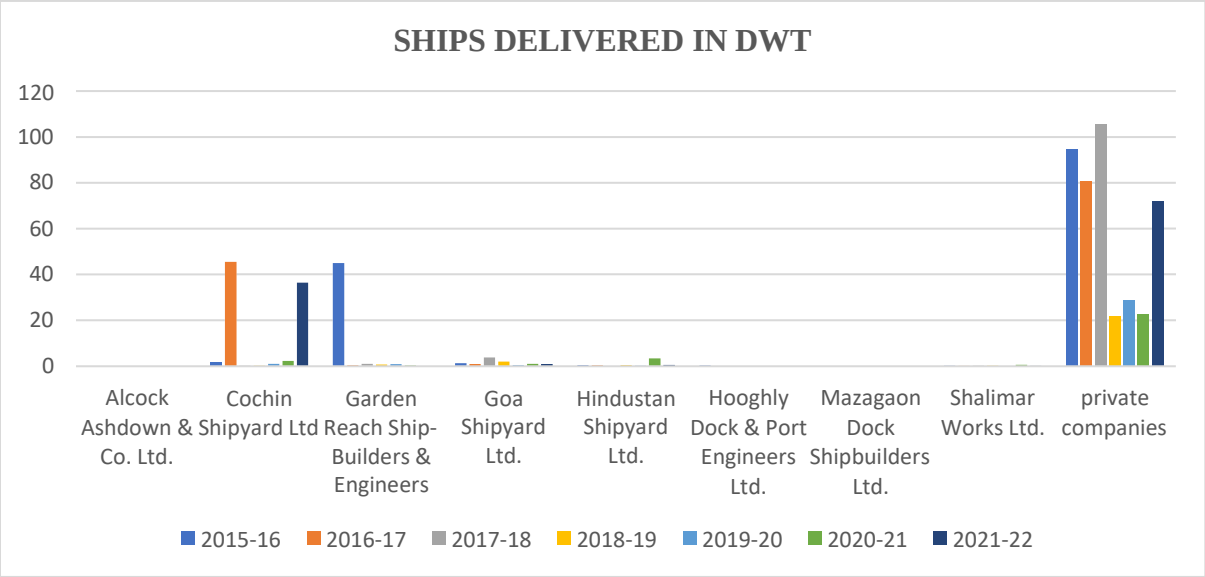
The provided data outlines the values of ships delivered by different companies in India from 2015-16 to 2021-22.

1. Public Companies:

• Cochin Shipyard Ltd exhibited varying values of ship deliveries, ranging from 0.12 in 2017-18 to a notable increase of 36.47 in 2021-22.

• Garden Reach Ship-Builders & Engineers consistently delivered ships with relatively lower values, fluctuating between 0.33 and 1.02, dropping to zero in 2021-22.

Figure 4.4: Ships Delivered in Dwt



Source: Ministry of Port and Shipping Statistical Report

• Goa Shipyard Ltd.'s deliveries varied from 0.46 to 3.82 over the years, recording a value of 0.94 in 2021-22.

• Hindustan Shipyard Ltd witnessed fluctuations, notably reaching 3.35 in 2020-21, then decreasing to 0.51 in 2021-22.

• Alcock Ashdown & Co. Ltd., Hooghly Dock & Port Engineers Ltd., and Mazagaon Dock Shipbuilders Ltd. did not deliver any ships during this period.

2. Private Companies:

Private shipbuilding firms contributed significantly higher values, ranging from 21.46 to 105.35 in 2019-20, with fluctuations. In 2021-22, the value was 71.75.

2. Grand Total:

• The total value of ships delivered, combining both public and private sectors, fluctuated from 143.04 in 2015-16 to 109.68 in 2021-22, showing variations over the years.

In summary, private shipbuilding companies made substantial contributions to the total value of ships delivered. Cochin Shipyard Ltd exhibited fluctuations, while other public companies delivered fewer ships with lower values.

4.3. Shipbuilding Capacity Public Companies – By Company Wise

The ability of a shipyard or a nation's shipbuilding industry to build and deliver ships in a specified amount of time is referred to as shipbuilding capacity. It stands for the greatest quantity and size of ships that a shipyard or company can produce concurrently or consecutively. Several factors affect the capacity of shipbuilding:

1. Infrastructure: Enough dry docks, slipways, fabrication shops, outfitting facilities, and storage areas are necessary for shipyards to build ships. The shipyard's ability to manage several projects at once is based on the state and availability of these facilities.

