Technical, Social, and Economic Impacts of Enforcing Age Restrictions on Indian Flag Vessels and their Impact on Indian Tonnage

As per the DGS Order 6 of 2023

Prepared for

The Directorate General of Shipping,
Ministry of Ports, Shipping and Waterways,
Government of India.

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Disclaimer

This report titled *Technical, Social, and Economic Impacts of Enforcing Age Restrictions on Indian Flag Vessels and their Impact on Indian Tonnage as per the DGS Order 6 of 2023* has been prepared in response to a request from the Directorate General of Shipping (DGS) to evaluate the DGS Order 6 of 2023 and assess the appropriateness of the order considering technical, social, and economic considerations.

The analyses, findings, and views expressed in this report are based on data and information available from the Directorate General of Shipping, Ministry of Ports, Shipping and Waterways, Government of India, Various Industry Organizations, Primary Data collected from various stakeholders, Secondary Research using Published Academic and Industry Databases.

To support the analysis of large datasets and extensive information repositories, OpenAI tools have been utilized in the preparation and structuring of this report. While every effort has been made to ensure the accuracy and relevance of the information presented, the report reflects data available at the time of preparation and may not account for subsequent developments.

The conclusions and recommendations are exploratory in nature and are not intended to represent official policy positions or endorsements by any government agency or organization referenced.

Executive Summary

India's maritime sector is of increasing strategic and economic importance, driven by a thriving shipping industry, major port infrastructure development, and the need for a strong naval presence to support trade. Initiatives like Sagarmala aim to foster economic growth and coastal development. While the Indian fleet has grown to a capacity of 13.7 million Gross Tonnage (GT) and handled 1,129.63 million tonnes of cargo in FY2022-23, environmental sustainability remains a key challenge, particularly concerning emissions and potential pollution from older vessels, in the context of global average ship age of 22 years. International Maritime Organization (IMO) regulations are becoming stricter to achieve net-zero emissions, and the Directorate General of Shipping (DGS) has issued Order No. 6 of 2023 to phase out non-compliant vessels and improve fleet quality.

This comprehensive study assesses the implications of age restrictions on Indian tonnage, examining the challenges and opportunities for various stakeholders and the broader impact on the shipping industry. The methodology combines qualitative insights from semi-structured questionnaire-based interviews with diverse organizations in the Indian maritime sector, and detailed quantitative analysis of shipping data related to vessel quality, safety records, carbon emissions and financial metrics.

The implementation of DGS Order No. 06 of 2023, which introduces age-based restrictions for Indian-flagged vessels, represents a significant regulatory milestone in India's maritime governance. This evaluation assesses the rationale, relevance, and expected outcomes of the order in the context of operational performance, environmental sustainability, regulatory compliance, and alignment with national and international policy frameworks. The evidence compiled through primary stakeholder engagement, secondary data analysis, and scenario-based modeling provides a strong foundation to validate the order's intent and structure.

One of the most compelling findings supporting the order lies in the clear correlation between vessel age and safety performance. Data from the Directorate General of Shipping's Port State Control (PSC) and Flag State Inspection (FSI) reports show that vessels over 20 years of age have significantly higher average Deficiency Indices (DI)—up to 5.34, compared to 1.63 for younger vessels. They also have a Nil Deficiency Rate of just 12.5%, underscoring their vulnerability to detentions and non-compliance with international safety standards. These older ships are often plagued by structural degradation, outdated equipment, and higher maintenance burdens, making them less safe and more costly to operate.

Environmental performance further justifies order. CO_2 emissions analysis reveals that ageing vessels disproportionately contribute to maritime emissions. When carbon pricing penalties (e.g., USD 150–380 per tonne of CO_2 as proposed under MEPC 83) are applied, the OPEX for older ships increases sharply, eroding profitability and competitiveness. Simulation models confirm that vessels beyond 25 years are economically unviable in the long term when accounting for rising fuel costs, retrofit limitations, and emissions penalties. This supports the policy's focus on fleet renewal and improved compliance with international decarbonization mandates.

A primary stakeholder survey also lends support to the order, revealing a clear divide between commercial resistance and technical endorsement. While management stakeholders cited concerns about capital cost and asset devaluation, technical professionals—including classification society representatives and ship superintendents—strongly supported the age norm, citing recurring safety incidents, regulatory risks, and retrofit infeasibility in older vessels. This resistance to change highlights the need for regulatory direction, as voluntary transition is unlikely in the absence of policy compulsion.

Among the three policy scenarios evaluated, Scenario 3—a selective, performance-aligned application of age norms—emerged as the most practical and effective. It affects only 4.99% of India's gross registered tonnage, while targeting the most outdated and high-risk segments. This approach balances environmental and safety imperatives with the need for fleet continuity and operational stability. It also triggers positive downstream effects, including increased demand for newbuilds from Indian shipyards and enhanced activity in the ship recycling market, both of which align with Maritime India Vision 2030 and India's net-zero shipping objectives.

To strengthen the order's operational and stakeholder acceptability, the evaluation recommends the introduction of a Safety and Sustainability Index (SSI). This performance-based tool would allow technically sound, environmentally compliant older vessels to continue operating under conditional extensions. This flexibility reduces the risk of capacity shortages or abrupt asset write-offs, while preserving the policy's strategic intent. Moreover, it creates a framework for progressive modernization by incentivizing proactive compliance and investment in cleaner, safer technologies.

In conclusion, the evaluation of DGS Order No. 06 of 2023 demonstrates that the age norm policy is technically justified, economically sound, and strategically aligned with India's maritime and environmental goals. The findings validate the need for regulatory intervention to retire aging, non-compliant ships and replace them with cleaner, safer, and more efficient tonnage. With appropriate support mechanisms, stakeholder engagement, and data-driven flexibility, the order can catalyze a generational shift in India's merchant fleet and enhance its global maritime standing.

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List of Key Abbreviations

GT	Gross Tonnage
NT	Net Tonnage
DWT	Dead Weight Tonnage
DGS	Directorate General of Shipping
MT	Metric Tonnes
COx	Carbon Oxides
NOx	Nitrogen Oxides
SOx	Sulphur Oxides
IMO	International Maritime Organization
ICCSA	Indian Coastal Conference Shipping Association
INSA	Indian National Shipowners Association
BIMCO	Baltic and International Maritime Council
MS/MV	Motor Ship/Motor Vessel
CAP	Condition Assessment Program
PSC	Port State Control
SOLAS	Safety of Life at Sea
MARPOL	Marine Pollution
ISM	International Safety Management
ONGC	Oil and Natural Gas Commission
EXIM	Export Import
GHG	Green House Gas
PSU	Public Sector Unit
MSME	Micro, Small, and Medium Enterprises
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
ESD	Environmental Ship Design
OEM	Original Equipment Manufacturer
OSV	Offshore Supply Vessel
MODU	Mobile Offshore Drilling Unit
ME	Main Engine
AE	Auxiliary Engine
HFO	Heavy Fuel Oil
LFO	Low-Sulphur Fuel Oil

1 Introduction

India's importance in maritime affairs has significantly increased, characterized by a flourishing shipping industry, major port facilities, and a strategic naval presence. The maritime sector is essential to India's trade, as it facilitates the transportation of goods and energy resources. Furthermore, initiatives such as Sagarmala aim to leverage maritime opportunities for economic growth, port modernization, and the development of coastal communities. As of June 30, 2024, the Indian fleet's capacity reached 13.7 million Gross Tonnage (GT)[1]. The total cargo traffic at the Indian ports was 1129.63 MT in the year 2022-23[2]. However, sea freight contributes notably to environmental issues, including emissions of COx, NOx, SOx, and particulate matter, as well as oil pollution from incidents and harm to marine life. With time, the quality of vessels declines regarding fuel efficiency and seaworthiness, with the global average age of ships being around 22 years[3]. The International Maritime Organization (IMO) has introduced stricter environmental regulations and ambitious goals to achieve net-zero emissions. In this context, older vessels pose a significant challenge in the shift towards more sustainable practices.

The Directorate General of Shipping (DGS), Ministry of Ports, Shipping, and Waterways, Government of India (GOI), which oversees the implementation of shipping policies and legislation, has issued Order Number 6 of 2023 to improve the quality of India's national fleet. This Order outlines a strategy to phase out non-compliant and aging vessels while instituting regulatory measures to enhance the quality and maintenance of the country's tonnage. The Order No. 06 of 2023, issued on February 24, 2023, marks a significant policy step toward modernizing India's maritime fleet and ensuring greater compliance with global safety and environmental standards. The primary motivation behind this directive is to address the growing concern over the aging Indian fleet, which is notably older than the global average. With this order, the DGS aims to promote "quality tonnage" by establishing stricter age norms for vessels operating under the Indian flag and for foreign-flagged vessels engaging in coastal and EXIM trade within Indian waters. The policy is aligned with international goals, particularly the International Maritime Organization's (IMO) strategies for reducing greenhouse gas (GHG) emissions and improving operational safety. It also seeks to prevent India from becoming a destination for substandard, older ships, especially those unable to meet current safety or emissions requirements.

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[1] For more information, visit: https://www.dgshipping.gov.in/WriteReadData/userfiles/file/300624%20-%20Monthly%20Tonnage%20Statement.pdf
[2] For more information, visit: https://www.investindia.gov.in/sector/ports-shipping
[3] For more information, visit: https://unctad.org/system/files/official-document/rmt2022ch2_en.pdf

The order mandates maximum permissible age limits for different types of vessels (as outlined in Annexure-I of the directive)[4]. It applies to both Indian and foreign vessels seeking licenses under Sections 406 and 407 of the Merchant Shipping Act, 1958. While newly acquired ships must comply with these age caps, vessels already in service (classified as "existing vessels") are granted a three-year grace period to continue operations. Exemptions are made for certain specialized units like passenger vessels, Floating Production Storage and Offloading units (FPSOs), Floating Storage Regasification Units (FSRUs), and MODU/SPS-certified vessels. This framework aims to reduce the operational footprint of obsolete ships and catalyze the adoption of newer, more energy-efficient technology within the Indian fleet.

The expected impact of the order is multifaceted. For one, it exerts pressure on Indian shipping companies to invest in newer vessels or retrofit older ones to meet both age and qualitative norms. This could improve the fleet's competitiveness and safety while reducing the environmental impact of maritime trade. Furthermore, by disincentivizing the use of old foreign vessels in Indian coastal waters, the order helps to create a level playing field for Indian operators and encourages domestic shipbuilding and fleet renewal. However, it may also pose challenges for small and medium-sized ship operators due to the capital-intensive nature of acquiring new vessels. Additionally, some sectors, such as coastal shipping, could face short-term disruptions if significant portions of their fleet become non-compliant.

Despite the order's forward-looking goals, there is a compelling need for further investigation and evaluation. An economic impact study would also be prudent to assess how this order impacts the industry. The order should be aligned with incentive mechanisms under broader national maritime strategies like the Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047 to ensure smoother implementation. A deeper analysis is needed to understand how India's approach compares with global benchmarks in countries enforcing similar norms. This would help India calibrate its regulations based on best practices, while balancing sustainability with economic feasibility. Overall, while DGS Order No. 06 of 2023 is a critical move toward fleet modernization, safety, and environmental sustainability, it demands further scrutiny and integration into India's maritime growth and climate adaptation frameworks to unlock its full potential. In this context, this study aims to evaluate the potential advantages and disadvantages of imposing age restrictions on Indian tonnage, identify challenges and opportunities for various stakeholders, and assess the overall impact of the Order on the Indian shipping industry. To achieve these objectives, the study

[4] https://www.dgshipping.gov.in/WriteReadData/News/202302270559032302259DGSOrder06of2023onAgeNorms.pdf

conducts a comprehensive analysis of both primary and secondary data related to Indian shipping and forecast the effects of these changes across all aspects of the industry.

2 Research Methodology

This study adopts a comprehensive, mixed-methods research design that combines stakeholder engagement, quantitative analysis, and international benchmarking to evaluate the rationale, implications, and feasibility of implementing vessel age norms in India's maritime sector, as outlined in DGS Order No. 06 of 2023. The research is structured around four major components: stakeholder feedback, regulatory data analysis, environmental performance assessment, and policy alignment.

Stakeholder Feedback

- Conducted structured survey of 42 maritime stakeholders
- Supplemented with in-depth interviews
- Captured perceptions, operational concerns, and implementation readiness

Regulatory Data Analysis

- Examined age distribution across 964 Indian-flagged vessels
- Analyzed Port State Control (PSC) and Flag State Inspection (FSI) data (2024)
- Evaluated deficiency trends, detention rates, and compliance by age group

Environmental Performance

- Estimated vessel-level and fleet-wide CO_2 emissions
- Modeled performance using EEXI and CII metrics
- Conducted regression analysis to correlate emissions and efficiency with vessel age

Policy Alignment

- Reviewed national and global maritime policies (e.g., Maritime India Vision 2030, MEPC 83)
- Conducted international benchmarking (Japan, EU, Panama, Liberia)
- Analyzed coherence with Harit Sagar Guidelines and India's net-zero goals

Analysis and Forecasting

- Developed scenario matrices (immediate, 3-year, and 5-year phased exits)
- Estimated investment needs for fleet renewal
- Simulated carbon penalty exposure under various non-compliance levels

Key Findings

- Identified risks from older vessels (OPEX, compliance, safety)
- Highlighted support for age norms among technical stakeholders
- Quantified financial implications of delayed transition

Recommendations

- Proposed phased implementation of age norm
- Suggested exemptions for retrofitted or compliant vessels
- Advocated policy support through green finance, domestic shipyard incentives, and carbon relief schemes

Figure 1: Overview of Research Methodology

The primary data collection involved a structured survey administered to 42 key stakeholders, including shipowners, technical superintendents, classification society representatives, and offshore operators. These responses were supplemented with in-depth interviews to capture nuanced insights and contextual understanding. The feedback was analyzed thematically to differentiate perspectives between technical professionals and general management, identifying areas of alignment, concern, and resistance regarding the proposed age-based norms.

Secondary research focused on a robust quantitative analysis of vessel registry data, inspection records, and environmental performance indicators. Age distribution of the Indian fleet was assessed using data from the Directorate General of Shipping (as of February 2026), covering 964 registered vessels. Analytical tools such as histograms, violin plots, and box plots were used to examine age dispersion by vessel type and gross tonnage. Port State Control (PSC) and Flag State Inspection (FSI) reports from 2024 were reviewed to assess compliance trends, with metrics such as detention rates, deficiency indexes, and nil deficiency rates analyzed across different vessel age brackets. This provided empirical evidence of the performance degradation and risk increase associated with older vessels.

A key part of the methodology involved modeling CO_2 emissions and simulating financial penalties under the GHG pricing frameworks introduced by MEPC 83. Emission estimates were drawn from DNV and national registry data, and penalty scenarios were calculated for varying compliance levels (80%, 50%, and 20%) using price points ranging from USD 100 to 380 per tonne of CO_2. Additionally, vessel performance was evaluated using IMO's Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII), with regression analysis used to correlate EEXI scores with vessel age across different ship types.

To contextualize the findings within global policy and operational trends, the study reviewed a wide range of literature including academic research on ship ageing and safety, the UNCTAD Review of Maritime Transport 2024, MARPOL Annex VI amendments, and key Indian maritime strategies such as the Maritime India Vision 2030, Amrit Kaal Vision 2047, and Harit Sagar Guidelines. International benchmarking was conducted to compare India’s approach with global practices on age-based norms and decarbonization mandates, including policies in Panama, Japan, Liberia, and the European Union.

Lastly, the study developed scenario-based forecasts to estimate fleet attrition timelines and replacement needs under immediate exit, 3-year grace, and 5-year phasing models. These forecasts were integrated with economic models estimating replacement costs and Indian shipyard capacities to evaluate the financial and industrial implications of large-scale fleet renewal.

Overall, this research methodology integrates stakeholder sentiment, empirical performance data, and policy benchmarking to provide a multi-dimensional understanding of the proposed age norm policy. It offers a rigorous, data-backed foundation for evaluating the operational, environmental, and economic consequences of fleet modernization in alignment with India’s maritime sustainability goals.

3 Policy Changes and Macro-Economic Situation

Determining an optimal age restriction policy for Indian-flagged vessels must be situated within the broader context of recent policy reforms and India's evolving macro-economic landscape in the maritime sector. With the government's aggressive push through initiatives such as the Maritime India Vision 2047, Sagarmala, and the ₹25,000 crore Maritime Development Fund, India is poised for a transformative leap in port infrastructure, fleet modernization, and shipbuilding capacity. Simultaneously, structural shifts such as increased global demand for Indian exports, rising freight costs due to geopolitical disruptions, and a renewed focus on environmental sustainability have elevated the strategic importance of a modern, efficient, and compliant merchant fleet. These macroeconomic trends, coupled with India's ambitions to become a major shipbuilding hub and reduce dependence on foreign-flagged vessels, provide a timely opportunity to reassess the role of aging ships in the national fleet. A data-driven, performance-linked age restriction policy supported by regulatory clarity and financial incentives can align India's shipping ecosystem with global safety standards while enhancing trade competitiveness and environmental stewardship.

3.1 Overview of Indian Mercantile Fleet

The Indian mercantile fleet presents a mixed profile of vessel types, age ranges, and operational capacities, reflecting both the strategic importance of India's maritime sector and the systemic challenges it faces. The fleet is composed predominantly of Harbour Tugs (346 vessels), General Cargo Vessels (275), Oil Tankers (123), Bulk Carriers (83), and Offshore Support Vessels (39). These categories not only shape the country's logistics infrastructure but also reflect critical service segments such as coastal shipping, port operations, energy transport, and offshore exploration. However, the fleet is aging—with average vessel ages ranging between 13.6 and 19.6 years, and some vessels operate well beyond 40 or even 50 years. Oil tankers and offshore units show particularly high average ages, which raises serious questions about their ongoing seaworthiness, environmental performance, and regulatory compliance. Collectively, these vessels contribute millions of gross tonnages (GT), with oil tankers alone accounting for over 4.8 million GT. The fleet's aging profile is compounded by delayed registrations: over 44% of ships were registered more than two years after delivery, and nearly one-third were flagged only after a decade or more. This lag not only undermines India's ability to monitor fleet conditions in real time but also affects its international maritime standing and readiness for compliance with global safety and sustainability norms. These insights point to an urgent need for performance-based age norms, time-bound registration policies, and a coordinated effort to modernize the Indian fleet to ensure safety, competitiveness, and alignment with the Maritime India Vision 2047. The below table summarizes the status of registered vessels which are impacted by the order.

	Count	Average of GT	Average of Age in Years (As on 28.02.2026)
Anchor Handling Tugs	6	1518.67	17.00
Bulk Carriers	83	32172.55	13.58
Cement Carriers	13	5560.69	21.85
Chemical Carrier	1	16786.00	25.00
Container Vessels	24	24225.13	22.67
Dumb Barges	1	413.00	3.00
Gas Carrier	23	37503.04	20.17
Gas/ Chemical Carrier	1	2657.00	35.00
General Cargo Vessels	275	1798.92	15.52
Harbour Tugs	346	414.55	16.23
Offshore Fleet	39	2117.77	19.59
Oil Tankers	123	39224.26	18.59
Oil/Chemical Carrier	10	27168.20	18.60
Other Vessels	19	1213.47	15.84
Grand Total	**964**	**10431.13**	**16.60**

Table 1: Overview of Indian Mercantile Fleet

Based on the data extracted from the official DGCI&S report on Statistics of Foreign and Coastal Cargo Movement of India[5] (2024) The comparative overview of vessel movements at Indian ports underscores a significant disparity between Indian-flagged and foreign-flagged ships in international cargo trade. According to the latest data, 15,866 foreign vessels entered Indian ports with cargo, carrying an enormous 378.15 million Net Registered Tonnage (NRT). In contrast, Indian-flagged vessels engaged in international operations recorded 3,056 cargo entries, managing only 86.5 million NRT. This means foreign vessels accounted for 83.9% of all international cargo entries and handled 81.4% of the total inbound cargo tonnage. Similarly, for outward cargo movement, 9,399 foreign ships cleared Indian ports with a combined tonnage of 171.02 million NRT, compared to 1,826 Indian vessels carrying 34.15 million NRT. This indicates that foreign-flagged vessels were responsible for 83.7% of cargo clearances and 83.4% of the outbound tonnage.

These figures expose a substantial imbalance in India's international maritime traffic. Despite having a large coastal fleet, Indian-flagged vessels contribute a relatively small fraction of the country's international cargo movement. The overwhelming dominance of foreign vessels, particularly from open registries such as Panama, Liberia, and the Marshall Islands, highlights both the global competitiveness of foreign shipping lines and the structural limitations of India's own maritime sector. To address this, India must accelerate

[5] https://www.dgciskol.gov.in/writereaddata/Downloads/2025031116424520232024%20Publication.pdf

fleet modernization, promote registration of high-capacity vessels under the Indian flag, and reform regulatory and financing frameworks. A strategic emphasis on newer, environmentally compliant, and larger vessels, backed by supportive policies is essential to secure a greater share of global maritime trade and reduce dependency on foreign shipping tonnage.

