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Challenges and Capabilities of Indian Shipbuilding and Maintenance Ecosystem in India: An Empirical Assessment

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Abstract: *India's share in the global ship building and repair ecosystem is nearly 1 to 2 % only. Besides being the fastest growing economy in the world and having a long coastline, the percent share of its shipbuilding capacity is not aligned with its economic development and projected market growth. There are many challenges and barriers that the country needs to address in its present shipyard ecosystem. The present study aimed to bring out challenges, strengths and weakness of the shipbuilding sector of India. The present study used a quantitative descriptive research design and a purposive sampling method to collect the primary data from 246 participants of the industry belonging to various functional roles. A structured questionnaire was developed to assess various dimensions of Indian shipbuilding industry. Descriptive method of frequency and percentages was used to analyze the data. The chi-square goodness of fit test was used to test the hypotheses and examine the discrepancies between observed and expected frequencies on each item of the tool. Based on the study results, recommendations are proposed that may serve as corrective measures and support shipbuilding programs way ahead. The study aligns with initiatives like Aatmanirbhar Bharat and Make in India by offering recommendations on shipyards' project planning, execution, and maintenance. Overall, the study contributes to the academic literature and the modernization of India's shipbuilding industry for future research.*

Keywords*: ship building, supply-chain readiness, digital shipyard, operational efficiency, indigenization, shipyard performance*

Introduction

India has a large coastline of about 11,098 kilometres and an Exclusive Economic Zone of nearly 2.37 million square kilometres. It has 12 major ports and 217 minor ports that support commercial sea routes and trade. Apart from this, there are smaller ships and vessels also which operate on inland waterways and canals. The Directorate General of Shipping reported that the Indian shipping stood at a 13.66 million Gross Tonnage with more than 1500 registered ships (Ministry of Ports, Shipping and Waterways, 2024). With these numbers, India is seen as an emerging economic power that now has a greater share of participation in international overseas trade (Singh, 2025, as cited in *The New Indian Express*, 2025). According to the *World Trade Statistical Review* (2023), India's share in overseas exports has increased from 0.8% in 2003 to nearly 1.9% in 2022. There is a rising trend in cargo traffic being handled at Indian docks and ports. Though there is an immense opportunity for manufacturing and developing the shipyard sector in India, but it is not free of challenges. One of the biggest challenges is the limited and outdated infrastructure of many Indian shipyards. When compared with leading worldwide shipbuilding countries, Indian shipyards lack modern dry docks and are still working on older production methods (Chhabra, 2015). They are limited in advanced production facilities and are in need of the latest technology and automation (Sahu, 2022). This hampers productivity and delivery timelines of ships in India. For similar ships, Indian yards require several times more man-hours and much longer construction time than Japanese or Korean shipyards (KPMG & National Productivity Council [NPC], 2020). India also faces the challenge of weak supply chains and industry-specific trained human resources. Studies have shown that innovation practices play an important role in improving productivity in shipyard manufacturing (Baihaqi et al., 2024). Thus, there is a significant requirement for innovative shipbuilding and ship maintenance activities in the country. The increasing movement and expansion of port-related activities have put an additional pressure on the shipbuilding and repair sector. It must enhance and improve its

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capacity and efficiency in the coming years. In order to maintain foreign trade and remain competitive in global markets, India needs a better infrastructure in the form of ports, ships, and ancillary services (Blanco-Novoa et al., 2024). India is expected to adopt a two-pronged approach in order to meet the demands and support economic growth. The shipbuilding ecosystem is a labor-intensive sector and has a potential of generating mass employment opportunity for Indian youth. In order to enhance its efficiency in shipbuilding sector, India should focus on constructing new ships, on one hand, and maintaining and replacing the exiting ships, on the other (Brewster, 2012; Ullah, 2019). For this, a better infrastructure, better supply chains and digitization interventions must be adopted by the sector. A better supply chain systems and effective coordination among industry stakeholders is required.

Literature Review:

In order to progress fast and multiply its GPD manifold, India should take benefit of its long coastline and international shipping routes. It is already the fastest growing economy in the world. If India boosts its shipbuilding and maintenance industry, it can further reap the natural advantage of its geographical location. This location advantage can help attract both domestic and foreign shipyards for construction and maintenance (John, Dixit, & Srivastava, 2011). It will also help reduce dependence on international cargo imports which can become a problem in war, crisis or hostile situations. The supply chains are disrupted and prices get inflated, which impact the financial stability of the country. Having a greater shipbuilding capability will make the country self-reliant in these difficult times (KPMG, 2008). It is also important for India to reduce its trade deficit by boosting its manufacturing sector. By enhancing its shipbuilding capabilities, India can have an edge in trade, economy and develop a strong currency.