2. Technical Expertise: Naval architecture, marine engineering, welding, outfitting, and other related professions are among the specialist knowledge and abilities needed for shipbuilding. A competent crew with the requisite knowledge is essential for shipyards to execute shipbuilding tasks effectively.

3. Production Procedures: A key factor in evaluating shipbuilding capacity is the effectiveness of project management and production procedures. Shipyards use a variety of methods, like concurrent engineering, pre-outfitting, and modular building, to expedite production and shorten construction durations.

4. Financial Resources: To invest in infrastructure, buy equipment, and maintain operations, there must be sufficient financial resources. To increase their capacity, shipyards require funding for personnel training, technical advancements, and research & development.

5. Orderbook: A shipyard's capacity is determined by the quantity and size of shipbuilding orders

listed in its order book. A larger orderbook suggests a heavier workload, which can necessitate the shipyard increasing its capacity to keep up with demand.

6. Industry Collaboration: To increase capacity, cooperation with suppliers, subcontractors, and other industry stakeholders is essential. Construction lead times can be decreased by ensuring on-time delivery of supplies, parts, and machinery through efficient supply chain management and collaborations.

A nation's ability to manufacture ships is often increased by the presence of several shipyards in a thriving shipbuilding industry. Usually, these nations have developed shipbuilding zones or clusters that encourage cooperation and resource sharing among shipyards. For nations hoping to boost trade and commerce, bolster naval defense capabilities, develop their maritime industries, and participate in the global shipbuilding market, shipbuilding capacity is a vital component. Maintaining competitiveness in the global shipbuilding sector and growing shipbuilding capacity need sustained investment in skilled labor, technology, and infrastructure.

Table 4.5: Shipbuilding capacity public companies - by company-wise

Name of the company	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**
Alcock Ashdown & Co. Ltd.	15	15	0	0	0
Cochin Shipyard Ltd	110	110	110	110	110
Garden Reach Ship-Builders & Engineers	0	0	0	0	0
Goa Shipyard Ltd.	4.5	4.5	4.5	4.5	4.5
Hindustan Shipyard Ltd.	80	80	80	80	80
Hooghly Dock & Port Engineers Ltd.	3	3	3	0	0
Mazagaon Dock Shipbuilders Ltd.	40	40	40	0	0
Shalimar Works Ltd.	0.5	0.5	1.2	1.2	1.2

Source: Ministry of Port andShipping Statistical Report

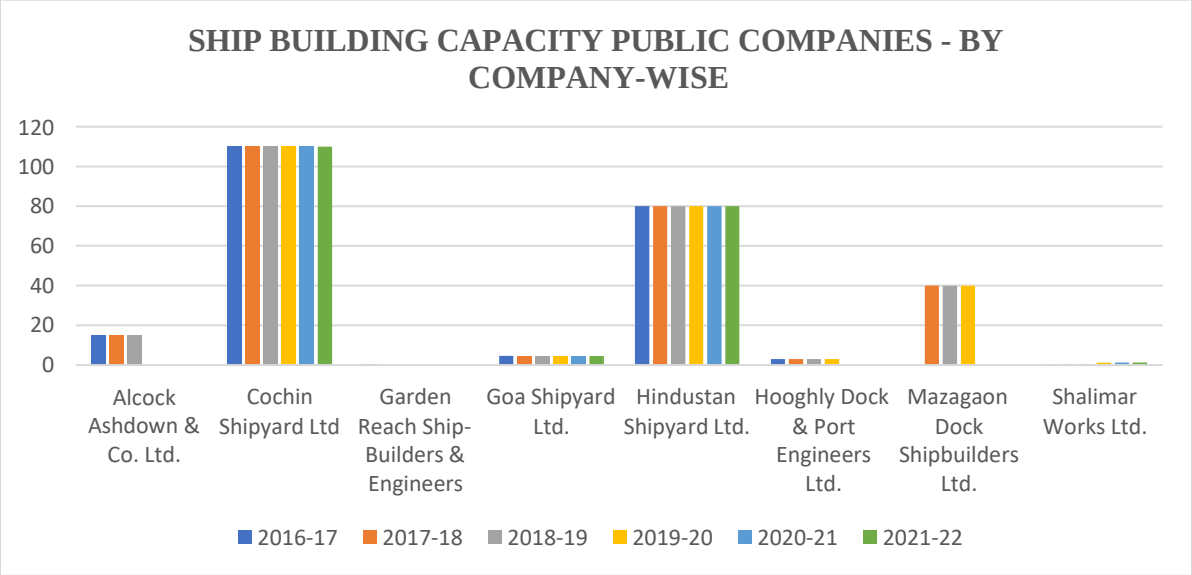
The shipbuilding capacity of public firms for the years 2017–18 to 2021–22 is displayed in the table in terms of thousand deadweight tons (1000DWT).