3.2 Key Global Initiatives Impacting Indian Shipping

3.2.1 IMO initiatives to control maritime pollution

The amendments to the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI, which came into force on November 1, 2022, represent an important advancement in the global effort to reduce greenhouse gas (GHG) emissions from shipping[6]. These amendments were developed as part of the Initial IMO Strategy on Reduction of GHG Emissions from Ships, which was agreed upon in 2018. Their purpose is to enhance the energy efficiency of ships and help mitigate their environmental impact. The amendments introduce specific technical and operational measures aimed at improving the energy efficiency of ships in the short term. This is aligned with the broader objectives of the IMO to combat climate change and reduce air pollution related to maritime operations. The amendments focus on operational efficiencies that shipowners can implement immediately. These may include best practices for energy management, optimization of operational procedures, and improvements in design and performance of ships. Technical requirements likely involve standards for ship design and equipment specifications to enhance energy efficiency, which can lead to a decrease in fuel consumption and corresponding GHG emissions. The overarching goals of these MARPOL amendments include:

- Reduction of GHG Emissions: By enhancing energy efficiency, the shipping industry is expected to see a significant reduction in overall GHG emissions.
- Alignment with IMO Targets: The amendments support the IMO's long-term targets for climate action, contributing to the strategy for achieving net-zero GHG emissions by or around 2050.
- Incentives for Sustainable Practices: These requirements aim to encourage shipowners and operators to adopt more sustainable practices, thereby promoting a greener maritime industry.

The implementation of these amendments marks a crucial step towards achieving enhanced environmental stewardship in the shipping sector, emphasizing the need for continuous improvement and innovation in the industry’s approach to energy efficiency and pollution reduction. **Annexure 1** provides the timeline for

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[6] https://www.imo.org/en/MediaCentre/PressBriefings/pages/CII-and-EEXI-entry-into-force.aspx

implementing these amendments. From 1 January 2023 it will be mandatory for all ships to calculate their attained Energy Efficiency Existing Ship Index (EEXI) to measure their energy efficiency and to initiate the collection of data for the reporting of their annual operational carbon intensity indicator (CII) and CII rating.

In light of the MARPOL Annex VI amendments and the introduction of EEXI and CII norms implementing structured age restrictions for ships in India is no longer optional but essential. India's merchant fleet, with a disproportionately high number of vessels over 20 years old, is increasingly vulnerable to compliance risks, operational inefficiencies, and reputational challenges at international ports. Age-related degradation in vessel performance, coupled with outdated technology, hampers energy efficiency and undermines India's efforts to align with the IMO's decarbonization targets. Introducing age-based regulatory benchmarks (e.g. such as mandatory condition assessments beyond 15 or 20 years) will ensure that only technically sound and environmentally compliant ships remain operational. These restrictions must be coupled with a performance-linked framework that allows well-maintained and retrofitted vessels to continue operating, while phasing out unfit, high-emission ships. Such a policy would not only enhance safety and reduce environmental impact but also boost the global competitiveness of Indian shipping, enabling access to green finance, avoiding carbon penalties, and enhancing credibility in international trade.

3.2.2 Carbon Intensity Index[7]

The CII determines the annual reduction factor needed to ensure continuous improvement of a ship's operational carbon intensity within a specific rating level. The actual annual operational CII achieved must be documented and verified against the required annual operational CII. This enables the operational carbon intensity rating to be determined[8]. The Carbon Intensity Indicator (CII) is an important operational measure implemented by the International Maritime Organization (IMO) to enhance the environmental performance of the shipping industry. The CII regulation is applicable to vessels over 5,000 Gross Tonnage (GT) starting from 2023. CII is calculated as an annual average of CO2 emissions per mile of ship capacity transport work and results in a rating from A to E, depending on compliance with established thresholds that vary by vessel type and size. To be compliant, vessels must achieve a 'C' rating or better. Ratings of 'D' or 'E' indicate non-compliance, prompting vessel owners to implement improvement plans within their Ship

[7] https://www.clarksons.com/home/green-transition/what-is-eexi-and-cii/
[8] https://www.imo.org/en/MediaCentre/PressBriefings/pages/CII-and-EEXI-entry-into-force.aspx

Energy Efficiency Management Plan (SEEMP). CII thresholds will become progressively stricter each year until 2026, promoting ongoing enhancements in energy efficiency.

The CII measures a ship's operational carbon intensity in grams of CO_2 emitted per transport work (e.g., per tonne-nautical mile). Each ship has a required CII value based on its type, size, and a reference line set by IMO. An annual reduction factor is applied to the reference line, tightening the CII requirement each year (e.g., 2% stricter per year from 2023 to 2030). Ships must improve efficiency over time to maintain or improve their CII rating. CII is calculated by dividing the total annual CO2 emissions by the vessel's capacity (either deadweight or GT depending on the ship type) and multiplied by the total distance traveled throughout the year. Some vessel-type-specific correction factors may apply. The initial CII ratings will be calculated in 2024 based on emissions data collected in 2023.

Actual vs Required CII

- The actual CII is calculated annually using:
  - $Actual\ CII = \frac{Total\ CO_2\ emissions\ (grams)}{Transport\ Work\ (tonne-nautical\ mile)}$
- This is compared to required CII (adjusted yearly)
- If a ship's actual CII ≤ required CII, it meets the standard. If not, corrective action is needed.

- Ships receive an A to E rating based on performance
  - A (Major superior) – Significantly better than required
  - B (Minor superior) – Slightly better than required
  - C (Moderate) – Meets the required CII
  - D (Minor inferior) – Below required (must improve)
  - E (Inferior) – Poor performance (requires corrective action)
- Ships rated D or E for 3 consecutive years must submit a corrective action plan.

This would imply that shipowners must record fuel consumption, distance travel, and cargo data. Such data is verified by flag states or recognized organizations. Results are reported in the Ship Energy Efficiency Management Plan (SEEMP) and IMO's data collection system (DCS).

Strategies for Compliance

- Easiest Methods: The simplest way to improve CII ratings often involves reducing sailing speed. Other strategies may include retrofitting Energy Saving Technologies (ESTs) and implementing operational efficiencies, such as optimizing sailing routes and minimizing waiting times in ports.

- Corrective Action Plans: Vessels rated 'D' or 'E' must develop and present corrective action plans to show how they will achieve a 'C' rating or better. Specifically, a vessel rated 'D' for three consecutive years or rated 'E' for one year must submit these plans as part of their SEEMP.

Market Implications

- Performance Indicator: CII will serve as a crucial performance metric affecting chartering decisions, vessel values, financing availability, and insurance costs.

- Market Segmentation: The introduction of CII could lead to tiered markets, where vessels rated highly receive premiums from charterers, while poorly rated vessels may trade at discounts.

Market Impact Analysis

- Current Trends: Analysis from Clarksons Research suggests that approximately one-third of vessels could receive a 'D' or 'E' rating if operational behaviors remain unchanged. If no adjustments are made, this number could increase towards 50% by 2026.

- Speed Reduction Needs: To achieve a 'C' rating across the fleet, a moderate reduction in speed may be necessary, with some parts of the fleet requiring significant speed reductions to meet compliance.

CII represents a crucial step in promoting sustainability in the shipping industry and is expected to have significant implications for operational practices and market dynamics in the coming years. The introduction of the Carbon Intensity Indicator (CII) under IMO regulations justifies the need for age-based restrictions in India's merchant fleet. The CII, applicable to all vessels above 5,000 GT, mandates continuous annual improvements in carbon efficiency, with ships required to achieve a rating of 'C' or better to avoid corrective actions. Older vessels—many of which dominate the Indian fleet—typically lack the technological upgrades and design efficiencies needed to meet these tightening benchmarks. As CII thresholds become progressively stricter each year until 2026, the likelihood of older ships receiving 'D' or 'E' ratings increases significantly, thereby triggering mandatory compliance plans, market penalties, or eventual regulatory exclusion. Given that these ships are also less fuel-efficient and harder to retrofit economically, enforcing structured age restrictions ensures that the Indian fleet remains compliant, competitive, and environmentally responsible. By aligning age norms with CII performance metrics, India can proactively phase out high-emission, outdated vessels and promote a cleaner, more sustainable maritime future.

3.2.3 Energy Efficiency Design Index (EEDI)

The Energy Efficiency Design Index (EEDI) is an IMO regulation that ensures new-built ships are designed to be more energy-efficient, reducing their carbon intensity over time. EEDI sets increasingly strict performance targets for new ships, encouraging innovation in ship design (e.g., hull optimization, alternative fuels, energy-saving technologies). Different ship types (e.g., tankers, bulk carriers, container ships) have unique efficiency benchmarks, recognizing their operational differences. For instance, Large Container Ships - The largest container ships (>200,000 DWT) built after April 1, 2022, must be 50% more efficient than the original EEDI baseline. Purpose of EEDI is to ensure new vessels emit less CO_2 per transport work (tonne-nautical mile), drive technological advancements in maritime sustainability, and complement operational measures (like CII) by focusing on design efficiency.

Feature	EEDI (Design Focus)	CII (Operational Focus)
Applies to	New-build ships	Existing ships in operation
Goal	Improve design efficiency	Improve annual operational efficiency
Compliance	Verified at construction	Monitored yearly via emissions reporting
Flexibility	Fixed at build	Adjustable through operational measures

Table 2: Comparison of EEDI with CII

The EEDI ensures future ships are inherently cleaner, while the CII pushes current fleets to optimize performance. Both are critical to the IMO's GHG reduction strategy.

3.2.4 IMO MEPC-83: GHG requirements

IMO Net-Zero Framework: A Global First in Industry-Wide Emission Control[9],[10]. During MEPC 83, the IMO approved the comprehensive Net-Zero Framework—an industry-wide approach to mandating emissions reductions and pricing mechanisms for global shipping, set to be enforced by 2027. This is the first regulation of its kind that combines mandatory emission limits with a GHG pricing system for an entire industry sector. The framework will be incorporated into MARPOL Annex VI (Prevention of Air Pollution), which already includes mandatory energy efficiency standards. It targets ships over 5,000 GT, responsible for approximately 85% of international shipping CO_2 emissions, aligning with the IMO's climate strategy. The regulatory impacts include that Ships will be required to reduce their annual GHG

[9] https://www.dnv.com/news/imo-mepc-83-ghg-requirements-approved-taking-effect-from-2028/

[10] https://www.imo.org/en/MediaCentre/PressBriefings/pages/IMO-approves-netzero-regulations.aspx

fuel intensity based on a well-to-wake approach, those ships which are emitting above thresholds must acquire remedial units, or may be rewarded for using zero/near-zero fuels, through financial incentives, compliance entails trading surplus units between ships or purchasing remedial units from the IMO Net-Zero Fund, which will be financed by industry contributions. The IMO Net-Zero Fund will collect contributions from emissions trading and disburse funds based as rewards for low-emission ships, development of innovation, infrastructure, and technology transfer, and to develop capacity building and supportive measures for vulnerable nations, including Small Island developing states and least developed countries. The amendments to MARPOL Annex VI are expected to be adopted by October 2025, approved in Spring 2026, and enter into force by 2027.

Implementing structured age restrictions in India's mercantile fleet offers a compelling pathway to reduce both operating costs and greenhouse gas emissions. Under the IMO's forthcoming Net-Zero Framework (MARPOL Annex VI, effective 2027), vessels over 5,000 GT will face a tiered carbon pricing system: ships emitting above the base fuel intensity target will be liable to purchase "remedial units" (RUs) at US $380 per tonne CO_2, while those exceeding the direct compliance target pay US $100 per tonne CO_2[11]. Older, less efficient vessels—common in India's fleet—are more likely to generate emissions deficits, making frequent RU purchases a recurring cost. By contrast, newer, more efficient ships emit considerably less per tonne-nautical mile, thereby reducing or avoiding such penalties. At MEPC 83 (April 2025), India voted in Favor of the two-tiered Greenhouse Gas Fuel Intensity (GFI) model—supporting a system that sets clear emissions thresholds and pricing (US $380/t CO_2 for significant non-compliance, and US $100/t CO_2 for milder cases)[12]. In doing so, India backed a framework that rewards cleaner ships while capping its total annual compliance cost to under US $100 million. Recognizing the path-dependent nature of this regulation, India's Directorate General of Shipping (DGS) issued a detailed Guidance note to prepare stakeholders for compliance by 2027, reinforcing its intent to align fleet performance with global standards. Age-based fleet renewal aligns with the Carbon Intensity Indicator (CII) operational framework, which rewards ships achieving a 'C' rating or better while penalizing underperformers through fines or mandatory corrective actions. Replacing ageing vessels with ones featuring modern hull designs, propulsion systems, and cleaner fuel capabilities (like LNG) reduces CO_2 intensity and rupees spent on fines estimated at several hundred thousand dollars annually per non-compliant ship.

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[11] https://forourclimate.org/insights/50
[12] https://www.carbonbrief.org/qa-nations-agree-carbon-pricing-system-to-steer-shipping-towards-net-zero/

3.2.5 Efficiency Existing Ship Index (EEXI) [13]

The Energy Efficiency Existing Ship Index (EEXI) is a significant regulatory measure introduced by the International Maritime Organization (IMO) that came into effect on January 1, 2023. A ship's EEXI compares energy efficiency to a baseline. After achieving EEXI, ships will be compared to the required Energy Efficiency Existing Ship Index based on a percentage reduction from the EEDI baseline. It must be calculated for ships over 400 GT according to ship type and size variables. To fulfil a minimal energy efficiency criterion, each ship's calculated achievable EEXI must be below the specified value[14]. EEXI aims to ensure that existing international cargo and passenger vessels of 400 Gross Tonnage (GT) and above meet a minimum energy efficiency standard by assessing their CO2 emissions relative to their transport capacity. This is part of a broader strategy to reduce greenhouse gas emissions in the shipping sector. The EEXI value must be included in the vessel's International Air Pollution Prevention (IAPP) certificate during its first renewal survey after January 1, 2023. This marks the first inclusion of EEXI requirements in the IAPP since its inception in 2009.

Calculation of EEXI

EEXI is calculated using a formula derived from the Energy Efficiency Design Index (EEDI) and takes multiple factors into account:

- Installed Power: The power of the vessel's engines.
- Specific Fuel Consumption: The amount of fuel consumed by the engines.
- CO2 Conversion Factor: The emissions factor related to the fuel type used.
- Ship Capacity: Typically based on deadweight tonnage.
- Speed: Evaluated at a standard reference level of installed power.
- Correction Factors: Adjustments can be applied for specific vessel types or structural enhancements.

The formula's complexity reflects the various factors affecting energy efficiency, allowing for a tailored assessment of each vessel's performance.

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[13] https://www.clarksons.com/home/green-transition/what-is-eexi-and-cii/
[14] https://www.imo.org/en/MediaCentre/PressBriefings/pages/CII-and-EEXI-entry-into-force.aspx

If a ship's calculated EEXI value is below the required target, modifications may be necessary. Most vessels are expected to become compliant through minor changes, such as speed reductions or minor equipment upgrades. However, some may require substantial modifications, which could involve significant costs or technical adjustments. Without a valid EEXI value, a ship cannot receive its IAPP, which effectively prohibits it from trading. Therefore, vessel owners must ensure compliance to maintain operational licenses. EEXI serves as a vital tool in driving improvements in the energy efficiency of the existing fleet, aligning with the IMO's overarching goals for greenhouse gas reduction in the shipping industry. By focusing on technical efficiency and requiring adherence to specific standards, EEXI aims to support the transition to a more sustainable maritime sector.

3.2.6 IMO and Age Restriction

The International Maritime Organization (IMO) does not impose strict age restrictions on ships for several reasons, even though a ship's age can influence its ability to meet emission standards:

- Technological Advancements: Many older vessels can be retrofitted with modern technologies and systems that improve their energy efficiency and reduce emissions. This allows them to comply with current environmental regulations without needing to be decommissioned.
- Economic Considerations: Age restrictions could have significant economic implications for shipping companies and the global supply chain. Many older vessels are still operationally and economically viable, providing essential services. Abruptly phasing them out could disrupt trade and lead to increased costs for consumers.
- Environmental Impact: The production and scraping of ships have their own environmental impacts. The IMO recognizes that introducing age restrictions could result in the generation of more waste and pollution from ship dismantling without necessarily leading to substantial reductions in overall emissions.
- Gradual Transition: The IMO focuses on gradual improvements through regulations that apply to all vessels, regardless of age. This approach encourages the entire fleet to enhance efficiency progressively, allowing for a smoother transition toward sustainability while providing flexibility for shipowners.
- Funding for Upgrades: Financially supporting or incentivizing retrofitting and upgrades for older vessels could offer a practical solution to maintaining compliance with emission standards rather than enforcing a blanket age restriction.

- International Consensus: Implementing age restrictions would require a consensus among member states, which could be challenging given the diverse interests and circumstances within the global shipping community.
- Balance of Regulations: The IMO aims to strike a balance between environmental goals, economic viability, and operational practicality. Measures like the Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII) target efficiency improvements across the fleet without resorting to strict age limits.

In summary, while a ship's age can impact its emissions, the IMO prefers a regulatory framework that emphasizes enhancing the existing fleet's efficiency and sustainability through technological upgrades and operational improvements rather than imposing outright age restrictions. India's maritime sector is at a critical inflection point, with a disproportionately aging fleet operating in a rapidly evolving global regulatory and economic environment. As the IMO's Net-Zero Framework and the Carbon Intensity Indicator (CII) regulations begin to reshape global shipping, older Indian vessels (over 20 years old) face mounting challenges in meeting emissions and efficiency standards. These ships not only emit significantly more CO_2 per tonne-nautical mile but also risk incurring steep penalties, with the IMO proposing carbon pricing fines ranging from $100 to $380 per tonne of excess CO_2 emissions. Additionally, India's support for a two-tier GHG pricing model, while safeguarding short-term economic interests, signals its long-term alignment with stricter global environmental norms. Age restrictions, therefore, become an essential tool to drive phased fleet renewal, reduce compliance costs, and enhance India's competitiveness in international trade. By prioritizing the replacement of outdated vessels with more efficient, regulation-compliant tonnage, India can ensure its shipping industry remains viable, sustainable, and integrated within the global maritime economy, while also accessing green financing and technological upgrades.

3.3 Key Interventions by Government of India

3.3.1 Maritime India Vision 2030[15]

The Maritime India Vision (MIV) 2030 is a strategic blueprint launched by the Government of India to transform the country's maritime sector into a globally competitive and sustainable industry by the year 2030. It aims to position India as a major maritime nation, leveraging its extensive coastline, maritime trade potential, and maritime resources.

[15] https://sagarmala.gov.in/sites/default/files/MIV%202030%20Report.pdf

Key Objectives:

- Enhance Maritime Infrastructure: Modernize and expand port facilities, logistics, and transportation networks to improve efficiency and connectivity.
- Develop Blue Economy Sectors: Foster growth in shipping, offshore oil and gas, renewable energy (like offshore wind), aquaculture, and marine tourism.
- Promote Maritime Trade: Increase cargo handling capacity and streamline shipping operations to make India a leading maritime trading hub.
- Strengthen Maritime Security: Improve naval and coast guard capabilities for safeguarding maritime interests.
- Foster Innovation & Technology: Incorporate advanced technologies such as automation, digitization, and green shipping solutions to make maritime operations sustainable and competitive.
- Capacity Building & Skill Development: Develop a skilled workforce through training, research, and skill enhancement initiatives aligned with global standards.
- Environmental Sustainability: Focus on eco-friendly infrastructure, reducing marine pollution, and adopting green technologies in maritime activities.

In line with the objectives of Maritime India Vision 2030, introducing age-based vessel restrictions supports the broader goal of transforming India into a global maritime hub. The vision emphasizes the development of new ports, logistics parks, and special economic zones, which demand a modern, efficient, and environmentally compliant fleet to maximize throughput and trade capacity. As India seeks to attract international collaborations and foreign investments, maintaining a high-performing and sustainable fleet becomes critical for global credibility and competitiveness. Moreover, the vision underscores the importance of cleaner and greener shipping, directly aligning with the IMO's decarbonization agenda and making the phasing out of older, high-emission vessels an urgent priority. Age restrictions will also stimulate domestic demand for new vessels, providing a strong impetus to the Indian shipbuilding industry, helping it scale up and establish itself as a competitive global player. In this context, fleet renewal through structured age norms becomes a foundational pillar to achieve India's long-term maritime growth and sustainability objectives. The vision aims to boost India's GDP contribution from the maritime sector, create employment opportunities, and establish the nation as a prominent maritime power by harnessing its strategic geographic advantage and vast maritime resources.

3.3.2 Maritime Amritkaal Vision 2047 (MAKV Vision)[16]

The Maritime Amrit Kaal Vision 2047 (MAKV 2047) is a comprehensive roadmap by India's Ministry of Ports, Shipping, and Waterways to transform the maritime sector into a global leader by 2047. Building on the Maritime India Vision 2030, it aims to harness India's 7,500 km coastline, inland waterways, and coastal districts to boost the Blue Economy, ensuring sustainable and inclusive growth.