The sector has high growth potential as it generates large employment opportunities for its youth. The data supports the fact that ship manufacturing generated nearly three times more jobs than any other heavy engineering industry (John, Dixit, & Srivastava, 2011). The industry employs a diverse set of skilled engineers, technicians and workers across many disciplines. A strong manufacturing unit is also connected with repair facilities which are again labour-intensive activities that generates employment. India has a greater availability of skilled engineers and technical manpower which is its strength. A large number of engineers and technicians graduate every year, which gives the industry access to technically capable human resources (KPMG, 2008). Ship manufacturing and repair also support growth of related sectors like steel, aluminium, electrical machinery, technology and ancillary industries. It is estimated that nearly 65% of the value of a ship comes from its supporting industries and the rest 35 % of the value is contributed by assembling and integrating these parts. Domestic demand for ships and different types of vessels is rising steadily in India. The sector is also connected to defence and the safety of any nation, thus bringing strategic as well as economic benefits to the country. Another major strength of the Indian shipbuilding industry is support from the government policies such as *Make in India* and the *Shipbuilding Financial Assistance Scheme* have given direct incentives to domestic shipyards. These initiatives are aimed at improving competitiveness and encouraging local construction. Studies report that with proper policy support and infrastructure development, Indian shipyards can attract international orders, especially for small and medium-sized vessels (Confederation of Indian Industry [CII] & KPMG, 2017).

Even with a great opportunity, India's shipbuilding industry today has less than 1% share in the global shipbuilding market. This is much lower when compared to countries like China, South Korea, and Japan, which together dominate most of the world's shipbuilding sector (Civilstap Himachal, 2025; Department-related Parliamentary Standing Committee on Transport, Tourism and Culture, 2024.; OECD, 2015). This gap clearly shows that India is still behind in terms of scale, speed, and competitiveness in ship construction (Press Information Bureau, 2025). It is important to note that the shipbuilding industry in India has some unique features when compared to other sectors. Shipbuilding requires a long gestational time period as projects take several years to complete. The sector

requires huge investments and long durations consistently, which makes the construction cycle tedious and cost-heavy. Ships have to be on globally comparable and competitive standards (Blanco-Novoa et al., 2024; Kheireldin, 2021). The cost, timelines, and delivery have to match international standards of effectiveness and efficiency of the final product. Only then, ships can establish their credibility in international markets and new orders will be received. Also, shipbuilding requires a large number of labour workforce and millions of components to first design and then manufacture. It requires a strong industrial manufacturing base and a well-developed network of logistics infrastructure for cargo transport. In order to boost "Make in India" and give a push to the manufacturing sector of the country, the shipbuilding and ship repair industry must advance rapidly. It is a strategically important sector as it will generate a multiplier effect in both investments and turnover. It also has a significant chance of generating employment for Indian youth (Blanco-Novoa et al., 2024; Kheireldin, 2021; Liker & Lamb, 2000; Phogat, 2013).

The tax structure and policy framework are quite complex in India and create delays (S&P Global, 2025). Multiple clearances and mandatory compliances make the system complex and projects more costly and time consuming (Sahu, 2022). A chain of procedural approvals impacts performance and reduces the competitiveness of Indian shipyards in global markets. Further, availability of finance is another important challenge. Shipbuilding projects require long-term funding, but such financing is limited in India (S&P Global, 2025). According to ICRA (2025), shipyards in India depend on commercial loans with high interest rates (around 9–10 percent), while shipyards in other countries get funding at much lower rates (4–8 percent). This difference directly increases project costs and reduces competitiveness. Thus, administrative procedures, approval systems and financial constraints together delay the projects and increase the cost, making the sector slow and inefficient (Press Information Bureau [PIB], 2019). India also has a shortage of industry-specific trained human resources. Though thousands of engineers graduate every year, many still lack specialized shipbuilding and ship repair skills required by the industry (Sahu, 2022). There is a need for exclusive specialized training for staff which can increase the number of trained personnel and thus, enhance performance of shipyards. India also lacks a well-connected cluster of shipyards, component suppliers, R&D centres, and modern dry docks. The ship repair and maintenance segment is another underutilized area in Indian shipyards (Jena, 2025). This indicates a missed opportunity for revenue and employment generation. There is a strong competition from neighbouring countries of India which are pioneers in the shipbuilding sector (Hexagon, 2025). These include countries like China, South Korea, and Japan which have highly efficient shipyards (SuperKalam, 2025; Thangam & Kumar, 2015). They manufacture ships on a large-scale, and have strong government backing (OECD, 2015; Tan, 2020). This creates high competition for Indian shipyards making them difficult to compete on price and delivery timelines with these nations. Global economic uncertainty also affects ship demand. Slowdown in international trade is due to current geopolitical tensions, and wars going on in the world. New orders of ship construction are thus delayed and beings a halt in investment decisions.