1. Ashdown & Alcock, Ltd. From 2017–18 to 2018–19, Alcock Ashdown & Co. Ltd.'s shipbuilding capacity stayed at 15,000 DWT. From 2019–20 to 2021–22, the company's shipbuilding capacity was not stated.

2. Cochin Shipyard Ltd: For the duration of the given time, Cochin Shipyard Ltd consistently built ships with a 110,000 DWT capacity.

3. Garden Reach Ship-Builders & Engineers: From 2017–18 to 2021–22, there is no information in the table on Garden Reach Ship-Builders & Engineers' reported shipbuilding capacity. 4. Goa Shipyard Ltd.: From 2017 to 2018, Goa Shipyard Ltd. consistently built ships with a 4,500 DWT capacity.

Figure 4.5: Shipbuilding capacity public companies - by company-wise



Source: Ministry of Port and Shipping Statistical Report

5. Hindustan Shipyard Ltd.: During the designated time, Hindustan Shipyard Ltd. consistently built ships with a DWT capacity of 80,000.

6. Hooghly Dock & Port Engineers Ltd: From 2017–18 to 2019–20, Hooghly Dock & Port Engineers Ltd was able to build ships with a 3,000 DWT capacity. However, for the years 2020–21 and 2021–22, the company's shipbuilding capacity was not stated.

7. Mazagaon Dock Shipbuilders Ltd.: From 2017–18 to 2019–20, Mazagaon Dock Shipbuilders Ltd. was able to build ships with a 40,000 DWT capacity. However, for the years 2020–21 and 2021–22, the company's shipbuilding capacity was not stated.

8. Shalimar Works Ltd.: From 2019 to 2021–22, Shalimar Works Ltd.'s shipbuilding capacity rose from 500 DWT in 2017–18 and 2018–19 to 1,200 DWT. Based on the data, Cochin Shipyard Ltd. consistently had the largest shipbuilding capacity— 110,000 DWT—among the publicly traded enterprises across the given time frame. Some enterprises did not publish their shipbuilding capacity for specific years, had lesser capacities, orremained steady.

4.4 Problems in the Indian Shipbuilding Industry

The Indian shipbuilding industry has faced several challenges in recent years. Here are some of the key problems:

1. Infrastructure Deficiency: India's shipbuilding infrastructure, including shipyards and docking facilities, lacks modernization and advanced technologies, resulting in inefficiencies and higher expenses.

2. Skill Shortage: The industry faces a scarcity of skilled workers proficient in naval architecture, marine engineering, and welding, impeding growth and competitiveness.

3. Cost Competitiveness: Indian shipyards struggle to match international rivals in cost competitiveness due to high capital expenses, taxes, and bureaucratic hurdles, making them less appealing to global buyers.

4. Project Delays: Persistent project delays arise from inadequate coordination among stakeholders, regulatory approval delays, and insufficient planning, leading to cost overruns and diminished customer trust.

5. Financial Constraints: Accessing financing remains a challenge for Indian shipyards, especially for large-scale projects, due to limited long-term funds, high-interest rates, and strict lending criteria.

6. Lack of Research and Development: Limited investment in research and development stifles innovation, preventing the adoption of advanced technologies and efficiency improvements in shipbuilding processes.

7. Regulatory Complexity: Complex and time-consuming regulatory procedures impede the ease of doing business in the shipbuilding sector, requiring substantial effort to obtain clearances and comply with regulations.

8. Foreign Competition: Indian shipbuilders face intense competition from established foreign counterparts, particularly from countries like South Korea, China, and Japan, which possess advanced technologies, economies of scale, and robust supply chains.