Key Themes and Initiatives:

- Green and Sustainable Maritime Sector: Develop carbon-neutral ports, adopt renewable energy, and promote LNG, hydrogen, and ammonia bunkering. Implement shore-to-ship power and reduce emissions through green shipping initiatives.
- Cruise Tourism: Enhance infrastructure at existing ports (Mumbai, Goa, Cochin) and develop new cruise terminals. Relax cabotage rules, extend e-visa facilities, and reduce GST on tickets to attract global cruise lines.
- Coastal Shipping and Inland Water Transport: Increase cargo volume handled by waterways to over 500 MMTPA by 2047. Develop 50+ operational waterways and improve multimodal connectivity.
- Maritime Clusters: Establish industrial clusters near ports and develop islands like Andaman & Nicobar as bunkering and ship repair hubs.
- Shipbuilding and Recycling: Aim to rank among the top five globally in shipbuilding and become the leader in ship recycling by expanding facilities like Alang.
- Technology and Innovation: Implement smart ports, automation, and digital solutions like AI/ML for efficiency. Establish a Maritime Development Fund to finance innovation and infrastructure.
- Global Maritime Presence: Strengthen India’s role in international maritime organizations and partnerships like BIMSTEC and IORA.
- Strategic Aspirations: Increase port handling capacity to 10,000 MMTPA. Develop 3 transshipment hubs and 2 new major ports. Create 3.5–4 million additional jobs and attract INR 75–80 lakh crore in investments.

MAKV 2047 aligns with India’s goals of self-reliance (Aatmanirbhar Bharat) and sustainability, positioning the country as a global maritime leader while driving economic growth and environmental

16 https://shipmin.gov.in/sites/default/files/Maritime%20Amrit%20Kaal%20Vision%202047%20%28MAKV%202047%29_compressed_0.pdf

stewardship. Within this transformative roadmap, implementing age restrictions on vessels becomes a foundational policy move to support India's strategic aspirations. As MAKV 2047 aims to develop green and sustainable maritime infrastructure (including carbon-neutral ports, LNG and ammonia bunkering, and shore-to-ship power) it is imperative that the operating fleet aligns with these goals. Aged vessels, often high in emissions and low in efficiency, directly conflict with the vision of a cleaner, technologically advanced fleet. Age restrictions would phase out outdated ships, pushing demand for modern, energy-efficient vessels and thereby bolstering India's shipbuilding ambitions, which aim to place the country among the world's top five in the sector. Additionally, as India plans to develop maritime clusters, smart ports, and ship repair hubs, only a fleet that meets future environmental and operational benchmarks can fully utilize these advanced facilities. By ensuring that the active fleet meets international standards of sustainability and innovation, age-based norms will reinforce India's global maritime presence, attract foreign investment, and support the creation of over 3.5 - 4 million maritime jobs making fleet renewal a vital lever in realizing the ambitious objectives of MAKV 2047.

3.3.3 Harit Sagar Guidelines[17]

The Harit Sagar Guidelines are an initiative by the Indian government focused on promoting environmentally sustainable practices within the maritime sector. These guidelines aim to ensure that port operations and maritime activities align with ecological conservation and sustainability goals. Key aspects of the Harit Sagar Guidelines could include:

- Green Port Infrastructure: Encouraging the development and use of energy-efficient and sustainable port infrastructure to reduce carbon footprints and promote eco-friendly operations.
- Pollution Control Measures: Implementing measures to control and reduce pollution from maritime activities, including waste management protocols and emission reductions.
- Biodiversity Protection: Establishing guidelines to protect marine ecosystems and biodiversity, ensuring that port development and operations do not harm local wildlife and habitats.
- Renewable Energy Use: Promoting the adoption of renewable energy sources, such as solar and wind, in port and maritime operations to minimize reliance on fossil fuels.
- Efficient Resource Utilization: Encouraging the efficient use of resources, such as water conservation and waste recycling, to minimize environmental impacts.

[17] https://shipmin.gov.in/sites/default/files/Harit%20Sagar%20-%20Green%20Port%20Guidelines%20.pdf

- Stakeholder Engagement: Involving local communities and stakeholders in decision-making processes to ensure sustainable development that considers social and environmental impacts.

By implementing the Harit Sagar Guidelines, India's maritime sector aims to achieve a balance between economic growth and environmental stewardship, contributing to sustainable development goals. As the country promotes green port infrastructure, including the adoption of energy-efficient and eco-friendly facilities, it is crucial that the vessels docking at these ports are equally compliant with modern emission and efficiency standards. Older ships, often lacking essential upgrades like emission control systems or waste management protocols, undermine pollution control measures and contribute disproportionately to air and water pollution. Age restrictions help phase out such polluting vessels, making room for cleaner, compliant ships that align with India's push for biodiversity protection and resource efficiency in port zones. Additionally, with a growing emphasis on the use of renewable energy, newer vessels are better equipped to integrate with this green infrastructure, whereas aging ships may require costly retrofits or be incompatible altogether. Instituting age-based fleet norms thus complements India's holistic sustainability framework and ensures that both maritime infrastructure and the vessels it supports evolve in a synchronized and environmentally responsible manner.

3.3.4 National Green Hydrogen Mission[18]

The National Green Hydrogen Mission is a government-led initiative in India aimed at making the country a global leader in green hydrogen production and usage. It seeks to achieve a target production capacity of 5 million tonnes per annum of green hydrogen by 2030, with a focus on creating export opportunities and promoting domestic demand. The mission encompasses various components, including incentives for green hydrogen and green ammonia production, pilot projects in diverse sectors, and the development of green hydrogen hubs and infrastructure. With an ambitious target of achieving a production capacity of 5 million tonnes per annum by 2030, the mission is designed to drive decarbonization across sectors, enhance energy security, and boost economic growth through green innovation. At its core, the mission focuses on stimulating domestic demand and international trade of green hydrogen and its derivatives like green ammonia. A major component is the Strategic Interventions for Green Hydrogen Transition (SIGHT) programme, which offers incentives for manufacturing electrolyzers and producing green hydrogen. The mission also supports pilot projects across key industries, including steel, mobility, shipping, and

[18] https://mnre.gov.in/en/national-green-hydrogen-mission/

decentralized energy, while promoting the development of green hydrogen hubs and supporting infrastructure for storage, transport, and distribution.

To sustain long-term growth, the mission encourages research and development, fosters public-private partnerships, and emphasizes skill development to build a competent workforce. A robust regulatory and policy framework will underpin these efforts, ensuring standardization and scalability. The broader significance of the mission lies in its potential to decarbonize high-emission sectors, reduce dependence on fossil fuel imports, and drive indigenous manufacturing, ultimately supporting India's clean energy transition and generating significant employment opportunities. It also paves the way for technological advancement, especially in areas like fuel cells and hydrogen-based propulsion systems, marking a decisive step towards a sustainable and self-reliant energy future.

The National Green Hydrogen Mission plays a pivotal role in India's broader clean energy transition, and its successful implementation hinges on the readiness of related sectors such as shipping. In this context, age restrictions on vessels are essential to accelerate the maritime sector's alignment with the mission's goals. Older ships, typically powered by heavy fuel oil and lacking compatibility with alternative fuel systems, pose a significant barrier to the adoption of green hydrogen and its derivatives like green ammonia as viable marine fuels. By contrast, newer vessels can be designed or retrofitted for dual-fuel or zero-emission operation, making them more adaptable to upcoming fuel transitions supported under the mission. The National Green Hydrogen Mission actively promotes pilot projects in shipping and the development of hydrogen supply infrastructure, signalling the need for a modern, future-ready fleet that can serve as a demand anchor for green fuels. Instituting age-based restrictions will help phase out non-compliant, high-emission ships and drive investment into new vessels that support indigenous green hydrogen usage, thereby ensuring the maritime industry complements the mission's objectives of decarbonization, energy security, and technological advancement. Aligning vessel eligibility with clean energy readiness would not only enhance environmental outcomes but also position India's fleet to attract green financing, benefit from incentive schemes under the SIGHT programme, and strengthen its global competitiveness in a rapidly decarbonizing maritime economy.

4 International Use Cases and Policy Focus

As India seeks to expand its footprint in global maritime trade, implementing structured age norms for its mercantile fleet has become a strategic imperative. A significant proportion of India's vessels, particularly those under the Indian flag, are aging and lack the technological and structural resilience required in modern maritime operations (details provided in the next section). In an industry where the global average vessel age is now scrutinized—especially beyond the 15 to 20-year threshold[19]—India's continued reliance on older ships without systematic oversight places its fleet at a serious disadvantage in terms of safety, sustainability, and global competitiveness. We conducted detailed secondary research on various cases wherein age has impacted on the operations of the ship. **Annexure 2** provides details of the key cases and international policies.

The findings of our secondary research indicate that aging vessels are inherently more prone to structural failures, machinery breakdowns, and safety non-compliance. As demonstrated in high-profile maritime tragedies such as the sinking of SS El Faro, older ships can suffer catastrophic failures even when certified as operational, if they lack modern navigation systems, survival equipment, or updated weather-routing capabilities. To prevent such incidents and improve the quality of Indian tonnage, it is essential that India formalizes a framework for age-based vessel monitoring. This could involve instituting a tiered inspection regime, where ships aged 15–20 years undergo intermediate condition assessments, and those older than 20 years are subjected to a full technical audit—similar to international best practices like the Condition Assessment Program (CAP) followed in many flag states.

However, it is equally important that such regulations avoid being overly rigid. A one-size-fits-all age cutoff may penalize vessels that are well-maintained, retrofitted, and environmentally compliant, while allowing under-maintained but younger vessels to continue operations. Therefore, India should move toward a performance-based regulatory model—where vessel age serves as a trigger for enhanced scrutiny, but the final operational decision is based on multiple performance indicators. These may include:

- The vessel's safety inspection history.
- Certification and rating from a recognized classification society.
- Environmental performance (e.g., SOx/NOx emissions, energy efficiency index).

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19 https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.1186%2833%29.pdf

- Crew training levels and incident history.
- Degree of retrofitting and modernization (e.g., scrubbers, ballast water management, digital navigation systems).

This approach incentivizes shipowners to invest in vessel upgrades and adopt the best global practices while allowing well-performing older ships to continue serving in low-risk routes. India's merchant fleet, while expanding in capacity, faces structural challenges related to aging vessels, inconsistent maintenance, and insufficient safety audits. The share of Indian-flagged vessels over 20 years old is disproportionately high[20] compared to global standards (44% in India vs. 30% in other countries). In the absence of well-defined decommissioning or inspection policies based on age, older vessels continue to operate under minimal scrutiny, sometimes until failure or detainment by port state controls. This poses risks not only to crew and cargo but also to India's international reputation as a maritime nation. Moreover, India's aspirations to grow its shipbuilding sector and attract more international shipping lines will remain constrained unless the regulatory environment ensures high safety and compliance standards. Structured age norms will allow the Directorate General of Shipping (DGS) and Indian Register of Shipping (IRS) to better allocate inspection resources, set progressive de-flagging timelines, and create incentives for scrapping obsolete ships domestically—thereby also generating business for Indian recycling yards in Alang and elsewhere.

One of the most frequent criticisms from shipowners and operators is that increased safety inspections and regulatory audits reduce the ease of doing business. While safety and compliance are non-negotiable, the process by which they are enforced often leads to delays in clearances, vessel detention at ports, and unpredictability in voyage planning. Uncoordinated inspections, inconsistent enforcement across regional maritime authorities, and limited digital infrastructure compound the issue. For example, a vessel flagged in India may face multiple overlapping inspections—flag state control, port state control, IRS classification surveys, and customs compliance—without a centralized digital system to streamline the data or inspection records. This results in duplication of effort, extended port stays, and increased operating costs. Such inefficiencies directly impact India's score in global maritime competitiveness indices.

A structured age norm framework, if paired with digitized inspection systems and performance-based exemptions, can alleviate these concerns. Older vessels that meet stringent compliance benchmarks could be granted exemptions allowing reduced inspection frequency and faster port clearance, thereby rewarding good performance and reducing friction for compliant operators. India must view age norms for its

[20] https://shipmin.gov.in/sites/default/files/ISS%202023.pdf

mercantile fleet not as a punitive measure, but as a pathway to modernize, professionalize, and elevate the quality of its maritime assets. While ship age serves as a vital proxy for risk, a nuanced, performance-based system will ensure that well-maintained and retrofitted vessels are not unfairly penalized. Simultaneously, regulatory systems must be streamlined to reduce redundancy, lower business friction, and incentivize compliance. This dual approach focusing on stricter oversight with flexible implementation will enable India to build a safer, more competitive, and environmentally responsible maritime future.

5 Substantive Analysis of the DGS Order 6 of 2023

5.1 Published Academic Research

Based on an extensive review of recent academic literature, there is a clear and growing body of evidence suggesting that while ship age alone is not the sole determinant of maritime accidents, it plays a significant role in influencing operational risk, particularly when combined with other factors such as poor maintenance, vessel type, and geographical conditions. Studies by Papanikolaou and Eliopoulou (2008) and subsequent works consistently highlight that older ships, particularly bulk carriers and LNG vessels over 20 years of age, show a much higher frequency of accidents—up to three times more in some cases—than newer ships. This trend is echoed across different geographies and ship types, especially in data-heavy analyses such as those by Eliopoulou et al. (2016) and Fan et al. (2020), reinforcing concerns about the reliability and structural integrity of aging fleets.

Crucially, research such as that by Aalberg et al. (2022) and Xue et al. (2021) emphasizes that age-related deterioration often correlates with navigation accidents (e.g., groundings and collisions), though it is often exacerbated by substandard maintenance regimes. Other factors—such as classification society, flag state, vessel size, and operational region—were also identified as influential, sometimes more so than age alone. However, older vessels also tend to be smaller and more maintenance-challenged, compounding their risk profile and making age a practical indicator for policy action.

The research also underlines that not all vessel types are equally affected by aging—some categories, such as bulk and LNG carriers, show marked degradation in safety performance beyond the 20-year mark, whereas others are more resilient. This variation supports a differentiated, performance-based age restriction policy, where vessel age is considered alongside its operational history, maintenance records, and technical condition.

While ship age is not the only factor influencing accident likelihood, it is a key indicator of underlying risk when combined with maintenance quality and vessel type. For India's aging fleet, especially considering stricter environmental and safety norms globally, these findings justify the introduction of age-based restrictions, ideally paired with condition assessments and incentives for modernization. Adopting such evidence-backed policies would not only enhance maritime safety and environmental compliance but also align Indian shipping with international best practices and competitiveness.

Annexure 3 gives a detailed list of academic papers and their contribution to these findings.

5.2 Review of Maritime Transport (RMT) 2024

The global maritime industry is grappling with the challenges of an ageing fleet, stricter environmental regulations, and increasing uncertainty about future propulsion technologies. The UNCTAD Review of Maritime Transport (RMT) 2024 [21]offers a compelling case for policy intervention, highlighting how the average age of vessels worldwide has increased significantly in recent years. At the beginning of 2024, the average global fleet age by vessel count stood at 22.4 years, reflecting a two percent rise over the previous year. This number is especially driven by a large population of older, smaller vessels—general cargo ships, oil tankers, and other categories—that are now operational well past their optimal economic and environmental lifespan.

India's maritime fleet reflects these same trends, with a high percentage of ageing tonnage still in use, particularly among vessels that are smaller and less efficient. Given the increasing pressure to meet environmental goals set by the International Maritime Organization (IMO), and to maintain competitiveness in international trade, it is imperative for India to adopt a 25-year age norm policy for the withdrawal of older ships. The 2024 UNCTAD report confirms that 42% of the global fleet is older than 20 years, with general cargo ships (57%) and oil tankers (35%) forming the bulk of these ageing vessels. Additionally, the average vessel size of ships over 20 years old is only 7,234 DWT, compared to significantly larger averages for younger ships, implying a correlation between age and inefficiency.

Despite the growing age of the global fleet, demolition activity remains low, with only 431 vessels scrapped in 2023. This is largely due to strong freight markets, geopolitical disruptions (such as the Ukraine conflict), and inflated second-hand vessel prices, which have collectively delayed fleet renewal decisions. Moreover, approximately 60% of second-hand ships sold in 2023 were over 15 years old, showing a market tendency to favor extending the life of existing assets rather than investing in newbuilds. However, this commercial logic—while viable in the short term—runs counter to long-term strategic goals such as safety, emission compliance, and fleet modernization.

One of the key barriers to fleet renewal is the uncertainty over future fuels and ship technologies. Many shipowners hesitate to order new vessels due to fears of investing in potentially obsolete platforms. The 2024 report notes that this uncertainty is especially visible in bulk, crude, and chemical tanker segments where the orderbook remains thin. However, this hesitation reinforces the need for government-led guidance and policy certainly. A 25-year age norm, therefore, serves as a forward-looking mechanism to

[21] https://unctad.org/system/files/official-document/rmt2024_en.pdf

encourage planned vessel decommissioning while giving shipowners and builders clear investment timelines. The implementation of a 25-year shipping age limit can be justified on both economic and environmental grounds. Financial modeling (including stochastic dynamic programming models) shows that the optimal economic life of most vessel types is below 25 years or near 25 years. Operating beyond this threshold often results in diminished returns due to higher operating costs, lower fuel efficiency, and reduced compliance with emerging global norms. An age norm would also incentivize fleet renewal, support India's shipbuilding industry and aligning with the goals outlined in Maritime India Vision 2030.

For successful implementation, the policy should be phased and flexible. For example, vessels reaching 25 years can be retired in annual batches, while exemptions can be provided for retrofitted ships that meet current environmental standards such as EEXI and CII. Furthermore, ships operating on strategic domestic routes with limited replacement options may be granted short-term extensions under defined conditions. At the same time, policy success will depend on complementary enablers: green finance instruments, access to affordable credit, and enhanced capacity in Indian shipyards to absorb increased newbuild demand.

India should also consider developing a national ship registry that tracks vessel age, emissions, and operational status, with annual reports to guide stakeholders and foster compliance. This data-driven approach, coupled with a clear regulatory framework, can mitigate resistance from shipowners and enhance investor confidence. In sum, a 25-year age norm is not only consistent with global benchmarks but also positions India's fleet for safety, sustainability, and long-term competitiveness in a rapidly transforming maritime environment.

5.3 A Summary of Indian Flagged Vessels

This section presents a detailed statistical analysis of the Indian-flagged merchant fleet, focusing on age distribution, gross tonnage (GT), and compliance with the age norms established under the Directorate General of Shipping (DGS) Order No. 06 of 2023. The primary objective of this study is to assess the structural age profile of India's fleet, understand how vessel age correlates with tonnage, and evaluate the proportion of vessels that may be phased out over time under the prescribed exit age limits. Further details of the analysis are provided in **Annexure 4**.

The methodology employed involves exploratory data visualization and categorical cross-tabulations using fleet registry data. A combination of box plots, histograms, and violin plots are used to illustrate central tendencies, distribution shapes, and outliers in vessel age and tonnage. For example, box plots provide insight into median vessel age and interquartile ranges, while histograms supplemented with Kernel Density

Estimation (KDE) curves offer a smoothed view of frequency distributions. The analysis also segments vessels by GT bands (e.g., 0–15K, 15K–30K, etc.) to understand how age trends differ by vessel size.

Furthermore, the study uses cross-tabulation tables to quantify the relationship between age groups and GT categories, enabling a more granular understanding of how many vessels fall under potential exit criteria. Lastly, bar charts illustrate the gross tonnage distribution of vessels that are expected to exit service under current norms—immediately, in 3 years, and in 5 years—offering a temporal projection of regulatory impact. This structured analytical approach ensures both current and forward-looking insights into fleet modernization and regulatory preparedness.

The analysis offers a comprehensive overview of the Indian-flagged merchant fleet based on vessel age, gross tonnage (GT), and regulatory implications under the DGS Order No. 06 of 2023. It draws from official vessel registry data and employs statistical and visual methods to understand the structural profile and modernization needs of India's shipping sector. The core objective is to assess the composition and aging pattern of the fleet and to identify which segments are most affected by the prescribed age restrictions.

Visual analysis through box plots and violin plots indicates that a significant proportion of India's fleet is aging, with median vessel age concentrated between 15 and 20 years. The violin plots show a heavy skew toward older vessels, particularly in the small- and mid-tonnage segments. Histograms further confirm a clustering of vessels around the 15–25-year age mark, especially in the 0–30,000 GT category. While some vessels are newly built or modernized, there is a notable tail of ships beyond the 30-year mark, which raises operational, environmental, and safety concerns.

When grouped by gross tonnage bands—namely 0–15K, 15K–30K, 30K–45K, and above 45K—the data reveals that older vessels are more concentrated in the lower tonnage categories. In contrast, ships above 45,000 GT are generally newer, reflecting higher investment and compliance costs associated with large-scale vessels. However, these larger vessels also represent a disproportionate share of total gross tonnage, indicating that while fewer in number, they carry significant strategic importance for India's cargo capacity and trade competitiveness.

One of the key components of the analysis is the projection of fleet attrition under the DGS age norms. Bar charts quantify the total GT of vessels that fall under three categories: immediate exit (those already beyond age norms), exit in 3 years, and exit in 5 years. The results show a substantial proportion of the fleet—particularly in the bulk carrier and general cargo segments—will need to be phased out within the next 3 to 5 years unless retrofitted or replaced. This highlights the urgent need for fleet renewal and investment in compliant, energy-efficient ships.