India depends on other countries for ship manufacturing material and ancillary equipment. Delayed supply chains of these raw materials is yet another challenge for Indian shipyard sector (Drishti IAS, 2025). In many projects, imported components account for nearly 70–80% of the total material requirement, mainly sourced from East Asian countries. Shipbuilding in India depends largely on foreign suppliers whether it is steel, machines, engines, electronic systems, and ancillary parts (Baihaqi et al., 2024). Due to this, material delivery takes longer time which increases the cost of the project. The construction is also vulnerable to external supply disruptions. Design-related issues are also a major cause of delay. Many times, ship design specifications are not finalized before construction starts. Changes in design during construction create confusion, and delay (Sahu, 2022). Poor coordination between design agencies, shipyards, and suppliers delays in the supply of critical items like steel leading to delays and cost overruns (Chhabra, 2015). The government has also

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acknowledged that delays and cost escalation in shipbuilding projects are caused by late design finalization, and procurement delays (Press Information Bureau [PIB], 2019). Domestic demand for new ships in India is also weak. Indian ship owners often prefer buying second-hand ships from foreign markets instead of placing new construction orders with Indian yards. In addition, increasing environmental regulations are posing yet another challenge. There are stricter emission norms in place, and green ship standards, and sustainability requirements are increasing the cost of ship manufacturing (Liker & Lamb, 2000; Phogat, 2013). The profitability is also impacted due to environmental concerns in the projects.

Problem Statement and Rationale:

The Indian shipbuilding industry is currently unable to deliver the required load of ships because of various reasons. As documented in the literature above, systemic and administrative inefficiencies result in significant time and cost overruns. This failure to achieve self-reliance in ship manufacturing poses a critical risk to India's strategic ambitions in the Indo-Pacific region (Brewster, 2012; Ullah, 2019). Thus, there is a need of quantitative and analytical research to identify the strengths, weaknesses, and challenges faced by the industry.

Aim of the Study:

The study seeks to empirically examine the inherent challenges faced and the existing strengths and weaknesses in the shipbuilding ecosystem in India.

Objectives and Hypotheses of the Study:

The study aims to address the problem statement through the following objectives:

Objective 1: To identify and quantify the primary internal and external challenges faced by the ship building sector in India.

Null Hypothesis 1: There lies no difference between expected and observed frequencies across the five response categories for each item indicating the absence of a perceived challenge in the shipbuilding and maintenance sector.

Objective 2: To analyse the current strengths and weaknesses of the Indian shipbuilding industry.

Null Hypothesis: There lies no significant difference between the observed and expected frequencies across response categories for items measuring strengths and weaknesses of the shipbuilding and maintenance sector of India.

Based on the literature review, specific constructs representing challenges, strengths and weakness of the Indian shipbuilding industry were identified. These dimensions were used to empirically investigate the objectives (Table 1 below)-

Table 1 Objectives of the Study and Their Dimensions

Objective (O)	Focus of the Objective	Dimensions / Constructs
O1: Challenges in Warship Building	Identification and quantification of internal and external challenges faced by private sector warship-building stakeholders in India	(a) Supply-chain constraints (b) Financial limitations (c) Regulatory and bureaucratic challenges (d) Vendor capacity (e) Skilled workforce availability (f) Design and technology maturity (g) Underdeveloped ancillary industry
O2: Strengths and Weaknesses of the Industry	Analysis of the current strengths and weaknesses of the Indian warship-building industry	(a) Indigenous design capability (b) Competitive labor advantage (c) Infrastructure adequacy (d) Innovation culture (e) Coordination across stakeholders (f) Process efficiency

Methodology

Research Design

The present study is a descriptive and exploratory research using a quantitative survey approach. The design was suitable to capture perceptions and attitude of significant stakeholders of shipbuilding

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and repair industries within the country. The design helped to objectively assess and compare of challenges and strengths across predefined dimensions of objectives.