Addressing these challenges necessitates a multifaceted approach involving infrastructure enhancement, skill development initiatives, policy reforms, financial assistance, and increased investment in research and development. By tackling these issues, the Indian shipbuilding industry can enhance competitiveness, attract more orders, and bolster the nation's economic progress.

4.5. Opportunities for Indian Shipbuilding Companies

Despite facing obstacles, the Indian shipbuilding sector presents numerous avenues for expansion and advancement. Through strategic planning and investments, India can capitalize on these opportunities to bolster its standing in the global shipbuilding arena.

a. Domestic Demand: India's extensive coastline and burgeoning maritime activities, such as shipping and coastal security, create a substantial market for various types of vessels. Focusing on fulfilling domestic needs enables Indian shipbuilders to establish a solid footing and enhance their competitiveness internationally.

b. Defense Shipbuilding: With ambitious plans to bolster its naval fleet, India's defense sector provides significant opportunities. Embracing the government's "Make in India" initiative and catering to the defense sector's demands can secure long-term contracts and foster technological advancements.

c. Offshore Industry: The offshore oil and gas sector, in particular, demands specialized vessels like drill ships and FPSOs. By investing in advanced vessel construction and collaborating with global players, Indian shipbuilders can tap into this growing market.

d. Green Shipping: The global focus on environmental sustainability creates a niche for eco-friendly vessels. By adopting innovative technologies and fuels, Indian shipbuilders can lead in green shipping, meeting the rising demand for environmentally conscious solutions.

e. Ship Repair and Maintenance: India's strategic location and competitive costs make it a promising hub for ship repair services. With modern facilities and skilled labor, Indian shipyards can attract both domestic and international clients.

f. Skill Development: India's skilled workforce can be further honed through targeted training programs, enabling shipbuilders to undertake complex projects and attract global clientele.

g. International Collaboration: Partnering with international counterparts offers access to advanced technologies and enhances competitiveness. Joint ventures and technology transfers can elevate India's standing in the global shipbuilding landscape.

In conclusion, while challenges persist, India's shipbuilding industry holds immense potential. By leveraging domestic demand, focusing on defense, offshore, and green sectors, investing in skill development, and fostering international collaboration, India can emerge as a significant player in global shipbuilding, driving economic growth and employment opportunities.

CHAPTER V
GOVERNMENT INITIATIVES

5.1. Policies Supporting Shipbuilding

India has put in place several laws to encourage shipbuilding there. The aforementioned measures are intended to stimulate expansion within the shipbuilding sector, augment market viability, and elevate indigenous manufacturing competencies. The following are some of the main laws that encourage shipbuilding in India:

I. The National Maritime Development Programme: NMDP was established by the Indian government to advance the growth of the maritime industry, which includes shipbuilding and ship repair. It focuses on improving skills, upgrading technology, developing infrastructure, and providing financial support to the maritime sector.

II. Shipbuilding Financial Assistance Policy: Under this policy, Indian shipyards are given financial support to produce mercantile, navy, and offshore vessels. It seeks to increase the competitiveness of Indian shipyards in the international market and provide incentives for shipbuilding activities in India.

III. Strategic Partnership (SP) Model: The goal of the Strategic Partnership policy is to encourage private industry involvement in shipbuilding and other defense-related manufacturing. In line with this strategy, private sector enterprises in India are urged to work with international Original Equipment Manufacturers (OEMs) to produce defense equipment, such as ships and submarines, domestically.

IV. Make in India Initiative: The Make in India campaign, which was started to encourage homegrown manufacturing and draw in international capital, has a big influence on the shipbuilding sector. It creates a favorable atmosphere for indigenous shipbuilding and entices international shipbuilding firms to make investments in India.

V. Technology Upgradation Fund Scheme (TUFS): The Technological Upgradation Fund Scheme (TUFS) offers Indian shipyards financial support for technological upgrading and advancement. TUFS seeks to improve the competitiveness of Indian shipyards and make them capable of meeting global standards by providing support for technological developments.

VI. Indian Register of Shipping (IRS): An autonomous ship classification society, the Indian Register of Shipping offers shipbuilding and classification services to Indian vessels and shipyards. It is essential for guaranteeing adherence to global norms and advancing the caliber and security of ships constructed in India.