The findings emphasize that without proactive policy and financial support, the current age distribution poses a risk to India's maritime ambitions under the Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047. The aging fleet threatens operational reliability, environmental performance, and safety compliance, especially in light of stricter IMO regulations such as the Carbon Intensity Indicator (CII) and EEXI requirements. Moreover, the potential exit of a significant portion of vessels may impact coastal trade capacity and increase reliance on foreign-flagged vessels if replacements are not timely.

This analysis demonstrates that while India's shipping fleet remains operationally relevant, it is on the cusp of a major transition. A large proportion of vessels are nearing or have surpassed age limits and will face increasing regulatory and commercial pressure to retire. The data underscores the need for a clear national strategy on ship replacement, green fleet incentives, and shipyard capacity expansion. Instituting age-based restrictions, as recommended by the DGS, is a crucial but only partial step—complementary measures including green financing, targeted subsidies, and streamlined ship acquisition policies will be vital to modernize and future-proof India's merchant fleet.

5.4 Impact of age on attained EEXI

The Energy Efficiency Existing Ship Index (EEXI) is an International Maritime Organization (IMO) regulation aimed at reducing greenhouse gas emissions from older ships. It sets a minimum energy efficiency standard for existing vessels, requiring them to meet specific carbon intensity limits based on ship type and size. Shipowners must calculate their vessel's EEXI and implement technical or operational measures—such as engine power limitations, hull modifications, or speed optimization—to comply. The regulation, which came into effect in 2023, is part of the IMO's broader strategy to cut maritime emissions by at least 40% by 2030 compared to 2008 levels. Compliance ensures ships operate more sustainably while minimizing environmental impact.

This section examines the relationship between vessel age and energy efficiency performance using the Attained Energy Efficiency Existing Ship Index (EEXI) as the key metric. Based on a sample dataset, regression analysis was conducted with Age as the primary explanatory variable, and DWT and Ship Type as moderating variables **(Annexure 6).**

The results reveal a positive correlation between vessel age and Attained EEXI, indicating that older ships tend to be less energy efficient. This trend is visually supported by the scatter plot, which shows a consistent upward pattern of EEXI values with increasing age across various ship types. These findings substantiate the view that newer vessels, built with advanced propulsion systems, better hull designs, and stricter compliance with emissions standards, are significantly more environmentally efficient. The analysis reinforces the strategic value of fleet modernization as a pathway to achieving the IMO's decarbonization goals, including the 2030 target of a 40% reduction in emissions.

Modern vessels are leading the way in pollution reduction, showcasing significantly improved environmental performance compared to older ships. With advancements in cleaner propulsion technologies, optimized hull designs, and stricter compliance with emissions standards, newer vessels contribute to a substantial decrease in maritime carbon and pollutant output. By reducing the average age of the global fleet and accelerating the replacement of older, less efficient ships with new builds, the shipping industry can make meaningful progress toward slashing greenhouse gas emissions. This transition not only aligns with international sustainability targets but also plays a pivotal role in achieving net-zero goals. Investing in fleet modernization, supported by policies like the Energy Efficiency Existing Ship Index (EEXI), ensure that the maritime sector remains on track to meet its environmental commitments while fostering long-term operational efficiency.

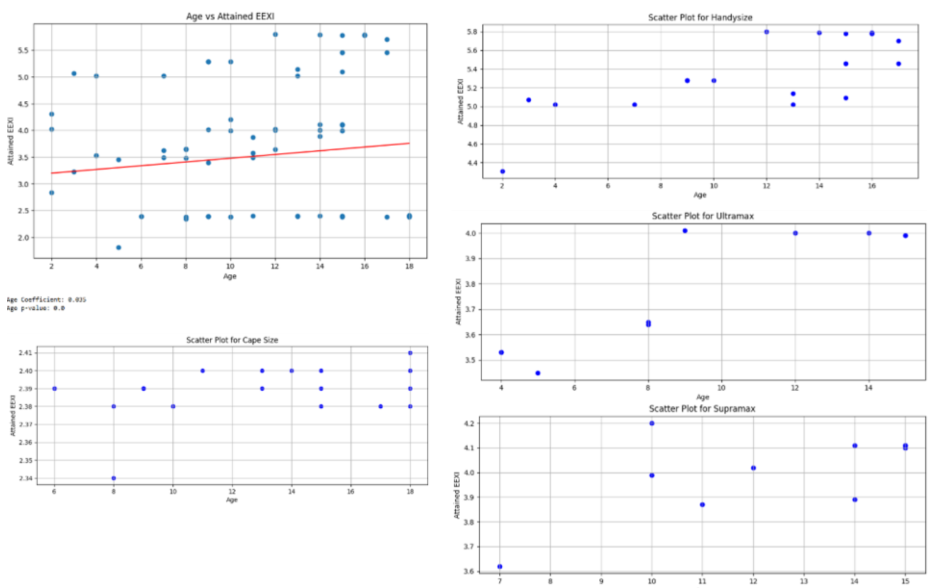

Figure 2: Scatter plot of Age~Attained EXI; overall and ship type wise

Together, the visual and statistical analyses provide compelling evidence that vessel age significantly affects energy efficiency, as captured by the attained EEXI. These findings support global decarbonization efforts and justify regulatory frameworks that incentivize the phasing out of older, high-emission ships. Strategic investments in fleet modernization, backed by robust policy implementation, are essential to align the shipping sector with global climate goals. These findings provide strong empirical support for the implementation of an age norm policy in the Indian maritime sector. The clear positive correlation between vessel age and attained EEXI demonstrates that older ships are consistently less energy efficient, contributing disproportionately to greenhouse gas emissions. As newer vessels integrate advanced technologies, cleaner propulsion systems, and optimized hull designs, they outperform older counterparts in meeting international sustainability benchmarks. An age-based regulatory framework would thus encourage the gradual phasing out of inefficient, high-emission vessels and accelerate the transition to a cleaner fleet. By aligning national policy with the IMO's decarbonization goals, the age norm not only enhances environmental compliance but also promotes long-term economic and operational efficiency within the shipping industry.

5.5 Port State Control (PSC)

The Port State Control (PSC) inspection data, compiled annually by the Directorate General of Shipping (DGS), is a key instrument for evaluating the safety, compliance, and quality performance of foreign-flagged vessels operating in Indian waters. The 2024 Annual Report[22] on PSC and Flag State Implementation presents comprehensive data on 513 inspections, covering a range of ship types, flags, classification societies, and—most importantly—ship age categories. The report clearly illustrates that ship age is a strong indicator of risk and non-compliance. For instance:

- Vessels over 20 years old accounted for only 19.29% of inspections but represented over 41% of total detentions.
- The detention rate for vessels over 20 years was 16.16%, compared to just 1.76% for vessels less than 12 years old.
- The average deficiency index—a measure of deficiencies per inspected ship—rose sharply with age:
    - 1.63 for ships aged 0–12 years
    - 3.56 for ships aged 13–20 years
    - 5.34 for ships over 20 years
- The nil deficiency rate also declined dramatically with age:
    - 44.24% for ships aged 0–12 years
    - 25.58% for ships aged 13–20 years
    - 12.12% for ships over 20 years

These patterns remain consistent across ship types and inspection years, confirming that older vessels not only fail more frequently but also perform worse across all key safety metrics. This empirical evidence

[22]https://www.dgshipping.gov.in/WriteReadData/userfiles/file/Annual%20Report%202024%20-%20Online%20Version_compressed.pdf

strongly supports the formulation of a national age norm policy, wherein aging vessels—particularly those over 20 years—are subjected to more rigorous oversight, incentivized for retrofitting, or phased out in alignment with sustainability and safety goals. Leveraging PSC data in this way ensures that policy measures are not arbitrary but are data-driven, internationally benchmarked, and responsive to evolving risk patterns in the maritime domain.

5.6 Flag State Inspection

The Flag State Inspection (FSI) regime, as implemented by the Directorate General of Shipping (DGS), is a cornerstone of India's maritime regulatory framework. FSIs are conducted on Indian-flagged vessels to monitor compliance with safety, environmental, and operational standards. The 2024 FSI[23] data provides deep insight into the quality performance of Indian vessels, segmented by age, ship type, tonnage, and operating company. Notably, age-based scheduling of inspections is already embedded in India's FSI system, with older vessels inspected more frequently. The 2024 FSI data reinforces the rationale for transitioning from an inspection-based age model to a policy-backed age norm, by highlighting strong statistical correlations between vessel age and poor compliance outcomes. The data shows a clear deterioration in vessel performance with increasing age. Ships over 25 years exhibited the highest average deficiency index at 7.53, compared to 6.06 for ships aged 15–25 years, and 6.46 for ships below 5 years. Similarly, the nil deficiency rate—a measure of clean inspections—dropped drastically with age: only 2.34% of ships over 25 years passed inspections without a single deficiency, compared to 10.46% for those aged 5–15 years and 3.33% for the youngest cohort. While the detention rate for ships over 25 years stood at 3.91%, relatively comparable to other age groups, the persistently high deficiency levels and poor compliance performance highlight the increasing operational risk posed by aging vessels.

Average Deficiency Index	Nil Deficiency Rate	Detention Rate
Up to 5 years: 6.46 5–15 years: 6.39 15–25 years: 6.06 Over 25 years: 7.53	Up to 5 years: 3.33% 5–15 years: 10.46% 15–25 years: 9.77% Over 25 years: 2.34%	Up to 5 years: 3.33% 5–15 years: 5.81% 15–25 years: 2.93% Over 25 years: 3.91%

Table 3: Summary of FSI Data

[23]https://www.dgshipping.gov.in/WriteReadData/userfiles/file/Annual%20Report%202024%20-%20Online%20Version_compressed.pdf

Moreover, older vessels forming just 20% of inspected ships accounted for a disproportionately high share of detentions and deficiencies. Certain vessel categories such as tugboats and “other types of ships” were particularly underperforming in the older age segments, with tugboats over 25 years recording a deficiency index of 6.64 and nil deficiency rate of just 2.94%. These trends point to the diminishing returns of relying solely on inspections to manage risk in older ships. They also underscore the administrative and safety burdens these vessels place on the regulatory system. Given the alignment of these findings with India’s broader maritime goals under the Maritime India Vision 2030 and the country’s recognition under the QUALSHIP 21 program, an age norm policy is not only data-driven but strategically warranted. It will help phase out substandard vessels, reduce safety and environmental risks, and modernize the Indian fleet in step with global best practices.

Ship Type	Age Group	No. of Inspections	No. of Detentions	Deficiency Index	Nil Deficiency Rate
All Ship Types	0–12 yrs	113	2	1.63	44.24%
	13–20 yrs	301	21	3.56	25.58%
	> 20 yrs	99	16	5.34	12.12%
Bulk Carriers	0–12 yrs	57	1	1.43	49.12%
	13–20 yrs	145	8	3.24	32.41%
	> 20 yrs	33	5	5.51	18.18%
Gas Carriers	0–12 yrs	5	0	1	60.00%
	13–20 yrs	11	0	2.45	0.00%
	> 20 yrs	3	0	5.33	0.00%
Other Types	0–12 yrs	13	0	2.38	30.76%
	13–20 yrs	40	3	3.6	25.00%
	> 20 yrs	27	3	4.3	14.81%
Oil Tankers	0–12 yrs	1	0	0	100.00%
	13–20 yrs	23	5	5.47	8.69%
	> 20 yrs	3	2	6.33	0.00%
Container Ships	0–12 yrs	10	0	0.7	50.00%
	13–20 yrs	29	0	2.44	24.13%
	> 20 yrs	10	1	5	20.00%
Chemical Tankers	0–12 yrs	20	0	1.9	35.00%
	13–20 yrs	36	4	4.5	22.22%
	> 20 yrs	17	3	5.82	0.00%

Table 4: Detailed Analysis of FSI data by vessel type

The compiled data (Tables 13A to 13G in the 2024 Annual Report[24]) on Port State Control clearly establishes a consistent and measurable decline in vessel compliance and performance with increasing age. Ships less than 12 years old exhibit the strongest performance, with a low deficiency index (as low as 0.70 for container ships and 1.43 for bulk carriers), minimal or no detentions, and high nil deficiency rates—up to 60% in gas carriers and 50% in container ships. In contrast, vessels over 20 years of age show significantly higher deficiency indices, rising to 5.34 across all ship types and peaking at 6.33 for oil tankers and 5.82 for chemical tankers. Their nil deficiency rates fall steeply, in many cases to zero, indicating that virtually all older ships have some form of deficiency during inspection. Detention rates also increase with age, especially among high-risk ship types such as oil tankers and bulk carriers.

This trend is not limited to a specific vessel category but holds true across the board—bulk carriers, chemical tankers, gas carriers, general cargo ships, and even container vessels demonstrate a marked deterioration in performance with age. The sharp contrast in performance between younger and older vessels underscores the growing operational and safety risks associated with aging ships. These findings strongly support the introduction of a structured age norm policy, where vessels beyond a defined age threshold (e.g., 20 or 25 years) are phased out or subjected to stricter compliance measures. Such a policy would not only improve the overall quality and reputation of the Indian fleet but also align with global regulatory and environmental trends, reduce detention risks in foreign ports, and contribute to India's maritime modernization goals under the Maritime India Vision 2030.

5.7 Primary Survey – Stakeholder Feedback

This section explores stakeholder responses and empirical insights regarding DGS Order No. 6 of 2023, which sets age restrictions on Indian-flagged vessels. It draws upon findings from a structured survey and follow-up interviews with key maritime stakeholders, including shipowners, operators, regulators, and offshore service providers.

[24]https://www.dgshipping.gov.in/WriteReadData/userfiles/file/Annual%20Report%202024%20-%20Online%20Version_compressed.pdf

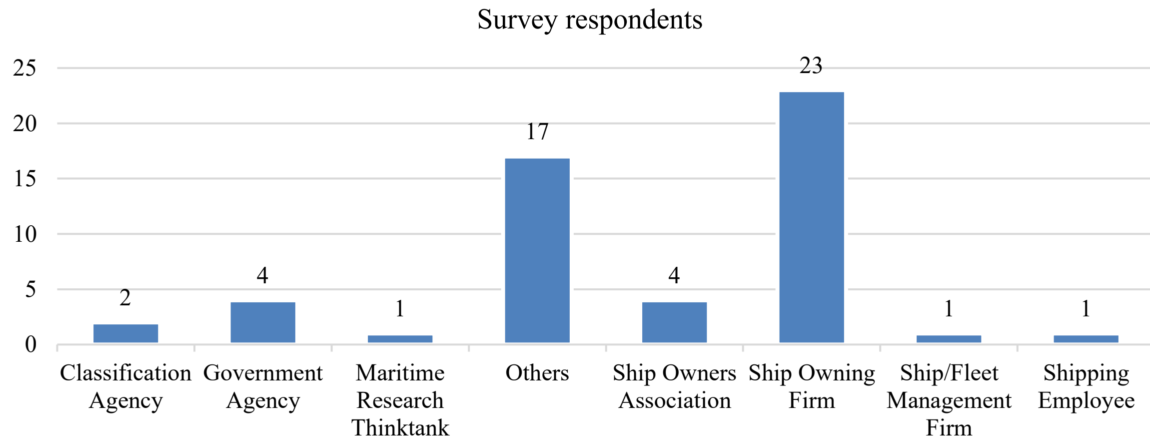

Figure 3: Summary of Respondents in Primary Survey

The survey assessed the perceived impact of the Order on various dimensions of the Indian shipping industry, including operational safety, economic viability, environmental sustainability, and international competitiveness. The Order, aimed at enhancing the safety, efficiency, and environmental standards of India's maritime sector, has triggered wide-ranging responses. While its intent to modernize the fleet and align with global green goals is acknowledged, many respondents argue that age alone is an insufficient indicator of a vessel's safety or sustainability performance. Instead, they highlight the importance of maintenance quality, technological upgrades, and the operational role of specialized vessels, particularly in the oil, gas, and dredging sectors.

In this context, the section systematically evaluates the implications of the Order from multiple angles, including financial feasibility, industry competitiveness, regulatory alignment with international norms, and the availability of supportive infrastructure and financing. Through this lens, it offers a grounded and nuanced analysis of the Order's motivations, impacts, and areas requiring policy refinement or reassessment. The respondent profile for the stakeholder feedback comprises a cross-section of India's maritime industry, including shipowners, classification societies, shipping company executives, offshore service operators, and technical experts. A total of 24 respondents participated in the survey, with follow-up input gathered from targeted interviews. The majority represented firms engaged in bulk shipping, offshore logistics, dredging, and coastal shipping. Their perspectives provide a balanced view of the operational, technical, and financial impact of the DGS age norm policy.

Perceptions of the Order's Intent and Need - Most respondents acknowledged the intention behind DGS Order No. 6 of 2023 as progressive, aiming to align India's fleet with global standards on safety, emissions, and competitiveness. However, many emphasized that age alone is not sufficient benchmark for vessel quality. Instead, vessel condition, maintenance history, and compliance records were viewed as better indicators of fitness. Some operators feared that a purely age-based restriction could unfairly penalize well-maintained or recently refurbished older ships, particularly in the offshore, dredging, and specialized cargo segments.

Impact on Industry Segments - The offshore sector, especially vessels used in oil and gas services, expressed strong concerns regarding the three-year window for phase-out of non-compliant vessels. Many of these assets are built to last 30–35 years and are subject to intensive class-based inspections. Respondents suggested that applying blanket age caps may disrupt ongoing contracts, affect project timelines, and impose capital burdens on operators. Similarly, coastal and smaller domestic operators expressed concerns about financial feasibility, given the high cost of acquiring newer vessels and limited access to long-term financing.

Views on Global Benchmarking and Environmental Goals - A large section of the respondents supported modernization and energy-efficiency goals but advocated for a performance-based assessment model, like Condition Assessment Programs (CAP) used globally. They acknowledged India's need to meet IMO climate goals, especially around the Carbon Intensity Indicator (CII) and Energy Efficiency Existing Ship Index (EEXI) but felt the policy must be supplemented with incentives for retrofitting, operational optimization, and low-emission technologies, rather than strict cutoffs based on age alone.

Suggestions for Improvement - Stakeholders broadly recommended introducing conditional exemptions based on third-party technical evaluations, lifecycle emissions analysis, and vessel performance. Additionally, many called for financial schemes, such as green ship financing, accelerated depreciation, or tax incentives to support fleet renewal. The importance of developing domestic shipbuilding capacity was also stressed, with concerns about the limited ability of Indian shipyards to deliver large numbers of compliant vessels in a short timeframe.

5.7.1 Key Survey Findings

While the DGS Order is seen as a positive move toward a safer, cleaner fleet, its current structure may lead to unintended consequences unless it allows for greater flexibility, contextual application, and supportive policy mechanisms. A transition strategy that combines age-based norms with performance criteria and financial aid could yield more balanced and sustainable outcomes for the Indian maritime ecosystem.

Despite the concerns raised by various stakeholders, the implementation of age norms remains both justified and necessary in the broader context of India's strategic maritime transformation. Much of the resistance is rooted in commercial interests, with operators seeking to extend the economic life of aging vessels to avoid immediate capital expenditure. However, this approach does not align with the long-term national priorities outlined in the Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047, which emphasize safety, environmental sustainability, and global competitiveness. The feedback received reflects a broader pattern of resistance to change, where legacy operations and entrenched practices slow the pace of structural reform urgently needed in the sector.

The responses from the technical stakeholders—comprising technical superintendents, shipyard executives, and engineering managers—reveal a markedly more favorable disposition toward the implementation of age-based norms for vessels under DGS Order No. 6 of 2023, especially when compared to the general stakeholder group that includes shipowners, dredging operators, and offshore service providers. Technical respondents largely view the age norm as a pragmatic tool to promote modernization, environmental sustainability, and operational safety in Indian shipping. They argue that while vessel age is not a perfect indicator of performance, it serves as a reasonable proxy for systemic inefficiencies, rising maintenance costs, and outdated technology that hinder competitiveness. These respondents support the order's intent, highlighting that it incentivizes the induction of technologically advanced, eco-friendly vessels, and aligns India's flag state policies with international trends in emissions control and port state compliance. They also underscore the strategic advantage of reducing India's reliance on older, harder-to-maintain vessels, which often pose safety, operational, and environmental risks.

In contrast, management stakeholders exhibit a more skeptical stance toward the age-based regulation. Their feedback emphasizes the economic disruption such a policy might cause—particularly for owners of specialized or capital-intensive ships like dredgers, diving support vessels, and offshore service craft. This group argues that operational condition, proper maintenance, and compliance with international standards such as SOLAS or MARPOL should be prioritized over blanket age limits. They contend that many older vessels remain seaworthy and compliant, and that the order may unjustly penalize smaller or domestic players who lack the financial muscle to rapidly replace assets. Furthermore, general respondents voice concerns about the lack of stakeholder consultation in the drafting of the policy and perceive the age norms as favoring large or better-funded shipping interests, thereby exacerbating market asymmetries and potentially eroding Indian tonnage through reflagging.

Moreover, technical respondents demonstrate higher confidence in the policy's potential to improve India's maritime safety profile, environmental performance, and global competitiveness. They offer a series of constructive, policy-aligned suggestions—such as implementing phased transitions, using performance-based exemptions (e.g., RightShip ratings), and introducing tax breaks or subsidies to ease financial burdens. Their responses convey a belief in the strategic rationale behind the policy and present it as a catalyst for long-overdue reforms in Indian shipping. General respondents, however, remain doubtful that the order can achieve its intended outcomes without first resolving underlying issues like inadequate financing options, infrastructure gaps, and inconsistent enforcement of existing safety inspections.