Tool

A survey instrument was developed specifically for the study. The tool comprised of two sections in line with the two objectives of the study. The first section, comprising of 7 items, was linked to objective one and had questions on challenges in shipbuilding sector. This section included statements related to supply-chain constraints, financial limitations, design and technology maturity, regulatory and bureaucratic challenges, vendor capacity, skilled workforce availability and underdeveloped ancillary industries. Higher scores on items indicated perception of greater challenges in the industry. The second section, comprising of six items, had items related to objective two examining strengths and weaknesses of the shipbuilding industry. Items in this section covered dimensions of indigenous design capability, competitive labor advantage, infrastructure adequacy, process efficiency, innovation culture and coordination across stakeholders. Respondents rated how strongly each factor acts as a strength or weakness in their organization. High score on section two indicated perception of strength whereas low score indicated a perception of weakness of the industry. All items were measured on a five-point Likert scale ranging from *Strongly Disagree (1)* to *Strongly Agree (5)*.

Sample and Sampling Technique

The study collected data from a sample of 246 respondents. The key stakeholders involved in shipbuilding activities in India were contacted. Given the specialized nature of the shipbuilding industry and the difficulty in accessing professionals working in sensitive and restricted environments, purposive sampling method was used to identify suitable respondents. This was further supported by snowball sampling. The initial respondents helped in reaching other relevant participants within their professional networks. The sample characteristics showed a wide variety of categories. The sample was predominantly male (97.6%) showing the male dominant profession. Majority of participants were from government organizations (69.5%), with relatively smaller number from public sector undertakings (17.1%) and private organizations (13.4%). Respondents of various functional roles responded to the survey, including- operations and maintenance, ship construction, planning, production, and design-related functions. Participants were mainly from engineering domains, particularly marine engineering, mechanical engineering, and electrical engineering. Their departmental affiliations included production, design, quality, and operations. Majority of the sample had an experience of more than 20 years. Overall, the sample reflects a knowledgeable and sector-relevant group of professionals involved in shipbuilding and ship maintenance activities across different organizational and functional contexts.

Procedure

The data was collected through both online and offline formats. A google form was prepared to collect the data from participants of various functional roles and background. The purpose of the study was explained to the respondents and informed consent was duly filled. All ethical approvals were taken beforehand and sample was informed about their rights to participate in the study. Participation was completely voluntary and anonymity and confidentiality of the respondents were duly preserved. Any debriefing, if required, was given after completion of data collection. The responses were screened for missing data. Thereafter, data was coded and analysed using Excel and SPSS-23. Data analysis was done using descriptive statistics in the form of frequencies for each item assessing perceived challenges in the shipbuilding and maintenance industry in India. The chi square goodness of fit test was performed to test whether responses in five categories of Likert scale of each item differed in observed and expected frequencies.

Results

The results of the Objective one and Hypothesis one pertaining to significant challenges in Indian shipbuilding and repair industry are documented in Table 2 below.

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Table 2 Perceived Challenges of Shipbuilding Industry in India (N = 246)

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Chi Square (df)p
(C1) Supply-chain constraints						
Our supply chain for key parts is weak and often unreliable.	9	21	39	132	45	191(4)**
(C2) Financial limitations						
The funding system for warship projects is slow and lacks flexibility.	3	78	42	102	21	134(4)**
(C3) Regulatory and bureaucratic challenges						
Government rules and approvals often delay projects.	9	33	51	120	33	145(4)**
(C4) Vendor capacity						
Vendor skills and quality standards are not consistent.	6	6	18	171	45	398(4)**
(C5) Skilled workforce availability						
It is hard to find enough skilled and experienced technical staff.	3	60	30	111	42	132(4)**
(C6) Design and technology maturity						
Our organization struggles to use advanced design and digital tools.	3	87	42	93	21	129(4)**
(C7) Ancillary industry						
The supporting (ancillary) industries for shipbuilding in India are still underdeveloped.	6	18	51	135	36	211(4)**

C represents Challenge

*Note: Chi-square goodness-of-fit tests were conducted for each item. **p < .001.*

The chi-square goodness-of-fit tests for all seven items indicated statistically significant results which shows that participants showed deviations from equal response distribution. Thus, the null hypothesis for all seven items for Objective one was rejected.