VII. Reduced Tax and Duty Burdens: To minimize the cost disadvantage Indian shipyards have in comparison to other nations, efforts are being made to streamline taxes and customs procedures.

VIII. Infrastructure Status: The industry is attempting to get "infrastructure status," which may yield additional financial and tax advantages.

IX. Emphasis on Green Shipping: Through programs like the National Centre for Excellence in Green Ports and Shipping, the government is encouraging the use of ecologically friendly technologies in shipbuilding.

Together, these initiatives seek to strengthen domestic manufacturing capacities, advance the expansion and competitiveness of India's shipbuilding sector, and establish India as a key participant in the world shipbuilding market.

5.2. Financial Incentives and Subsidies

Shipbuilding in India is greatly aided by financial incentives and subsidies. The following are some of the main financial rewards and subsidies that the nation offers for shipbuilding:

- Shipbuilding Subsidy Scheme: To encourage shipbuilding, the Indian government offers subsidies to shipyards in India through several programs. These subsidies, which are meant to lower shipbuilding costs and boost Indian shipyards' competitiveness in the international market, could take the form of grants, interest subsidies, or tax breaks.
- Interest Subsidy Program for Shipbuilding Infrastructure: The government provides interest subsidies on loans taken out by shipyards to enhance their shipbuilding facilities to incentivize investment in shipbuilding infrastructure. This scheme aims to lower the cost of capital for shipyard projects and facilitate the expansion of shipbuilding capacity in India.
- Export Credit Guarantee Corporation (ECGC) Cover: Indian shipyards that export ships can take advantage of this insurance against payment risks related to foreign purchasers. This insurance lessens the possibility of nonpayment and makes export funding for shipbuilding projects easier.

- Customs Duty Exemption/Reduction: To cut manufacturing costs for Indian shipyards, the government may offer exemptions from or reductions in customs duties on imported equipment, parts, and raw materials used in shipbuilding. The goal of this policy is to increase domestic shipbuilding's competitiveness against imports.
- Goods and Services Tax (GST) Relief: To lessen the tax load on shipyard operations, several inputs and services used in shipbuilding may be eligible for GST exemptions or relief. By taking this action, production costs are reduced and the cost competitiveness of ships produced in India is increased.
- The Technology Acquisition Fund Scheme (TAFS) offers Indian shipyards financial assistance for the purchase of cutting-edge machinery and technology required for contemporary shipbuilding procedures. With the help of this program, Indian shipyards will be able to produce ships that adhere to international standards thanks to increased technological capabilities.
- Incentives for Research and Development (R&D): To promote innovation and technological advancement in the shipbuilding industry. These rewards promote R&D spending and innovation in the maritime industry.

  The Indian shipbuilding industry seeks to stimulate growth, improve competitiveness, and attract investment through the provision of financial incentives and subsidies. They play a crucial role in attracting domestic and foreign investment, supporting technological advancement, and strengthening the overall ecosystem for shipbuilding in the country.

5.3. Regulatory Frameworks

The regulatory frameworks for shipbuilding in India are primarily governed by various laws, regulations, and guidelines set forth by governmental bodies.

- Indian Register of Shipping (IRS): The Indian Register of Shipping is an independent classification society that establishes and administers standards for the design, construction, and maintenance of ships. It ensures that ships built in India comply with international maritime standards.
- Directorate General of Shipping (DGS): The enforcement and implementation of maritime laws, including those about shipbuilding, are under the purview of India's maritime administration. It is in charge of the maritime industry's security, safety, and environmental protection.

- Merchant Shipping Act, 1958: The Merchant Shipping Act is the primary legislation governing various aspects of merchant shipping in India, including shipbuilding, registration of ships, safety, and pollution prevention.
- Indian Flag Vessel Construction Policy (IFVCP): The Indian government occasionally announces initiatives to boost domestic shipbuilding and enhance the Indian maritime industry's competitiveness. The IFVCP offers financial incentives and other supportive measures to encourage shipbuilding in Indian shipyards.
- Make in India project: By encouraging investment, enhancing infrastructure, and streamlining regulatory procedures, the project seeks to boost manufacturing in India, especially shipbuilding.
- International Maritime Organization (IMO) Regulations: India complies with the international laws and guidelines set forth by the IMO as a member. Numerous facets of ship design, building, safety, and environmental preservation are covered by these laws.
- Environmental Regulations: To reduce pollution and safeguard marine ecosystems, shipbuilding operations are subject to environmental regulations. These rules may contain specifications for sustainable activities, pollution control, and waste management.
- labor Laws: Shipbuilding involves large manpower and labor laws oversee employment practices, working conditions, and safety standards in shipyards to guarantee the well-being of workers.
- Customs and Import Rules: The Indian government imposes import rules and customs duties on the import of materials, machinery, and technology needed for shipbuilding.
- Quality Standards: To guarantee the safety, dependability, and seaworthiness of boats, shipbuilding in India must abide by quality standards established by international classification societies and regulatory bodies.
- Together, these legal frameworks seek to ensure that international norms and regulations are followed while promoting a favorable atmosphere for shipbuilding in India. They are essential in fostering the expansion and competitiveness of the Indian shipbuilding sector.