In summary, the divergence in views can be attributed to the technical group's alignment with long-term national objectives—fleet modernization, improved flag reputation, and sustainability—versus the general group's emphasis on operational viability, economic constraints, and the risks of abrupt regulatory shifts. While the technical respondents advocate for a structured and flexible rollout of the age norm policy, general stakeholders frame their opposition as a call for more inclusive, performance-oriented, and economically sensitive policymaking.

That said, the Directorate General of Shipping (DGS) can adopt a balanced and pragmatic approach by allowing a degree of flexibility for vessels that demonstrably meet high performance standards. Ships that undergo rigorous third-party assessments, maintain strong safety records, and integrate energy-efficient technologies should be eligible for conditional extensions (provided they align with the broader objectives of decarbonization, safety, and modernization). This would send a clear signal that the age norms are not punitive but reformative, encouraging voluntary compliance while maintaining the integrity of the policy. Such calibrated implementation would ensure that the mission's core goals are preserved, while supporting responsible shipowners in contributing to India's emergence as a sustainable maritime power.

6 Causal loop analysis of the important components of the Indian maritime economics

The maritime industry of a nation is a part of a complex system comprising of the world maritime industry, ship building industry, maritime authorities, national trade, etc. In this regard, we try to qualitatively analyze the impact of age restriction on the overall system. Figure below illustrates a causal loop diagram (CLD) showing the various constituent variables and their interrelationships. The variables of the CLD are illustrated in rectangular boxes and the arrows between them represent causalities. The direction of the arrows shows the direction of causality and the sign on them shows whether the causality is positive (+) or negative (-). The arrows and their signs always show the causality in the positive sense of a variable, e.g. increase in the Indian tonnage will lead to a reduction in freight rates. Parallel lines perpendicular to an arrow represent delay in the causality.

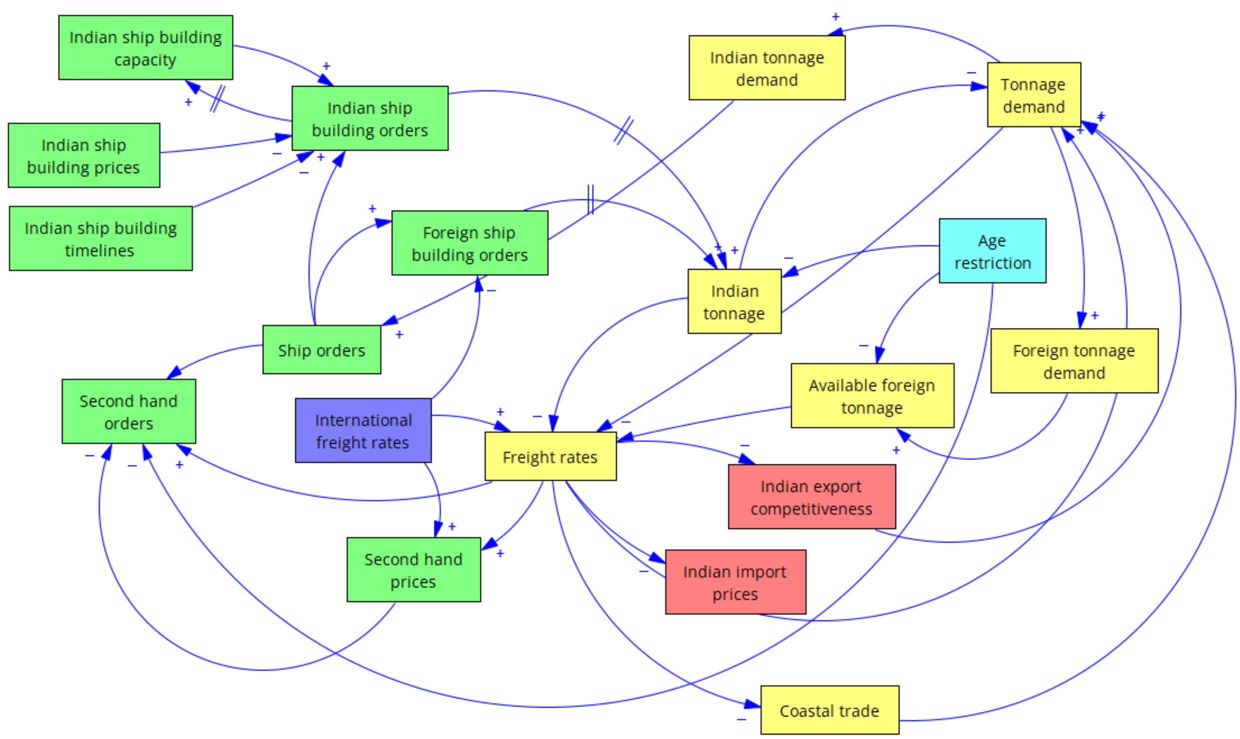

Figure 4: Causal Loop Diagram of the impact of age restrictions on maritime economics

Age restriction on the Indian vessels will lead to reduction in both Indian and available foreign tonnage. This will lead to an increase in freight rates for both deep ocean and short sea shipping in and to/from India. Higher freight rates imply reduced export competitiveness and higher import prices. Lower export competitiveness will lead to a reduction in tonnage demand. Higher freight rates will also lead to a reduction in coastal trade, which will further lead to a reduction in tonnage demand. Lower Indian tonnage will also lead to an increase of tonnage demand to fulfill the essential trade gap. Overall age restrictions should lead to more tonnage demand as a substantial part of existing tonnage will need replacement. Higher tonnage demand will lead to increase in demand for both Indian and foreign tonnage. Foreign tonnage can be immediately availed at higher freight rates, although Indian tonnage will take time to fill the gap. Indian tonnage demand will lead to higher numbers of ship orders. Ship orders can be either newbuild or second hand, with former being either given to the Indian shipyards or foreign shipyards. The orders to the Indian shipyards in-turn depends on their prices and timelines in comparison to the foreign shipyards and the current capacity. New orders to the Indian shipyards will lead to increase in capacity, although with some delay. Also, any new ship built will be added to the tonnage with a delay of a few years. Ship orders will also lead to an increase in second-hand orders. The proportion of second-hand orders depends on market prices, freight rates and age restrictions imposed. Although freight rates in Indian shipping is an important endogenous variable in this model, international freight rates will have a strong impact on the same. International freight rates will have a positive causation with second-hand ship prices and negative causation to foreign ship building orders. Overall, when the international freight rates are lower, age restriction will not impact on the economy negatively. On the other hand, when the international freight rates are higher, the overall impact of the Indian maritime economy will be negative as the flexibility of the Indian maritime trade to adjust tonnage based on the market demand will be lower. The cause and effect can be demonstrated using the variations in average vessel age along with Baltic Exchange Capesize index. As the index becomes high, one can see a commensurate increase in average vessel age, worldwide.

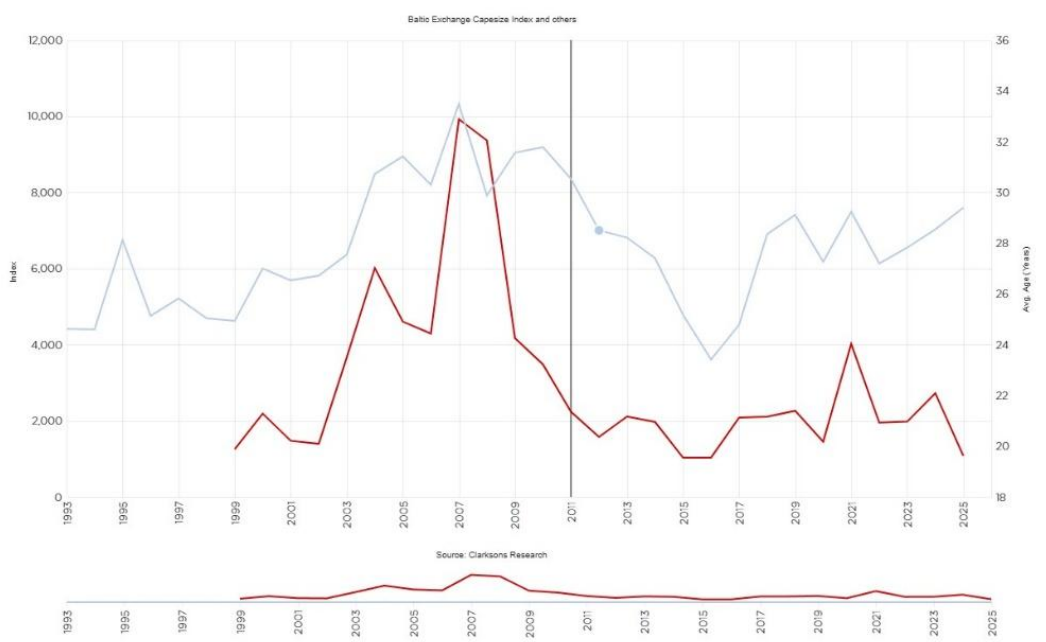

Figure 51: Variations in Age and Freight index

7 Scenario Analysis

In the context of a rapidly evolving maritime industry, scenario planning has become an essential tool for strategic decision-making. Global priorities such as environmental sustainability, operational safety, energy efficiency, and regulatory compliance are reshaping the way fleets are managed and vessels are deployed. One of the most critical policy levers influencing these priorities is the age profile of the operating fleet.

The maritime sector is currently navigating complex challenges, including increasing international pressure to reduce greenhouse gas emissions under frameworks like the IMO's decarbonization targets, the need for safer and technologically advanced vessels, and the growing importance of port state compliance. At the same time, shipowners and operators must weigh these pressures against the realities of capital expenditure, fleet availability, and market demand.

To guide regulatory and operational policy decisions, this report undertakes a comprehensive scenario planning exercise based on different vessel age norms ranging from 15 to 35 years. The goal is to evaluate the quantitative impact on fleet composition under each scenario and to explore the qualitative implications across key dimensions such as safety, energy efficiency, fleet renewal, and market readiness. The analysis spans five distinct scenarios:

- Scenario 1: A stringent norm allowing vessels up to 15 years of age.
- Scenario 2: A moderately strict age limit of 20 years.
- Scenario 3 (Proposed): A customized, policy-optimized scenario with differentiated norms across vessel types. This is based on the maximum conditional relaxation allowed to the existing fleet as per the DGS Order No. 06 of 2023 dated 24.02.2023 and Corrigendum I dated 24.06.202.

Oil Tankers	*25 years*	*Chemical Carrier*	*30 years*
Bulk Carriers	*25 years*	*Gas/ Chemical Carrier*	*30 years*
General Cargo	*25 years*	*Oil/Chemical Carrier*	*30 years*
Offshore Fleet	*20 years*	*Harbour Tugs*	*30 years*
Specialised Vessels	*30 years*	*Anchor Handling Tugs*	*25 years*
Container Vessels	*30 years*	*Dredgers*	*40 years*
Cement Carriers	*30 years*	*Dumb Barges*	*25 years*
Gas Carrier	*30 years*	*Other Vessels*	*25 years*

- Scenario 4: A lenient age norm allowing vessels up to 30 years old.
- Scenario 5: The most permissive case, allowing vessels up to 35 years of age.

Each scenario reflects a different regulatory posture—from highly conservative to broadly inclusive—and provides insights into its potential impact on fleet renewal cycles, shipbuilding demand, and compliance obligations. By presenting these five alternatives, the scenario planning framework enables stakeholders—including regulators, shipowners, classification societies, and policymakers—to make informed decisions that align with their strategic objectives, financial capacity, and long-term vision for a modern, efficient, and compliant maritime fleet. This structured approach not only aids in selecting an optimal policy direction but also anticipates the trade-offs and synergies between operational practicality and broader industry transformation goals. Through this lens, scenario planning becomes more than a forecasting tool—it becomes a blueprint for responsible and future-ready fleet governance.

7.1 Impact on Number of Vessels (Assuming Policy Implementation as Feb 2026)

Vessel Type (As per age norms)	Number of Vessels	Impact - Percentage of Ships Deregistered				
		Scenario 1 15 Yrs	Scenario 2 20 Yrs	Scenario 3 Proposed	Scenario 4 30 Yrs	Scenario 5 35 Yrs
Oil Tankers	123	82.11%	45.53%	13.82%	4.88%	4.07%
Bulk Carriers	83	40.96%	24.10%	3.61%	0.00%	0.00%
General Cargo Vessels	275	50.55%	21.82%	10.91%	8.36%	4.36%
Offshore Fleet	39	71.79%	38.46%	38.46%	10.26%	10.26%
Specialised Vessels	0	0.00%	0.00%	0.00%	0.00%	0.00%
Container Vessels	24	95.83%	75.00%	0.00%	0.00%	0.00%
Cement Carriers	13	84.62%	53.85%	23.08%	23.08%	0.00%
Gas Carrier	23	95.65%	30.43%	8.70%	8.70%	0.00%
Chemical Carrier	1	100.00%	100.00%	0.00%	0.00%	0.00%
Gas/ Chemical Carrier	1	100.00%	100.00%	100.00%	100.00%	100.00%
Oil/Chemical Carrier	10	80.00%	30.00%	10.00%	10.00%	0.00%
Harbour Tugs	346	54.05%	33.53%	9.83%	9.83%	2.31%
Anchor Handling Tugs	6	100.00%	16.67%	0.00%	0.00%	0.00%
Dumb Barges	1	0.00%	0.00%	0.00%	0.00%	0.00%
Other Vessels	19	47.37%	31.58%	21.05%	21.05%	21.05%
Average Impact	**964**	**59.13%**	**32.26%**	**11.41%**	**8.09%**	**3.53%**

Table 5: Impact on Number of Vessels (Assuming Policy Implementation as Feb 2026)

Scenario 1 – 15 Years Age Norm (Average Impact: 59.13%) - This is the most stringent scenario, applying a strict upper age limit of 15 years for vessels to be considered compliant. As a result, a large percentage of the fleet is impacted, with an overall average impact of 59.13%, indicating that over half of all vessels across types would not meet the requirement. Vessel types such as Gas Carriers (95.65%), Container Vessels (95.83%), Cement Carriers (84.62%), and Oil Tankers (82.11%) are especially impacted. This suggests that a significant portion of these fleets are older than 15 years. On the other hand, vessels like Gas/Chemical Carriers and Chemical Carriers report 100% compliance, possibly due to a newer or well-maintained fleet. While this scenario might be ideal from a safety, efficiency, or environmental standpoint, its high impact implies major operational disruptions and fleet overhauls would be necessary across the industry.

Scenario 2 – 20 Years Age Norm (Average Impact: 32.26%) - Scenario 2 offers a moderate relaxation of the age restriction, extending it to 20 years. This results in a noticeably lower average impact of 32.26%, meaning that roughly one-third of vessels are still affected, but two-thirds would comply. The biggest beneficiaries of this extension are vessel types like Harbour Tugs (impact reduced to 33.53%), Bulk Carriers (24.10%), and General Cargo Vessels (21.82%), which see significantly reduced impact from Scenario 1. However, vessels like Gas/Chemical Carriers and Chemical Carriers still remain at 100% compliance, confirming their fleet remains uniformly within the age norm. This scenario might represent a realistic compromise, improving compliance rates without drastically affecting older but operationally viable vessels.

Scenario 3 – Proposed Scenario (Average Impact: 11.41%) - Scenario 3 is labeled as the “Proposed” scenario, and appears to be a tailored model with varying age thresholds or custom exclusions for certain vessel categories. The average impact drops sharply to just 11.41%, indicating minimal disruption across the fleet. Key reductions include Container Vessels, Anchor Handling Tugs, and Chemical Carriers, all of which show 0% impact, meaning they are either exempt or fully compliant under the proposed terms. Offshore Fleet maintains a higher impact (38.46%), suggesting its fleet still includes a notable portion of older vessels. This scenario seems to be strategically optimized to balance regulatory goals (such as safety or emissions control) with minimal operational cost, and would likely be widely acceptable to stakeholders. However, the fact that some vessel types like Gas/Chemical Carriers remain at 100% compliance might indicate either a standardized exemption or uniformity in newer fleet age across that category.

Scenario 4 – 30 Years Age Norm (Average Impact: 8.09%) - By extending the age norm to 30 years, Scenario 4 results in a very low average impact of 8.09%. This means that over 90% of all vessels across the fleet would be considered compliant. Even vessel types that had high impacts in stricter scenarios—such as Oil Tankers, General Cargo Vessels, and Offshore Fleet—see their non-compliance percentages drop significantly. However, a few types, like Offshore Fleet (10.26%) and Cement Carriers (23.08%), still show relatively higher non-compliance, indicating the presence of vessels older than 30 years in these segments. While this scenario is very inclusive and non-disruptive, it might compromise on modernization, fuel efficiency, or safety standards, especially if older vessels are less capable of meeting environmental or technical regulations. It offers operational ease but could face pushback from regulatory bodies concerned with aged fleets.

Scenario 5 – 35 Years Age Norm (Average Impact: 3.53%) - Scenario 5 is the most lenient of all, allowing vessels up to 35 years of age to be considered compliant. As a result, the average impact is just 3.53%, meaning nearly all vessels across the fleet meet the criteria. Only a handful of vessel types such as Harbour Tugs (2.31%) and General Cargo Vessels (4.36%) show even minor levels of non-compliance. This scenario reflects a highly permissive policy, likely aimed at minimizing operational costs and disruptions. However, from a policy perspective, it raises concerns about the safety, performance, and environmental compliance of aging vessels. Given that some fleets may still be in active service well past their technical prime, this scenario might be considered outdated or risky unless offset by rigorous maintenance and inspection protocols. It may work in regions or sectors with budgetary constraints, but it's unlikely to satisfy stricter international maritime standards.

7.2 Impact on Gross Tonnage (Assuming Policy Implementation as Feb 2026)

Vessel Type (As per age norms)	Number of Vessels	Impact - Percentage of Gross Tonnage Lost				
		Scenario 1 15 Yrs	Scenario 2 20 Yrs	Scenario 3 Proposed	Scenario 4 30 Yrs	Scenario 5 35 Yrs
Oil Tankers	123	86.66%	42.07%	5.64%	0.06%	0.04%
Bulk Carriers	83	45.13%	29.31%	4.32%	0.00%	0.00%
General Cargo Vessels	275	42.46%	20.40%	8.25%	6.14%	3.19%
Offshore Fleet	39	67.99%	38.68%	38.68%	14.38%	14.38%
Specialised Vessels	0	0.00%	0.00%	0.00%	0.00%	0.00%
Container Vessels	24	99.77%	67.38%	0.00%	0.00%	0.00%
Cement Carriers	13	75.58%	21.50%	7.75%	7.75%	0.00%
Gas Carrier	23	94.69%	17.84%	0.70%	0.70%	0.00%
Chemical Carrier	1	100.00%	100.00%	0.00%	0.00%	0.00%
Gas/ Chemical Carrier	1	100.00%	100.00%	100.00%	100.00%	100.00%
Oil/Chemical Carrier	10	78.03%	22.86%	2.20%	2.20%	0.00%
Harbour Tugs	346	51.28%	25.83%	7.35%	7.35%	2.84%
Anchor Handling Tugs	6	100.00%	28.19%	0.00%	0.00%	0.00%
Dumb Barges	1	0.00%	0.00%	0.00%	0.00%	0.00%
Other Vessels	19	68.06%	58.38%	46.98%	46.98%	46.98%
Average Impact	**964**	**73.93%**	**36.21%**	**4.99%**	**0.86%**	**0.47%**

Table 6: Impact on Gross Tonnage (Assuming Policy Implementation as Feb 2026)

Scenario 1 – 15-Year Age Norm - Scenario 1 represents the most aggressive fleet renewal policy, imposing a strict 15-year cap on vessel age. This scenario would result in a massive 73.93% reduction in gross tonnage, effectively decommissioning most of the operational fleet. Key segments like container vessels (99.77%), gas and chemical carriers (94–100%), and oil tankers (86.66%) would be nearly eliminated from service, leading to an acute shortage in carrying capacity. This level of impact would overwhelm domestic and international shipyards with replacement demand, causing multi-year bottlenecks and skyrocketing new-building prices. Additionally, port infrastructure, logistics providers, and shipping companies would face significant disruptions, particularly those relying on specialized or less replaceable vessels. While this scenario would yield immediate gains in safety and environmental performance, the scale of economic dislocation, capital burden, and fleet availability risk make it impractical under current industry conditions.

Scenario 2 – 20-Year Age Norm - Scenario 2 adopts a somewhat more moderate approach than Scenario 1, setting a 20-year maximum vessel age. Despite this relaxation, the gross tonnage impact remains significantly high at 36.21%, with many essential vessel categories still heavily affected. For example, container vessels lose 67.38% of GT, oil tankers 42.07%, and offshore fleets 38.68%. These reductions suggest that a large proportion of operationally viable vessels would still be forced out of service. Such a change would pressure owners to reinvest in new tonnage quickly, posing challenges related to capital allocation, shipyard capacity, and delivery lead times. While this scenario would improve fleet standards in terms of energy efficiency and safety, the transition cost and potential freight market instability could outweigh its benefits. It remains ambitious and potentially valuable in the long term but requires phased implementation and financial safeguards for affected stakeholders.