The results of the Objective two and Hypothesis two pertaining to perceived strengths and weakness in Indian shipbuilding and repair industry are documented in Table 3 below.

Table 3 Perceived Strengths and Weaknesses of the Indian Shipbuilding Industry (N = 246)

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Chi Square (df)p
(SW1) Indigenous design capability						
Our organizational design and engineering skills are improving steadily.	0	9	21	174	42	283(3)**
(SW2) Competitive labor advantage						
Our workforce is cost-effective compared to global standards.	9	33	27	132	45	188(4)**
(SW3) Infrastructure adequacy						
Our docks and facilities are adequate for building large ocean /sea-going ships.	15	99	36	81	15	122(4)**
(SW4) Innovation culture						
We have a culture of innovation and continuous improvement.	9	63	57	102	15	118(4)**
(SW5) Coordination across stakeholders						

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Coordination between ship building yards, vendors, regulators, and government authorities works well.	15	90	75	63	3	118(4)**
(SW6) Process efficiency						
Performance-based contracts help improve accountability and on-time delivery	0	6	33	159	48	221(3)**

SW represents Strengths and Weakness

*Note: ** Chi-square goodness-of-fit tests were conducted for each item. **p < .001.*

The chi-square goodness-of-fit tests for all six items indicated statistically significant results which shows that participants showed deviations from equal response distribution when perceiving strengths and weakness of shipbuilding sector of India. Thus, the null hypothesis for all six items for Objective two was rejected.

Discussion

The Indian shipbuilding industry is seeing persistent structural constraints on one hand and has potential organizational strengths on the other. Participants agreed that supply chains for Indian shipbuilding sector are weak and unreliable, funding systems are slow and inflexible, and government rules and regulations often delay projects. Issues related to vendor capacity showed the highest deviation value from uniformity, meaning that inconsistencies in skills and quality standards are pertinent concerns of Indian shipbuilding sector. Further, absence of skilled workforce and experienced technical employees also emerged as a statistically significant challenge. Results also reported struggles in design and technological maturity of Indian ships along with underdeveloped ancillary or supporting industries essential for construction and maintenance functions of the industry. Thus, both internal capability gaps and external ecosystem constraints emerged as major challenges limiting the productivity and innovation of industry.

At the same time, the results also reveal important areas of emerging strength within the industry. Participants agreed that indigenous design and engineering capabilities for ship construction is gradually improving in India. Results also show that India has a cost-effective labor advantage as a foundational strength for its shipbuilding sector. Infrastructure adequacy also had a significant chi-square value demonstrating a mixed perception with substantial disagreement and neutrality alongside moderate agreement. When it comes to innovative culture, the respondents gave moderate endorsement but with notable neutrality. Coordination across stakeholders in Indian shipbuilding sector leaned more toward disagreement, meaning there was a perceived weakness in coordination mechanisms. Process efficiency indicated that performance-based contracts are widely perceived to improve accountability and timely delivery. Strengths indicate that India is in a transition phase gradually building on internal capacities and policy reforms aligned with the development of shipbuilding ecosystem in the country, but the sector is still lagging behind due to broader governance, infrastructural and institutional challenges.

India needs targeted interventions across multiple levels in order to enhance performance of its ship construction industry. It needs to streamline regulatory procedures to improve coordination among the stakeholders. The fragmented approach needs to get transformed into collaborative that bring suppliers, vendors, regulators, policy makers and ancillary industry together. platforms that bring together shipbuilding organizations, suppliers, regulators, and supporting industries to address fragmentation and promote coordinated capability development.

Conclusion:

The study provided empirical evidence about internal capability and potential challenges faced by shipyard sector in India. While incremental gains are evident in indigenous design competence, labor cost advantage, and process governance, these strengths remain constrained by supply-chain fragility, coordination deficits, and institutional bottlenecks.

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The sector appears to be in an early phase of systemic transition, where organizational improvements are not yet fully supported by ecosystem-level and regulatory reforms. Sustained performance enhancement will require integrated policy, infrastructure, and capability-building interventions across stakeholders.

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