5.3.1. Compliance and Enforcement Mechanisms

Mechanisms for compliance and enforcement are essential for guaranteeing that shipbuilding operations follow relevant laws, rules, and specifications. Various organizations and procedures are used in India to keep an eye on and enforce compliance in the shipbuilding sector.

- The Directorate General of Shipping (DGS) is India's highest maritime regulatory body and is essential in enforcing adherence to all maritime laws, particularly those about shipbuilding. It carries out surveys, audits, and inspections of shipyards to make sure that quality, safety, and environmental standards are being followed.
- Indian Register of Shipping (IRS): As a separate classification society, the IRS is in charge of confirming that its regulations and recommendations for ship design, construction, and maintenance are being followed. To verify adherence to classification regulations, it carries out plan approvals, surveys, and inspections of ships that are still under construction.
- Inspections and Audits: To determine if shipyards are complying with applicable rules, regulations, and standards, regulatory agencies, such as the DGS and IRS, regularly inspect and audit them. Aspects including worker welfare, environmental practices, quality control, and safety protocols are all included in these inspections.
- Certification and Classification: Approved agencies like the IRS are required to provide certificates and classifications for ships constructed in India. To get the approvals, licenses, and permits required for ship operation and international trade, one must adhere to classification norms.
- Environmental Regulations: Shipbuilding companies are required by law to keep an eye on and take steps to reduce their negative effects on the environment, including waste management, pollution control, and the preservation of natural resources. Regulatory bodies use environmental evaluations, audits, and reporting requirements to keep an eye on compliance.
- Worker Safety and Labor Standards: Regulatory organizations like the Ministry of Labor and Employment use workplace assessments, enforcement actions, and inspections to ensure that workers are adhering to labor laws and safety standards. Shipbuilding companies are mandated to offer their employees welfare facilities, appropriate training, and safe working conditions.
- Penalties and Enforcement Actions: Regulatory authorities may impose penalties, fines, or other

sanctions for noncompliance with their regulations. A suspension of activities, the revocation of permits, or legal action against violators are some examples of these Public Reporting and Transparency: To improve accountability and openness in enforcing compliance, regulatory bodies frequently keep public databases, reports, and notifications. Through this, the public, shipowners, and shipbuilders can obtain information about enforcement actions and regulatory compliance.

- India endeavors to guarantee the safety, quality, and sustainability of its shipbuilding sector while encouraging compliance with legal and regulatory mandates through the establishment of strong compliance and enforcement systems. Enforcing laws effectively helps maintain the integrity and competitiveness of the marine industry generally and improves India's standing as a responsible maritime nation.

CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

6.1. Findings

India's shipbuilding sector is expected to grow significantly because of several important factors. India has a bright future because of its vast coastline, growing marine trade, and growing domestic ship demand. Government programs like "Make in India" and the emphasis on assisting the military industry also offer plenty of chances for industry growth, which might have a big impact on the country's economy. But there are big obstacles ahead, mostly related to infrastructure. The industry's advancement is hindered by antiquated shipyards, a scarcity of dry docks, inadequate port infrastructure, and poor transportation networks. Delays, increased costs, and a decline in competitiveness are the results of these shortcomings, highlighting the critical need for infrastructure improvements to fully realize the potential of the sector.