Scenario 3 – Proposed Age Norm - Scenario 3, the proposed policy scenario, offers the most balanced and realistic pathway to achieving strategic maritime objectives without sacrificing economic and operational stability. With a minimal gross tonnage impact of only 4.99%, this scenario ensures that the core carrying capacity of the fleet remains intact. The GT losses are strategically concentrated in segments like general cargo vessels (8.25%), offshore units (38.68%), and cement carriers (7.75%), which typically include aging, less efficient vessels. More critical sectors such as container shipping and chemical tankers remain unaffected, preserving high-capacity and globally aligned assets. Scenario 3 facilitates a targeted and manageable fleet renewal, encouraging investment in modern ships while allowing continued operation of technically sound, well-maintained older vessels. It also aligns with IMO sustainability goals and domestic shipbuilding policy, enabling a gradual shift toward safer, greener, and more competitive maritime assets without risking systemic disruption.

Scenario 4 – 30-Year Age Norm - Scenario 4 relaxes the age cap to 30 years, resulting in a very low gross tonnage impact of just 0.86%. This allows the continued operation of nearly all vessels in the existing fleet, including older units that may no longer align with international best practices for safety and environmental performance. While this approach ensures short-term continuity in fleet operations and relieves shipowners of near-term capital pressures, it also prolongs the operational life of inefficient or outdated vessels. Prolonged use of such vessels may lead to increased fuel consumption, higher maintenance costs, and elevated safety risks, particularly in volatile cargo segments such as tankers and gas carriers. From a policy standpoint, this scenario offers operational ease but falls short in driving the renewal, innovation, and sustainability agenda required for global competitiveness and compliance with environmental standards.

Scenario 5 – 35-Year Age Norm - Scenario 5 is the most permissive and conservative option, with an average gross tonnage impact of only 0.47%, effectively maintaining the existing fleet without requiring any significant vessel retirement. While this approach provides complete stability and cost avoidance for shipowners, it also postpones necessary investments in modern technologies, energy efficiency, and safety enhancements. This scenario would likely result in a gradual erosion of fleet competitiveness, as other countries adopt tighter norms and port-state control regimes penalize older vessels. The continued operation of ships up to 35 years of age also increases the likelihood of breakdowns, accidents, and emissions violations, particularly in international waters where enforcement is strict. While this scenario may be suitable for short-term economic stability, it is incompatible with long-term sustainability goals, industrial policy incentives, and carbon neutrality ambitions, making it an unviable choice for a forward-looking maritime strategy.

7.3 Summary of Scenario Analysis

Based on the analysis of vessel impact under various age norm scenarios, it is recommended that Scenario 3 – Proposed be adopted as the guiding framework for policy implementation. This scenario results in a moderate fleet impact of 11.41%, significantly lower than the disruptive effects seen under stricter regimes such as Scenario 1 (59.13%) and Scenario 2 (32.26%). At the same time, it avoids the regulatory leniency of Scenarios 4 and 5, which, although less disruptive (8.09% and 3.53% impact, respectively), risk undermining the sector's modernization, safety, and environmental goals. By applying differentiated norms or exemptions across vessel types, Scenario 3 strikes a careful balance between practicality and progressive compliance. One of the most compelling advantages of adopting Scenario 3 is that it facilitates a gradual but deliberate renewal of the fleet, encouraging shipowners to invest in newer, more efficient vessels without triggering sudden or unsustainable capital demands. This approach can serve as a catalyst for shipbuilding activity, supporting domestic and global shipyards and stimulating the maritime supply chain. A managed transition of this nature ensures economic resilience while aligning with industry evolution.

Beyond the operational and economic considerations, Scenario 3 supports broader strategic objectives such as improved energy efficiency and reduced environmental impact. Newer vessels are typically built to meet the latest energy efficiency standards (such as the IMO's EEDI and EEXI regulations), use cleaner fuels, and incorporate advanced digital systems for optimized routing and fuel management. As such, enforcing moderate age norms indirectly contributes to meeting carbon reduction targets, while simultaneously lowering operating costs over the vessel's lifecycle. Safety considerations also weigh heavily in favor of timely vessel renewal. Older vessels, even if maintained regularly, are more susceptible to mechanical failure, corrosion, and regulatory non-compliance. Adopting moderate-age norm ensures that only vessels with proven safety, performance, and maintenance standards remain in service. This improves not only crew welfare and cargo integrity but also reduces the risk of environmental incidents, particularly important for sensitive vessel types like oil tankers and chemical carriers.

Based on the gross tonnage impact analysis, it is recommended that Scenario 3 (Proposed) be adopted as the regulatory framework for vessel age norms. This scenario provides the optimal balance between regulatory ambition and operational feasibility. By limiting the gross tonnage removed from service to just 4.99%, Scenario 3 ensures that fleet renewal can proceed at a sustainable pace, avoiding logistical disruptions and undue economic strain. At the same time, it targets the most vulnerable and outdated vessels, improving overall safety, efficiency, and environmental performance of the fleet. Furthermore, Scenario 3 supports key strategic objectives:

- It provides a clear, manageable pathway for fleet modernization and helps stimulate shipbuilding activity, fostering industrial growth and job creation.
- It aligns with IMO decarbonization targets and positions the fleet for future green compliance, including upcoming EEXI/CII regulations and carbon pricing mechanisms.
- It reduces the risk of accidents, pollution, and operational failures associated with aging tonnage, thereby enhancing maritime safety and reputation.

By contrast, Scenarios 1 and 2, though aggressive in ambition, would cause a sharp contraction in available gross tonnage and present serious challenges in fleet replacement, potentially destabilizing shipping operations. Scenarios 4 and 5, while operationally easier, lack the necessary incentive for modernization and carry long-term risks related to competitiveness, compliance, and safety. In conclusion, Scenario 3 represents a prudent, future-ready, and economically sound choice. It enables meaningful progress on maritime modernization goals without compromising the continuity and resilience of current operations. Stakeholders are encouraged to adopt this framework as the foundation for revised age-based vessel policies. Finally, a phased yet purposeful renewal strategy like that in Scenario 3 positions the fleet to remain globally competitive and aligned with the regulatory expectations of key maritime regions. Major global ports and trade partners are increasingly implementing or enforcing stringent age, emissions, and safety requirements. A fleet governed under Scenario 3 will be well-positioned to meet such standards, maintaining market access and trade fluidity. In conclusion, Scenario 3 offers a practical and forward-thinking path for policy adoption. It manages the trade-off between modernization and operational feasibility, while delivering tangible benefits in shipbuilding stimulation, energy performance, safety assurance, and regulatory preparedness.

8 Financial Impact of Age Norms Using NPV

As the maritime sector navigates increasing regulatory and sustainability pressures, determining the economically optimal lifespan of vessels has become a critical concern for shipowners and policymakers alike. This section presents a financial assessment of vessel retirement decisions using two analytical approaches: Net Present Value (NPV) analysis and a Stochastic Dynamic Programming (SDP) model. The aim is to evaluate whether imposing a 25-year operational age limit yields superior financial outcomes compared to extending operations up to 40 years.

By analyzing four representative vessel types—1000 TEU container ships, Handymax bulkers, Panamax bulk carriers, and Panamax tankers—under different acquisition scenarios (newbuild and secondhand vessels), the study quantifies the impact of early scrapping on long-term returns. The analysis incorporates key cost variables including OPEX, dry docking, repair inflation, scrap value, interest rates, and tonnage tax, while also factoring in market volatility using Monte Carlo simulations and Geometric Brownian Motion (GBM) models for revenue and scrap forecasts.

The container ship analysis highlights that 40-year operations provide a higher NPV than 25-year exits across all acquisition categories—newbuild, 5-year, 10-year, and 15-year-old vessels. Notably, newbuilds and 5-year-old secondhand vessels yield strong financial returns in both scenarios, but the 40-year operation generates an NPV advantage of nearly ₹15 crore over the 25-year exit. This gap narrows for 10-year and 15-year-old vessels, where the performance differences are less pronounced, and risks tied to aging and maintenance may outweigh the marginal returns. The trend line also shows that as vessel age increases, the viability of 25-year exits improves relative to longer operations, especially when regulatory penalties and decarbonization pressures are factored in. Therefore, while longer operations may appear more profitable on paper, the margin of advantage diminishes with vessel age, underscoring the strategic logic of a 25-year cap for older secondhand tonnage.

Figure 6: Estimated expected financial returns comparison 25-year exit vs 40-year exit

Among all vessel types analyzed, Panamax tankers show the strongest support for 40-year operations, particularly for secondhand 10-year-old vessels, where the NPV nearly doubles compared to 25-year exits. Newbuilds and 5-year-old vessels also favor the 40-year scenario with a clear financial upside. However, for 15-year-old tankers, the NPV difference between 25- and 40-year operations begins to narrow, and the longer operation enters a higher-risk zone due to rising OPEX and environmental costs. The steep upward trend line in the chart indicates that older vessels become increasingly cost-intensive to maintain, and the marginal benefit of additional operating years must be weighed against tightening carbon norms and operational inefficiencies. This reinforces the idea that while younger tankers may benefit from extended service, older assets are better phased out around the 25-year mark to avoid diminishing returns.

The NPV comparison for Handymax bulkers reveals that NPVs remain relatively stable between 25-year and 40-year exits, especially for newbuilds and 5-year-old acquisitions. The financial difference is narrow, indicating that both scrapping strategies are nearly equivalent in net value. However, the most noticeable insight arises from 10- and 15-year-old vessels, where 40-year operations only marginally outperform 25-year exits, despite the higher risk and compounding maintenance burdens. The trend line suggests a sharper escalation in OPEX and compliance cost for older Handymax vessels, which narrows the financial benefits of longer operations. Therefore, in volatile market segments like dry bulk, a 25-year exit policy offers not just risk mitigation, but also stable financial planning, especially when shipping earnings are unpredictable. This supports the policy rationale of limiting vessel life in the mid-size bulker segment.

For Panamax bulkers, the analysis indicates a clear NPV advantage for 40-year operations across newbuilds and younger secondhand vessels. The most prominent gain is observed in 5-year-old secondhand vessels, where 40-year operations yield significantly higher returns. However, the spread between the two exit strategies diminishes as vessel age increases. The 15-year-old segment demonstrates a much closer NPV outcome, with the long-term scenario barely outperforming the 25-year exit. The upward trajectory of the trend line reflects rising OPEX, carbon liabilities, and regulatory costs associated with aging tonnage. These pressures, when projected over an extended 40-year horizon, erode the initial NPV gains. Hence, while the Panamax bulker segment can support longer operations for relatively young vessels, the age norm threshold around 25 years remains a prudent limit for older units nearing the twilight of their economic life.

Vessel Type	Mean Optimal Scrapping Age (Years)	Standard Deviation (Years)	Key Insight
Container Ship (1000 TEU)	25.8	8.3	Close to 25-year norm; moderate variability
Handymax Bulker	11.7	9.1	Significantly below 25 years; high volatility
Panamax Bulk Carrier	18.8	8.9	Below 25-year mark; moderate-to-high volatility
Panamax Tanker (75,000 DWT)	20.8	9.1	Slightly below 25 years; high variability in scrapping decision

Table 7: Optimal Scrapping age as per NPV analysis

The findings show a clear divergence in optimal scrapping age across vessel types. For instance, the Container Ship (1000 TEU) shows a mean optimal scrapping age of 25.8 years, which closely aligns with the proposed 25-year exit norm. This suggests that for container ships of this size, extending operations beyond 25 years offers marginal benefit at best and could result in declining returns due to escalating maintenance and fuel costs. The standard deviation of 8.3 years also indicates a moderate level of uncertainty, implying that while some vessels might perform well slightly beyond 25 years, a policy anchored around this benchmark is broadly justified.

In contrast, the Handymax Bulker exhibits a markedly lower mean optimal scrapping age of 11.7 years, with a high standard deviation of 9.1 years. This suggests that such vessels may experience diminishing returns far earlier in their lifecycle. The reasons could include intense competition, lower freight rates, or higher relative OPEX in older Handymax vessels. The high volatility implies that market fluctuations can have a pronounced effect on the economic viability of continued operation, making early replacement more financially prudent in most scenarios.

For the Panamax Bulker and Panamax Tanker, the mean optimal scrapping ages are 18.8 years and 20.8 years, respectively. Both values fall below the 25-year threshold, reinforcing the economic rationale behind the age-based exit strategy. The relatively high standard deviations (around 9 years) highlight the influence of external market conditions, such as spot market rates, regulatory penalties, and carbon compliance costs, which can significantly alter the expected lifecycle profitability.

Overall, the SDP findings substantiate the argument for a 25-year exit policy as a sound strategic guideline. While some vessel categories (e.g. container ships) may remain viable slightly longer, others (like Handymax bulkers) may benefit from even earlier exits. The variation in results underscores the importance of segment-specific considerations and a dynamic regulatory approach that encourages early replacement while allowing flexibility for newer or better-performing assets. These insights can inform policymaking, investment planning, and regulatory reforms in the Indian maritime sector, particularly as it seeks to modernize its fleet in line with global standards.

9 Fleet replacement and Ship-building Market Generation

A year-by-year breakdown of vessels projected to reach their new "exit age" and require replacement between 2025 and 2034 is shown in the below table. Each calendar year is represented by a row, while each vessel category is represented by a column. The number of ships of each class due for retirement in the corresponding year is indicated by the number in each cell. By scanning across a row, the total replacement volume and the contributions of each vessel type can be discerned. Conversely, by examining a column, the timing of replacement waves for a specific ship class can be tracked.

The forthcoming enforcement of vessel age norms by February 2026 is poised to significantly impact the Indian shipping industry, with over 110 ships requiring immediate replacement and a sustained annual demand for 20–40 replacements over the next decade. This fleet renewal has far-reaching economic, safety, and competitiveness implications. From an economic standpoint, the replacement burden represents a substantial capital outlay for fleet owners, particularly in sectors like general cargo, harbour operations, and oil transport, where the ageing fleet is most pronounced. The upfront investment required for new vessels—estimated in millions of dollars per unit—could strain operators with limited access to affordable financing, especially smaller domestic players, leading to market consolidation or exit of undercapitalized firms.

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Anchor Handling Tugs	0	0	0	0	0	1	0	2	0	1
Bulk Carriers	3	2	1	3	5	6	2	3	0	5
Cement Carriers	3	2	0	0	0	0	0	2	0	0
Chemical Carrier	0	0	0	0	0	1	0	0	0	0
Container Vessels	0	2	4	2	1	0	1	3	1	2
Gas Carrier	2	0	0	0	1	0	1	1	1	0
Gas/ Chemical Carrier	1	0	0	0	0	0	0	0	0	0
General Cargo Vessels	30	2	3	2	9	14	13	6	11	15
Harbour Tugs	34	8	13	1	13	6	6	6	13	9
Offshore Fleet	15	3	3	4	2	1	0	3	2	4
Oil Tankers	17	3	4	11	12	9	6	3	9	10
Oil/Chemical Carrier	1	0	0	0	0	0	0	0	2	0
Other Vessels	4	0	2	0	0	0	1	1	0	1
Total	**110**	**22**	**30**	**23**	**43**	**38**	**30**	**30**	**39**	**47**

Table 8: Projected fleet replacement (Assuming Policy Implementation as Feb 2026)

From a shipping competitiveness perspective, the replacement cycle is both a challenge and an opportunity. While the short-term pressure may erode operational margins, the transition to modern, fuel-efficient, and technologically advanced vessels could enhance long-term global competitiveness. Modern ships typically offer better fuel economy, lower emissions, and improved cargo handling systems, aligning with evolving global trade norms and environmental expectations. Failure to modernize may render Indian operators less attractive to global cargo clients, particularly in containerized and energy cargo segments, where reliability and compliance are critical. Timely replacement is therefore essential to maintain India's position in regional shipping routes and to compete with Southeast Asian and Middle Eastern fleets undergoing similar transitions. On the safety front, ageing vessels are associated with higher risks of mechanical failures, maritime accidents, and port delays, all of which impose direct costs and reputational damage. By enforcing strict age limits, the policy reduces operational hazards, aligns with international maritime safety standards (e.g., SOLAS), and improves insurance and liability profiles for Indian fleet operators. However, the transition period may witness capacity shortages or disruptions in coastal and offshore logistics, particularly if replacement lags are not strategically managed.

Finally, the industry dynamics are likely to shift significantly. Domestic shipyards could benefit from increased orders, but only if adequately equipped to meet specifications and delivery timelines. Foreign shipbuilders may dominate initial replacement cycles unless India accelerates shipyard modernization and incentivizes local procurement. Additionally, charter rates and freight pricing may rise in the short term due to reduced available tonnage, particularly in specialized categories like chemical carriers and dredgers.

Over the longer term, fleet rejuvenation can unlock scale efficiencies, reduce operating costs, and enable greater integration of digital technologies and automation, transforming the Indian shipping sector from a fragmented service provider to a globally competitive logistics enabler.

To harness this opportunity and mitigate adverse impacts, a coordinated approach involving maritime finance reform, shipbuilding incentives, regulatory streamlining, and safety standard enforcement will be critical to steer the sector through this structural transition.

9.1 Impact on Ship-recycling

India's ship recycling industry stands to gain significantly from the upcoming wave of vessel retirements projected between 2025 and 2034. With over 350 ships set for decommissioning, many of which are General Cargo Vessels, Bulk Carriers, Oil Tankers, and Harbour Tugs—the cumulative gross tonnage entering the recycling stream will be substantial. Even by conservative estimates, this could translate to 6–8 million GT over the next decade, feeding directly into India's recycling yards, especially the Alang-Sosiya complex in Gujarat. Currently, India is the second-largest ship recycler in the world, handling approximately 2.47 million GT in 2022–2023. Projections indicate that this figure will rise to 3.8 to 4.2 million GT by 2025, driven by increasing supply from end-of-life vessels and global fleet decarbonization pressures. The replacement plan will accelerate this growth, as older, high-emission vessels are phased out in favor of modern, regulation-compliant alternatives[25].

This influx of scrapped tonnage offers India a strategic opportunity to enhance its position as a global hub for green ship recycling. The industry already contributes significantly to the steel sector, supplying valuable scrap that helps conserve raw materials and reduce emissions. For example, recycling one tonne of steel scrap saves 1.4 tonnes of iron ore, 0.8 tonnes of coal, and cuts 1.67 tonnes of CO_2 emissions—a critical advantage as India works toward its net-zero emissions targets. Moreover, this surge in vessel decommissioning can help meet the goals of India's National Steel Policy, which aims to secure 70 million tonnes of domestic scrap supply by 2030. The fleet replacement strategy will become a core feedstock source for this circular economy shift, making ship recycling an essential part of India's green industrial ecosystem[26].

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[25] https://infra.economictimes.indiatimes.com/news/ports-shipping/indias-ship-recycling-industry-to-grow-to-3-8-4-2-million-gt-in-2025-report/114162764

[26] https://climatecatalyst.org/wp-content/uploads/2024/12/Turning-the-Tide-Ship-Recycling-as-a-Source-of-Green-Steel-in-India.pdf

However, the industry must overcome key bottlenecks. Despite India’s capacity, only around 90 out of 120 facilities at Alang currently meet international safety and environmental norms under the Hong Kong International Convention. Additionally, volatile scrap steel prices—down from ₹54,400 per tonne in 2022 to ₹36,600 in 2024—have strained profitability[27]. To fully leverage the fleet renewal program, India must invest in compliance upgrades, worker safety, and technology modernization. Enhancing transparency, certification, and environmental standards will not only support domestic steel production but also attract shipowners globally looking to responsibly recycle vessels. The gross tonnage replacement from India’s maritime fleet renewal plan presents a powerful growth catalyst for the ship recycling industry. With the right policy alignment and infrastructure investment, this sector can emerge as a model for sustainable industrial practice—supporting national goals in steel, employment, circular economy, and climate action, while reinforcing India's global leadership in responsible ship recycling.

9.2 Impact of New Ship building

India's maritime sector is supported by a range of government policies aimed at strengthening ports, shipbuilding, and ship recycling. Despite being the 19th largest ship-owning nation with about 1.5% of the global fleet—dominated by players like SCI, Great Eastern, Chellaram, and Seven Islands—India remains relatively underrepresented as a flag state, ranking 22nd with just a 0.7% share. However, it has set ambitious targets to become a top 5 fleet nation with 100 million gross tonnage (GT) by 2047. While India has a long but mixed history in shipbuilding and repair, it aims to rank among the top 10 shipbuilders by 2030 and top 5 by 2047. Currently, India is 13th in global orderbook by compensated gross tonnage (CGT) with a 0.3% share, led by Cochin Shipyard. However, it faces stiff competition, particularly from China, which dominates the global orderbook with a 58% share.

Based on the analysis of the Indian ship replacement demand (2026–2035) and the capabilities of domestic shipyards, the opportunity for India's maritime sector is both significant and strategically timed. Over the next 10 years, more than 350 ships will require replacement, with the largest share needed in General Cargo Vessels, Oil Tankers, Harbour Tugs, Bulk Carriers, and Offshore Fleet. This projected demand aligns well with the existing capabilities of Indian shipyards, offering a major boost for domestic shipbuilding if capacity bottlenecks are addressed.

[27] https://www.entrepreneur.com/en-in/news-and-trends/indias-ship-recycling-industry-poised-for-growth-at-10/481150

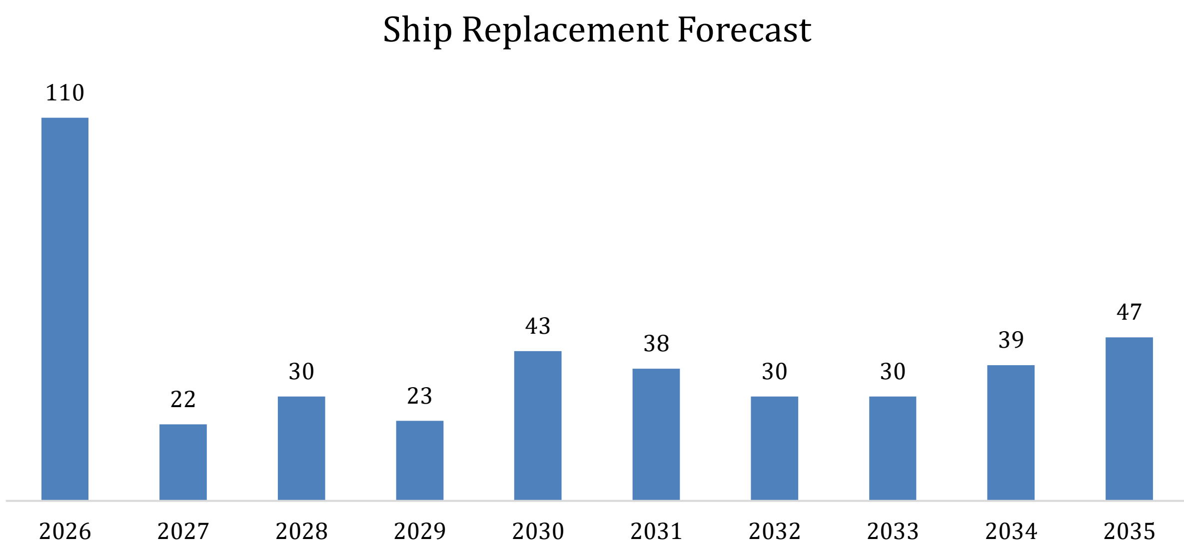


Figure 7: Ship Replacement Forecast (Assuming Policy Implementation as Feb 2026)

Several major Indian shipyards—such as Cochin Shipyard Limited, Hindustan Shipyard Limited, Mazagon Dock, and Garden Reach Shipbuilders—already possess experience in building a wide array of vessels including bulk carriers, oil tankers, offshore vessels, cargo ships, and patrol boats. For example, Cochin Shipyard has demonstrated high productivity, building 86 ships in the last decade, with substantial deadweight capacity of up to 235,000 DWT. These yards are equipped with dry docks, new-build berths, and fabrication infrastructure suitable for the types of vessels most urgently needing replacement.

The current scenario offers Indian shipyards a multi-year pipeline of assured orders, which can improve their utilization, provide scale economies, and enhance global visibility. With coordinated support through Make in India, Production Linked Incentives (PLIs), and infrastructure modernization schemes, Indian yards can not only meet domestic replacement needs but also position themselves as export-oriented builders for Southeast Asian and African markets. The following key bottlenecks and capability gaps need immediate attention

- Many shipyards are currently operating below optimal capacity due to inconsistent order flows and working capital constraints.
- Only a few Indian shipyards possess the advanced engineering, modular fabrication, and automation capabilities required to build large container ships, LNG/gas carriers, or specialized chemical tankers—segments that are technologically demanding.
- Indian shipyards also face supply chain limitations in marine-grade steel, high-spec equipment, and propulsion systems, which are often imported and subject to global volatility.

- Skilled manpower for modular design, green ship technologies, and integrated navigation systems is still evolving.

Indian shipyards, with their current capabilities, are well-positioned to construct a wide range of vessels essential for the country's maritime needs. These include general cargo vessels, bulk carriers (particularly up to Handymax and Panamax sizes), mid-range oil tankers, harbour tugs, anchor handling tugs, and various offshore support vessels. Additionally, Indian yards have proven competence in building patrol boats, corvettes, small container vessels (up to 3000 TEU), as well as cement carriers and dredgers, which form the backbone of both commercial and coastal operations.

However, certain technologically advanced vessel types still require significant capability upgradation. These include LNG and LPG carriers, which demand cryogenic containment systems and precision engineering, and large-size container ships (Post-Panamax and above), which require sophisticated modular construction and automation. Furthermore, the development of dual-fuel or methanol/ammonia-ready tankers, specialized chemical tankers with high-safety linings, and autonomous or digitalized vessels will necessitate investment in advanced design tools, digital integration, and next-generation propulsion systems. Addressing these gaps will be critical for India's shipbuilding sector to compete globally and transition toward future-ready maritime capabilities.

To fully capitalize on the upcoming ship replacement demand and strengthen India's position in the global shipbuilding industry, a series of strategic initiatives must be implemented. First, there is a pressing need for capacity mapping and alignment between the types of vessels required and the existing strengths of Indian shipyards. This should be accompanied by targeted public-private investments aimed at modernizing infrastructure, enhancing fabrication capabilities, and adopting advanced technologies for building high-spec vessels. The government should introduce financial incentives and policy support, including production-linked incentives (PLI) and soft financing options, to encourage large-scale vessel construction and reduce dependency on imports. In parallel, a robust skilling ecosystem must be developed to train workers in modular construction, clean fuel systems, and smart ship technologies. Additionally, the creation of green maritime corridors, equipped with infrastructure for LNG, methanol, and other alternative fuels, will be vital to support sustainable fleet renewal. Finally, standardizing design templates and streamlining procurement across public sector and private clients will not only accelerate delivery timelines but also improve cost-efficiency. Together, these strategic moves can position Indian shipyards as globally competitive, technologically advanced, and capable of meeting both domestic and export market demands. The replacement wave presents a transformational moment for Indian shipbuilding. With targeted policy support, financial incentives, and industry-academia collaboration, Indian shipyards can emerge not only as self-reliant builders for domestic needs but also as a competitive force in the global maritime construction ecosystem.

9.2.1 Replacement cost of exit Indian tonnage

Newbuilding cost			Second-hand 15 y.o. cost		
Min	Max	Average	Min	Max	Average
66700	139711	103206	27261	71677	49469

Total ships	141	
Total GT	6,34,916	
Per ship price	172	crores
Total in crores	24,252	crores

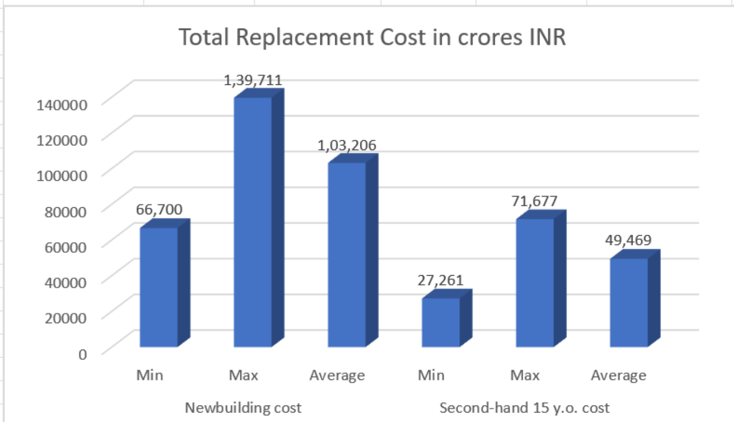


Figure 8: Replacement Cos of Indian Tonnage

It is important to have an estimate of the total tonnage which needs replacement as per the norms of the order. We estimated the cost of a new build and 15-year-old secondhand vessel, for each vessel which is going to be removed from the flag status once the order is passed. Figure above provides a comparative analysis of costs associated with newbuilding and second-hand 15-year-old ships, presented in crores INR. The table highlights that the total cost of new building ships varies from a minimum of 66,700 crores to a maximum of 1,39,711 crores, with an average expense of 1,03,206 crores. For second-hand ships that are 15 years old, the costs range from a minimum of 27,261 crores to a maximum of 71,677 crores, averaging at 49,469 crores. The bar graph visualizes these comparisons, clearly depicting the differences in minimum, maximum, and average costs between the two categories. Additionally, there are a total of 141 ships with a gross tonnage (GT) of 6,34,916 that has reached the exit age as per the order norms. As soon as the replacement process starts, the industry may need urgent financial assistance of this magnitude to maintain business continuity.

The projected schedule of ship replacements between 2026 and 2035 highlights a significant and growing financial burden associated with modernizing India’s ageing merchant fleet. Based on an average replacement cost of ₹172 crore per ship, the total estimated replacement cost for 110 vessels in 2026 is ₹18,920 crore. However, when accounting for a 5% annual escalation in shipbuilding costs, the financial requirements increase steadily over the decade. For example, the escalated replacement cost for 43 vessels in 2030 rises to ₹8,990 crore, and by 2035, the replacement of 47 ships is projected to cost ₹12,541 crore. This cumulative trend illustrates the impact of inflation and market volatility on fleet renewal efforts, underscoring the urgency of adopting a phased and proactive age norm policy. Delaying replacements not only inflates future capital expenditure but also risks operational inefficiency, regulatory non-compliance, and missed opportunities in green shipping investments.

Year	Ships to be Replaced	Estimated Replacement Cost (INR crores) 172 Crore per Ship	Escalated Replacement Cost (INR crores) 5% Cost Increase YoY
2026	110	18,920	18,920
2027	22	3,784	3,973
2028	30	5,160	5,689
2029	23	3,956	4,580
2030	43	7,396	8,990
2031	38	6,536	8,342
2032	30	5,160	6,915
2033	30	5,160	7,261
2034	39	6,708	9,911
2035	47	8,084	12,541

Table 9: Projected fleet replacement costs (Assuming Policy Implementation as Feb 2026)

10 Impact of GHG/GFI Regulations

The table below provides a comprehensive overview of the types of fuels currently used across the Indian coastal shipping fleet[28], highlighting their operational roles, environmental impact, adoption levels, and exposure to future carbon pricing penalties under the IMO's GHG Fuel Intensity (GFI) regime. These fuels are predominantly fossil-based and thus likely to attract significant penalties under upcoming carbon pricing frameworks due to their associated CO_2 emissions.

Fuel Type	Usage in Indian Coastal Fleet	Emission Profile	Estimated Number of Ships	Fleet Share (%)	Subject to GHG GFI Penalty
High Sulphur Fuel Oil (HSFO)	Predominantly used by older vessels, high emissions, gradually phasing out	High CO_2, SOx, and PM emissions	250	30.6	Yes
Very Low Sulphur Fuel Oil (VLSFO)	More common post-IMO 2020, standard for compliant vessels	Lower SOx and PM than HSFO; moderate CO_2	300	36.8	Yes
Marine Gas Oil (MGO)	Used in smaller vessels and tugs, higher cost but cleaner	Low SOx, PM; cleaner CO_2 profile than HSFO	150	18.4	Yes
Liquefied Natural Gas (LNG)	Limited adoption due to infrastructure; potential for growth	Lower CO_2 than MGO; very low SOx	30	3.7	No
Biofuels	Emerging option, drop-in compatible, used in trials and pilot projects	Carbon-neutral if sustainably sourced	20	2.5	No
Methanol	Minimal usage; future potential for newbuilds	Low CO_2 when derived renewably; toxic handling	5	0.6	No
Ammonia	Not in commercial use; seen as a long-term zero-emission fuel	Zero CO_2 emissions if green ammonia; toxic and corrosive	0	0	No
Hydrogen	Experimental use; primarily in pilot projects or under development	Zero direct CO_2; high safety requirements and cost	0	0	No

Table 10: Summary of GHG/GFI impact on Indian Ships

[28] https://www.dgshipping.gov.in/WriteReadData/userfiles/file/DNV%20Report.pdf

Further analysis was conducted using the DNV report[29] CO2 emissions and assuming an average GHG/GFI penalty of USD 150 (INR 13,000) per tonne of CO2 emissions. Results are presented below, which quantifies the financial implications of carbon pricing penalties for Indian coastal vessels under varying levels of non-compliance with greenhouse gas (GHG) fuel intensity standards, as set out in the latest MEPC 83 regulations. The study estimates the per-ship penalty cost for 80%, 50%, and 20% non-compliance scenarios. These penalties represent the additional operating expenditure (OPEX) that shipowners would face if vessels failed to transition to low-carbon or compliant fuels. The findings reveal a significant potential cost burden, especially for vessels with high emission profiles such as container ships, LPG carriers, and tankers. For example, a container ship with average emissions of over 10,000 tonnes CO_2 annually could attract a per-vessel penalty of over INR 10 crore in an 80% non-compliance scenario. Similarly, LPG carriers and dredgers also show high per-unit penalty figures, indicating that vessels operating with older engines or on heavy fuels will be disproportionately impacted. Even smaller vessels such as tugs and general cargo ships, despite lower emissions per vessel, may face considerable cumulative costs due to their large fleet size and operational frequency.

Vessel Type	Number of Vessels	CO2 Emission (Tonnes)	CO2 Emission / Ship	Per Ship Penalty (USD 150 / INR 13,000)		
				80% Non-Compliance	50% Non-Compliance	20% Non-Compliance
Tanker	106	5,14,759.0	4,856.2	5,05,04,651.7	3,15,65,407.3	1,26,26,162.9
Container	20	2,04,354.4	10,217.7	10,62,64,288.0	6,64,15,180.0	2,65,66,072.0
Bulk Carrier	66	1,66,920.2	2,529.1	2,63,02,580.1	1,64,39,112.6	65,75,645.0
LPG Carrier	23	1,63,401.7	7,104.4	7,38,85,986.1	4,61,78,741.3	1,84,71,496.5
Anchor Handling Tug	62	1,58,886.0	2,562.7	2,66,51,836.8	1,66,57,398.0	66,62,959.2
Platform Supply Ship	51	1,19,797.1	2,349.0	2,44,29,208.5	1,52,68,255.3	61,07,302.1
Tug	269	92,509.9	343.9	35,76,590.9	22,35,369.3	8,94,147.7
Dredger	20	81,970.9	4,098.5	4,26,24,862.8	2,66,40,539.3	1,06,56,215.7
General Cargo Ship	56	70,924.6	1,266.5	1,31,71,705.9	82,32,316.2	32,92,926.5
Others	143	1,57,105.6	1,098.6	1,14,25,862.5	71,41,164.1	28,56,465.6

Table 11: Projected penalty for non-compliance to GHG/GFI norms

These additional OPEX components pose a substantial challenge to the profitability and sustainability of Indian shipping companies. If compliance measures—such as fuel switching, retrofitting, or adoption of green technologies—are not implemented in time, shipping operators may experience a direct erosion of

[29] https://www.dgshipping.gov.in/WriteReadData/userfiles/file/DNV%20Report.pdf

operating margins, reduced competitiveness in international markets, and potential loss of charter opportunities, especially with cargo owners increasingly prioritizing green logistics.

Moreover, the regulatory risk will only grow over time as GHG caps tighten and carbon pricing mechanisms evolve. Therefore, upgrading vessels to meet IMO fuel-intensity and emission norms is not just an environmental obligation but an economic imperative. Investments in fuel-efficient technologies, alternative fuels (like LNG, methanol, or biofuels), and emissions monitoring systems can help shipowners avoid these penalties while also unlocking future carbon credits or green financing opportunities.

In conclusion, this analysis underscores the urgent need for a strategic fleet transition plan in India's coastal shipping sector. Without proactive upgrades, the financial penalties linked to GHG non-compliance could escalate into a systemic cost burden that threatens the viability of operations and undermines the broader national goals of maritime competitiveness and environmental responsibility.

11 Case studies illustrating the impact of the order

11.1.1 Oil and Natural Gas Corporation (ONGC): specialized vessels to sustain energy production

ONGC operates some specialized vessels, directly involved in petroleum production for India. These vessels are directly going to be impacted by the exit norms as illustrated in the order. We give a summary of the financial situation of these vessels.

1. *Sevak DSV*: ONGC will invest 6 crores (NPV) if she is scrapped, and only external chartering is utilized for the remaining life of the ship. A new ship will cost Rs 1,500 crores and take 5 years to complete.

2. *Prabha OSV*: The company will have to spend 4 crores (NPV) on external chartering if the vessel is de-commissioned for the remaining ship's life. A new ship will cost Rs 1,400 crores and take 3 years.

3. *Samudra Nidhi Well Simulation*: ONGC will incur a cost of 280 crores for external chartering, with the new ship's timelines ranging from 45 to 50 years.

4. *Geo Technical Vessel*: A new ship in this category will cost Rs 2,000 crores and take 4 years to complete.

As per our discussions with ONGC officials, these vessels are highly specialized and difficult to replace at this point in time, due to the saturation of able and competent shipyards all over the world. The de-commissioning of these vessels without timely replacement will increase the cost of oil exploration and production and may even cause disruptions in the operation, leading to tightened energy supply for the country.

11.1.2 DEME Group Case Study: International Business Continuity in Dredging Operations

DEME Group is a prominent international dredging corporation based in Belgium, actively operating in Indian ports. So far, they have been successfully completed or working on four projects across various Indian locations. Dredging is inherently an international operation, requiring the mobilization of specialized vessels across global ports.

Dredging Process in India

When dredging is needed at a specific port in India, the following process typically unfolds:

1. Bidding: DEME participates in a competitive bidding process for the dredging project.

2. Contract Award: Upon winning the bid, DEME arranges for the deployment of a specialized vessel for operations in India.

3. Local Operations: DEME operates through a subsidiary, an Indian-registered company focused on international seaport dredging.

4. Notice Announcement: As a member of the Indian National Shipowners' Association (INSAA), they provide a 48-hour notice for the required vessel type.

5. Vessel Procurement: If the needed vessel is not available in India, DEME must procure it from international waters.

6. Vessels and Licensing: The vessels used are foreign-flagged and require a specific period license to operate in India.

7. Age Limitation: A significant challenge is the regulation that prohibits the importation of vessels older than 20 years.

Challenges in Converting Vessels to Indian Flag - If DEME aims to convert a specialized dredging vessel to an Indian flag, they face several critical challenges:

- Inconsistent Demand: India does not always have a continuous demand for every type of specialized vessel, complicating investment decisions.

- Regulatory Approvals: Acquiring permission from the Reserve Bank of India (RBI) for international operations can take approximately six weeks.

- Economic Viability: The overall process may not be economically feasible for bringing specialized vessels under the Indian flag.

- International Compliance: Even if the RBI reduces approval time, other countries may impose regulations that prolong the overall process.

DEME Group's experience in India highlights the intricacies of managing international business continuity within the dredging sector. Addressing challenges such as regulatory compliance, vessel age restrictions, and fluctuating demand is crucial for their success.

12 Final Recommendations

Over the past few years, the maritime sector—both globally and in India—has undergone a paradigm shift toward stricter environmental compliance, lifecycle accountability, and strategic fleet modernization. At the international level, key regulatory milestones such as the IMO's revised GHG Strategy (2023), MEPC 83's adoption of fuel intensity standards, and the implementation of the Carbon Intensity Indicator (CII) and Energy Efficiency Existing Ship Index (EEXI) have collectively set the stage for a transition to low- or zero-emission shipping. These frameworks are aimed at achieving net-zero GHG emissions from international shipping around mid-century and require vessels to meet increasingly stringent performance thresholds based on age, fuel type, and efficiency.

India has mirrored this global momentum through several ambitious policy instruments, most notably the Maritime India Vision 2030, the Amrit Kaal Vision 2047, and the Harit Sagar Guidelines, all of which prioritize sustainable growth, decarbonization, and self-reliance in maritime capabilities. These initiatives call for the development of green ports, promotion of alternative fuels, capacity expansion in domestic shipyards, and a transition to a younger, technologically advanced merchant fleet. The underlying policy direction is clear: aging, inefficient, and non-compliant ships must give way to a safer, greener, and more competitive fleet that aligns with India's climate goals and global regulatory expectations.

In this context, DGS Order No. 06 of 2023 is not an isolated or abrupt regulatory move—it is a natural extension of India's evolving maritime policy landscape. The order, which introduces age-based norms for the operation of Indian-flagged vessels, directly supports the country's environmental obligations and industrial strategy. It addresses a critical gap in fleet regulation by ensuring that vessels past their prime operational age—many of which are associated with higher fuel consumption, poor safety records, and emissions violations—are gradually phased out of service. At the same time, the order retains built-in flexibility through clauses allowing technically sound and environmentally compliant vessels to continue operating, provided they align with national interests and global standards.

Understanding the spirit of DGS Order thus requires recognizing its dual objectives: to accelerate fleet renewal and decarbonization, and to safeguard the competitiveness of Indian shipping in an increasingly regulated global environment. By harmonizing India's domestic fleet policies with international frameworks such as MARPOL Annex VI and the IMO's Net-Zero Strategy, the order positions Indian tonnage for future resilience and growth. Far from being punitive, it serves as a policy enabler—guiding shipowners, operators, and policymakers toward a sustainable maritime ecosystem built on predictability, compliance, and strategic foresight.