A bright spot of possibility in the Indian shipbuilding industry is the defense sector. Due to the government's emphasis on indigenization and self-sufficiency in the defense industrial sector, Indian shipyards are busy building a range of aircraft carriers, submarines, and warships. This focus on defense shipbuilding not only encourages technological advancement but also helps industry participants land long-term contracts. Additionally, there is room for expansion in India's offshore sector, particularly in the fields of exploration and production of oil and gas. To support offshore operations, specialized vessels including support vessels, drill ships, and FPSOs are in high demand. Indian shipbuilders can successfully enter this profitable sector by making investments in cutting-edge technologies and working with foreign partners.

A competent labor force is essential to the success of the shipbuilding industry. Thankfully, India has a strong pool of competent workers and engineers that gives it a competitive advantage. However, to improve labor capacities and satisfy changing business expectations, continuous skill development activities and specialized training programs are crucial. And lastly, Indian shipbuilders have a great chance as the world moves toward more environmentally friendly and sustainable shipping methods. Indian players have the opportunity to establish themselves as leaders in the field of green shipping by adopting eco-friendly

technologies, energy-efficient vessels, and alternative fuels that are in line with international trends and environmental requirements.

In conclusion, India's shipbuilding sector offers abundant prospects in the fields of sustainability, offshore, workforce development, and defense, despite severe infrastructure constraints. To properly leverage this potential and tackle sector-specific obstacles, a thorough investigation and analysis are necessary.

6.2. Suggestions

A multifaceted approach is necessary to push India's shipbuilding sector toward sustainable growth and global competitiveness. First and foremost, to promote innovation in vessel design and manufacturing processes and guarantee adherence to international quality standards, it is imperative to invest in research and development (R&D) capabilities. Concurrently, bringing in cutting-edge technology and updating infrastructure will maximize output, raise standards of quality, and boost competitiveness. India stays up to date with global innovations and facilitates knowledge transfer through collaborations with multinational shipyards and maritime technology companies. Additionally, promoting cooperation between academic institutions and businesses to provide specialized training programs guarantees a workforce with the skills necessary to meet industrial demands, which promotes long-term prosperity. Offering incentives and establishing a favorable regulatory environment will draw investments, and encouraging local shipowners to place orders with Indian shipyards will boost domestic demand and advance the industry. Improved branding and marketing strategies highlight Indian shipyards' skills abroad, and sustainability programs respect environmental regulations, enhancing their reputation and drawing in eco-aware clients. By promoting local manufacturing and indigenization, the domestic supply chain can be strengthened, reducing reliance on imports, lowering risks, and boosting related businesses. Lastly, cooperative governance between governmental organizations, shipbuilding companies, and trade associations promotes group problem-solving and policy coordination, guaranteeing a favorable environment for the long-term growth and development of the industry.

6.3. Conclusion

The shipbuilding project in India highlights important data about orders, deliveries, and capacity in the country's shipbuilding industry, emphasizing the urgent need for more private-sector involvement. These numbers highlight obvious infrastructure shortcomings that hinder the industry's growth and competitiveness, such as obsolete shipyards, a dearth of dry docks, inadequate port facilities, logistical challenges, and a marked labor shortage.

Nevertheless, despite these difficulties, the sector offers a plethora of chances for significant growth. Notably, there are significant opportunities for expansion and profitability due to the expanding offshore industry and the growing domestic demand for ships, especially in the defense sector. The industry's shift to environmentally friendly and sustainable shipping methods, in addition to the untapped market for ship repair and maintenance services, further enhances growth possibilities, which are supported by the availability of a trained labor pool.

To fully realize the potential of the Indian shipbuilding sector, policymakers, industry stakeholders, and governmental agencies must work together. It is essential to make investments in shipyard modernization, dry dock capacity increase, port infrastructure improvement, and transportation network optimization. Strong talent development programs and tactical partnerships with global firms will also help to strengthen the industry's capacities, promoting long-term expansion and competitiveness. Through proactive resolution of current infrastructural issues and strategic utilization of new prospects, India may establish itself as a major player in the international shipbuilding industry. The growth trajectory that follows is expected to support the country's economy, create jobs, and establish India as a leading center for shipbuilding, maintenance, and repair services.

To bring this vision to life, all stakeholders must work together harmoniously to create an atmosphere that is supportive of innovation, technical improvements, and long-term industry success. India is well-positioned to establish a noteworthy position in the global shipbuilding industry using strategic alignment and focused investments. This would enable India to make a substantial contribution to the overall growth and development of the maritime sector.

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