The Indian fleet, while growing in gross tonnage and strategic relevance, exhibits significant structural vulnerabilities stemming from its aging profile, elevated environmental impact, and recurring compliance issues. As of early 2026, India's merchant fleet comprises over 960 registered vessels, a substantial proportion of which are over 20 years old. Age-wise distribution analysis reveals that older vessels—especially general cargo ships, bulk carriers, tugs, and oil tankers—make up a considerable share of the national tonnage. These vessels are not only technologically outdated but also exhibit poorer performance on key operational and safety indicators, including fuel efficiency and emissions compliance.

Environmental assessments further underscore the challenges associated with the aging fleet. CO_2 emissions data reveals that older ships contribute disproportionately to overall greenhouse gas output, with some categories such as container ships and LPG carriers recording per-vessel emissions in excess of 7,000–10,000 tonnes annually. If these vessels were to be penalized under emerging global carbon pricing mechanisms (e.g., USD 150 per tonne CO_2), they would face OPEX increases of several lakhs to crores of rupees per year, undermining their economic viability. Moreover, the technological limitations of these ships make retrofitting for compliance with IMO's EEXI and CII standards difficult, if not uneconomical.

From a safety and regulatory compliance standpoint, India's Port State Control (PSC) and Flag State Inspection (FSI) records paint a concerning picture. Vessels over 20 years old consistently show higher deficiency indices—averaging 5.34 per inspection compared to 1.63 for younger vessels—and significantly lower Nil Deficiency Rates. Older ships are overrepresented in detention statistics, often due to critical non-compliance issues such as malfunctioning fire safety systems, structural corrosion, outdated navigation equipment, and emissions violations. In addition, incident records show that vessel age correlates with higher accident probability, particularly in near-coastal operations and oil/chemical transport.

DGS Order No. 06 of 2023, which mandates age-based norms for ship operation, emerges as a timely and justified policy intervention. The order targets the root cause of multiple systemic issues—environmental inefficiency, safety risks, and global non-alignment—by encouraging the gradual withdrawal of aging, non-compliant tonnage. It does so while allowing for conditional flexibility, enabling newer or upgraded vessels to continue operation if they meet prescribed technical and environmental benchmarks. This approach ensures a fair, strategic, and forward-looking transition, aligning India's fleet with global expectations and reinforcing its long-term maritime competitiveness.

The secondary research undertaken in this study provides robust, data-driven justification for the implementation of age-based norms under DGS Order No. 06 of 2023. Through an extensive analysis of national fleet data, regulatory inspection records, and emission metrics, the findings reveal a strong correlation between vessel age and declining operational, environmental, and safety performance. These insights align with international empirical studies and reinforce the policy rationale for systematically phasing out aging tonnage.

One of the most compelling outcomes of secondary research is the clear link between vessel age and regulatory compliance issues. Data from Port State Control (PSC) and Flag State Inspection (FSI) reports for 2024 show that older vessels—particularly those beyond 20 years—exhibit substantially higher deficiency rates and are more frequently detained for critical failures. For example, ships over 20 years old recorded an average Deficiency Index (DI) of 5.34, compared to just 1.63 for newer vessels, and had a Nil Deficiency Rate of only 12.5%, in stark contrast to 60%+ for vessels under 12 years. This pattern illustrates that aging vessels impose not only operational risk but also reputational and regulatory liabilities on the Indian flag.

Environmental data further validates the need for age-based controls. Emission estimates compiled from DNV and national datasets show that older ships contribute disproportionately to CO_2 output. When matched against potential carbon pricing scenarios (e.g., USD 150 per tonne CO_2), the projected penalties for non-compliant, high-emission ships translate into a significant increase in operating expenditure (OPEX)—often making continued operation financially unviable. These cost projections support the economic logic behind phasing out inefficient tonnage and replacing it with compliant, fuel-efficient alternatives.

The analysis also leveraged performance indicators such as the Energy Efficiency Existing Ship Index (EEXI) and the Carbon Intensity Indicator (CII) to assess technological obsolescence. Regression analysis revealed a consistent degradation of these indicators with increasing vessel age, reaffirming that older ships are far less likely to meet IMO-mandated standards without costly retrofits. This reinforces the idea that relying on technical upgrades alone, without structural replacement through an age norm policy, would be inefficient and inconsistent with India's strategic goals.

The primary data, based on structured surveys and follow-up interviews with key maritime stakeholders, revealed a notable resistance to change, particularly among general management and commercial stakeholders, many of whom expressed concerns about operational disruptions, asset devaluation, and capital cost implications arising from age-based norms. This resistance often stemmed from a short-term financial perspective rather than alignment with long-term national or regulatory goals. In contrast, technical executives and classification professionals—those directly responsible for vessel safety, maintenance, and compliance—tended to support the implementation of age norms, citing recurring issues in older vessels such as rising dry-docking costs, structural degradation, and difficulty meeting EEXI and CII thresholds. This discrepancy in perception underscores the need for policy-driven guidance, as commercial decision-makers may underinvest in fleet renewal unless incentivized or required by regulation. DGS Order No. 06 of 2023 serves precisely this purpose: it shifts the industry's mindset from reactive maintenance to proactive modernization, ensuring that operational safety, environmental performance, and strategic competitiveness are not compromised by outdated commercial considerations.

The scenario analysis conducted in this study plays a central role in evaluating the financial and operational implications of implementing age-based norms for Indian-flagged vessels. Three policy scenarios were assessed: an immediate fleet exit at the proposed age limit, a phased withdrawal over 3 to 5 years, and a filtered policy targeting only high-risk vessel types. Among these, Scenario 3—which proposes a targeted application of the age norm—emerged as the most balanced and effective approach. It affects just 4.99% of India's gross registered tonnage, yet strategically removes the oldest and most inefficient vessels from the fleet. This approach minimizes disruption while aligning with India's long-term goals of safety, sustainability, and competitiveness.

To evaluate the economic justification for such a policy, the study utilized Net Present Value (NPV) modeling of vessel operations across different age categories and fuel types. The analysis clearly shows that the NPV of continued operations declines steeply beyond 20–25 years for most vessel types, especially when carbon pricing, rising maintenance costs, and insurance premiums are factored in. For high-emission vessels such as older tankers and LPG carriers, the model demonstrates that the economic case for continued operation collapses under scenarios involving even moderate carbon penalties (e.g., USD 150/tCO_2), validating the need for their timely replacement. Thus, the age norm is not only an environmental or regulatory imperative—it is a financially rational decision for fleet renewal.

The phased exit and renewal of older vessels will also generate substantial demand for shipbuilding, particularly within India's domestic yards. Based on projected replacements and average vessel cost, the implementation of the age norm under Scenario 3 could trigger demand for over 120–150 new vessels over the next decade. This directly supports India's shipbuilding ambitions under the Maritime India Vision 2030 and offers opportunities to boost local manufacturing, create employment, and enhance technological capabilities in line with the "Atmanirbhar Bharat" initiative.

In parallel, the withdrawal of aged vessels under the policy will also revitalize the domestic ship recycling sector, which has already gained momentum through India's accession to the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships. The phased release of end-of-life vessels—particularly general cargo ships, bulkers, and tugs—can ensure a steady supply of recyclable steel and machinery while improving safety and compliance standards within the Alang and other recycling clusters. In this way, the policy not only facilitates greener oceans but also contributes to a circular maritime economy, providing economic value from decommissioned assets.

Collectively, these results from scenario modeling, lifecycle economics, and sectoral interlinkages strongly support the adoption of DGS Order No. 06 of 2023. It catalyzes a virtuous cycle of fleet modernization, shipyard growth, and recycling expansion, while also safeguarding environmental and financial sustainability.

While the implementation of vessel age norms under DGS Order No. 06 of 2023 offers clear strategic, environmental, and economic benefits, it is not without its challenges. A policy of this scale—targeting the systematic phase-out of older ships—can introduce transitional risks that must be acknowledged and managed. These include short-term fleet shortages in niche coastal or inland segments, capital stress on small and medium-sized shipowners, potential surge in demand for shipyard capacity, and volatility in second-hand and scrap markets. If not carefully phased or supported, such risks could lead to service disruptions, increased freight costs, or even regulatory non-compliance during the transition period.

To mitigate these challenges, there is a strong case for developing contingency frameworks that allow for temporary extensions or route-specific exemptions, particularly in cases where fleet replacements are not readily available or where ships are operating under low-risk, domestic regulatory environments. These contingencies must be strictly conditional, based on vessel compliance with safety inspections, environmental benchmarks (such as CII/EEXI), and the absence of repeated deficiencies in Port State or Flag State inspections. Such provisions preserve regulatory credibility while allowing the maritime ecosystem sufficient time and space to adjust.

Simultaneously, successful implementation will require targeted government support to various stakeholders across the maritime value chain. Small vessel operators, in particular, may require access to low-interest green loans, depreciation incentives, or public-private leasing mechanisms to enable fleet replacement. Indian shipyards must be equipped with timely tenders, predictable demand, and policy assurances to invest in infrastructure upgrades and workforce expansion. Similarly, the ship recycling industry will need improved logistics, environmental safeguards, and fiscal stability to handle the incoming surge of decommissioned vessels efficiently and safely.

Finally, it is essential that the policy design remains flexible and performance-based, rather than strictly age-bound. Ships that are technically upgraded, retrofitted to comply with global environmental regulations, and have demonstrated consistent safety and operational performance, should be considered for time-bound exemptions. This approach rewards proactive compliance, minimizes disruption, and ensures that the policy is viewed not as punitive but as a strategic roadmap for modernization. In sum, balancing firmness with flexibility, and regulation with facilitation, is crucial to realizing the full potential of DGS Order 06 without compromising fleet stability, industry confidence, or maritime connectivity.

To address the risks associated with a strict age-based vessel exit policy while preserving its strategic intent, the introduction of a Safety and Sustainability Index (SSI) can offer a nuanced, performance-based regulatory framework. This index would serve as an evaluative tool to assess the operational viability and environmental compliance of aging vessels, allowing policy implementation to focus not just on chronological age but also on actual performance, safety records, and emissions behavior. Such an approach offers a middle ground—preserving the integrity of DGS Order No. 06 of 2023 while providing structured flexibility to operators who invest in vessel upgrades and operational improvements.

The SSI would be a composite score, calculated using parameters such as the vessel's Port State Control (PSC) and Flag State Inspection (FSI) history, Carbon Intensity Indicator (CII) rating, attained EEXI values, emission performance (e.g., CO_2 per tonne-mile), and compliance with safety and pollution-prevention equipment standards. A higher index score would indicate that a vessel, despite being older, remains structurally sound, operationally safe, and environmentally aligned. Such vessels could be granted conditional extensions, say for three to five years, with periodic reassessment. This allows for the rational use of capital-intensive assets while ensuring that underperforming, high-risk ships are still phased out as intended.

Implementing the SSI framework would also encourage a shift in industry behavior—from reactive compliance to proactive performance improvement. Shipowners would have a clear incentive to invest in emissions reduction technologies, hull maintenance, propulsion upgrades, and digital monitoring systems to improve their SSI score and thereby extend vessel life within regulated bounds. From a regulatory perspective, this performance-based model makes fleet governance more equitable and data-driven, aligning closely with global best practices in the EU, Japan, and Singapore, where risk-based inspections and fleet ratings are increasingly used to determine access, privileges, or sanctions.

Crucially, the SSI also supports the political and economic feasibility of the age norm. By allowing conditional extensions for compliant vessels, it reduces the perception of the policy as a rigid or punitive measure, instead positioning it as a dynamic, outcome-oriented reform. It also helps mitigate disruption in sectors like inland/coastal shipping or offshore services, where fleet turnover is slower and capital investment cycles are longer. By integrating this index into the regulatory framework of DGS Order No. 06, the Directorate General of Shipping can strengthen fleet modernization while preserving operational continuity, stakeholder trust, and alignment with India's sustainability and maritime leadership goals.

In addition, to enable a smooth transition for ship owners and ship management firms it is proposed that the following extension may be allowed from the initial timeline proposed in the DGS order number 06 of 2023.

Vessel Type	Exemption Time (years)
Oil tankers	2
Bulk carriers	3
General cargo vessel	4
Offshore fleet	2
Specialized vessels	5
Container vessel	4
Cement carriers	4
Gas carrier	5
Chemical carrier	3
Harbor tugs	4
Anchor handling tugs	4
Others	3

- Support for DGS Order No. 06 of 2023
    - The Indian merchant fleet has a high concentration of older vessels, many exceeding 20–25 years in age, with elevated operational, safety, and environmental risks.
    - Deficiency Index over 5.3, compared to 1.6 for younger ships.
    - Low Nil Deficiency Rates (<13%), indicating repeated safety and compliance failures.
    - Aging vessels are also less fuel-efficient, with higher CO_2 emissions and operational costs, making them vulnerable under emerging carbon pricing regimes (USD 150–380/tCO_2).
    - International standards under IMO MEPC 83, EEXI, and CII regulations demand lower-emission, higher-efficiency ships—older Indian vessels will struggle to comply.
    - India's long-term maritime vision (e.g., MIV 2030, AKV 2047, Harit Sagar etc.) demands a modern, sustainable, fleet—DGS Order No. 06 is a critical enabler in this transition.
- Policy Implementation and Phasing
    - Adopt Scenario 3 to implement age norms selectively and pragmatically.
    - Phase vessel retirements over 3–5 years by category to manage transition.

    - Allow conditional extensions for vessels meeting safety and environmental benchmarks.
- Performance-Based Flexibility via Safety and Sustainability Index (SSI)
    - Introducing a Safety and Sustainability Index (SSI) to assess vessels beyond age
    - Inspection and deficiency record (PSC/FSI)
    - CII and EEXI compliance, Operational safety and emissions performance
    - Use SSI to permit time-bound operations for compliant older vessels.
- Economic and Industrial Enablement
    - Offer green finance tools (low-interest loans, tax relief, leasing) for vessel replacement.
    - Expand shipyard capacity and incentivize domestic newbuilding.
    - Support ship recycling clusters to safely handle increased vessel scrapping.
- Contingency Planning and Stakeholder Support
    - Create route-specific or sectoral exemptions where replacement is constrained.
    - Provide flexibility for critical domestic services, especially for small operators.
    - Ensure stakeholder buy-in through phased rollout, audits, and transparent exemption rules.

13 About IIM Indore

Established in 1996 by the Department of Higher Education, Ministry of Education, Government of India, IIM Indore is recognized as one of the premier management institutions in the country. It is an Institute of National Importance under the Indian Institutes of Management Act 2017 and has been a frontrunner in the field of management education, industry interface, and the Government and PSU collaboration. IIM Indore seeks to be a contextually relevant business school with world-class academic standards that develops socially-conscious managers, leaders, and entrepreneurs.

Spread over 193 acres, IIM Indore has attained the 'Triple Crown' from three prestigious international accreditation agencies namely, Association of MBAs (AMBA, a UK-based accreditation agency), Association to Advance Collegiate Schools of Business (AACSB, USA) and the EFMD Quality Improvement System (EQUIS), a globally recognized international organization for management development. With this 'Triple Crown', IIM Indore is now among the top 100 business schools globally out of more than 13,000 schools offering business degree programmes. IIM Indore is the second IIM in the country to receive triple accreditation.

The Institute has achieved remarkable accolades and recognition in various prestigious rankings, solidifying its position among the top business schools in India and abroad. These include the NIRF Rankings, QS Rankings, FT Rankings, Eduniversal Rankings, and UN PRME Ratings.

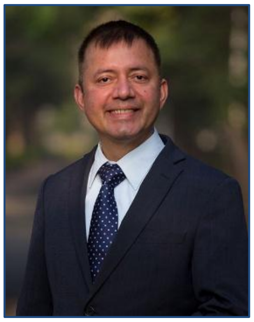
Currently, IIM Indore offers eight major programmes and numerous tailored Executive Education Programmes.

The Institute's vision transcends mere academic accomplishments as it eagerly embraces its role in shaping society and serving the nation. In the years to come, hand in hand with the government and administrative bodies at the local, state, and national levels, it aspires to make substantial strides forward, serving the nation and contributing to its progress.

As an Institute of National Importance, IIM Indore plays a vital role in providing consulting services to public, private, and government agencies. Some of the noteworthy cases include impact evaluations and studies for central ministries such as assessing central sector schemes for the Ministry of Tourism, and analyzing ground handling regulations for AI Assets Holding Limited (AIAHL) under the Ministry of Civil Aviation. The institute has also served as the Independent Verification Agency (IVA) for key national programs like STARS (Ministry of Education), STRIVE (Directorate General of Training, MSDE), and SANKALP Phases I & II (Ministry of Skill Development & Entrepreneurship). At the state level, IIM

Indore has contributed to projects for the State Agency for Public Service Madhya Pradesh on DLI target achievements, and for the State Project Directorate on higher education quality and strategic capacity building. Additionally, IIM Indore has provided consulting for the Department of Industries & Commerce, Government of Kerala in evaluating the 'Year of Enterprises' initiative, supported the Central Industrial Security Force in security deployment, and partnered with the Ministry of Railways for LEAD training and leadership development of IR officers. These engagements reflect IIM Indore's significant contributions toward policy support, capacity building, and institutional strengthening across sectors.

14 Project Team



Prof. Himanshu Rai: Prof. Himanshu Rai, Director, IIM Indore, is a visionary leader who has propelled the institute to global acclaim with the prestigious "Triple Crown" accreditation from EQUIS, AACSB and AMBA. A celebrated author of the bestseller Negotiation, co-author of Organizational Behavior, and the Hindi spiritual book Pravah, he has empowered over 50,000 professionals in leadership and negotiation. His career spans Tata Steel to consultancy for the World Bank and the Government of India. Passionate about ancient scriptures, yoga, mountaineering, theatre, and music, he blends intellect with creativity and adventure, inspiring excellence in education, leadership, and personal growth.

Prof. Saurabh Chandra: Prof. Saurabh Chandra is Professor in Operations Management and Quantitative Techniques at IIM Indore. He is an FPM Scholar from IIM Lucknow. Before entering academia, he worked as an Engineer in the maritime shipping industry and rose to the rank of Chief Engineer working on various projects. His core strengths are strategic and tactical analysis of planning and scheduling problems in organizations using mathematical programming and simulation. He has co-authored several case studies and research papers on the application of process analysis in supply chain management. His consulting interests include process improvement studies in organizations.

Prof. Subin Sudhir: Prof. Subin Sudhir is an Associate Professor in Marketing at the Indian Institute of Management Indore, India. He completed his FPM from the Indian Institute of Management Kozhikode. His research interests include Consumer Behavior, Word of Mouth, Rumor Research in Marketing, Customer Relationship Management, and Digital Marketing. Subin has earned his MBA, and B.Tech degrees from Kerala University. He has worked with IIM Trichy, the Institute for Financial Management and Research (IFMR), the Institute for Customer Relationship Management (iCRM), Tata Elxsi Limited, and Wipro Technologies prior to joining IIM Indore. He has participated in various international academic avenues. His research has been published in various international journals of repute. His teaching interests include Digital Marketing and Social Media Marketing, Retail Strategy, Customer Relationship Management, Sales and Distribution Management, Consumer Behavior, and Marketing Research

15 Annexures

15.1 Annexure 1 – IMO GHG Timeline

Year	International Maritime Organization's (IMO) regulatory milestones and future commitments
2006	Establishment of the first Emission Control Area (ECA) in the Baltic Sea to limit sulphur, nitrogen oxides, and particulate matter emissions from ships.
2007	North Sea becomes the second IMO ECA.
2013	Introduction of the mandatory Energy Efficiency Design Index (EEDI) for new ships and the Ship Energy Efficiency Management Plan (SEEMP) for all ships.
2014	The US Caribbean becomes the fourth ECA.
2015	Adoption of the Paris Agreement to limit global temperature rise and curb GHG emissions.
2016	Approval of the roadmap for emissions reduction strategy at MEPC 69; emphasis on the role of the IMO.
2018	Adoption of the Initial GHG Strategy, targeting a 40% reduction in carbon intensity by 2030 and a 50% reduction in total annual GHG emissions by 2050, against a 2008 baseline.
2019	Formation of voluntary commitments like the Poseidon Principles for climate-conscious shipping finance.
2020	Implementation of IMO 2020, lowering the global Sulphur limit in fuel from 3.5% to 0.5%.
2023	Introduction of the Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII); adoption of a revised GHG strategy at MEPC 80 aiming for a 30% GHG reduction by 2030 and substantial reductions by 2040 and 2050.
2024	On January 1, shipping included in the EU Emissions Trading System (EU ETS).
2025	Introduction of the Fuel EU Maritime proposal with strict GHG intensity limits for commercial vessels.
2026	Review of EEXI and CII effectiveness, potential amendments to strengthen requirements.
2028	Scheduled review of the IMO GHG reduction strategy and possible adjustments based on technological developments.
2030	Aim for at least a 20% reduction in overall GHG emissions compared to 2008 levels, with 5%-10% of energy sourced from zero or near-zero GHG emissions technologies.
2040	Indicative checkpoint, targeting a 70%-80% reduction in GHG emissions compared to 2008 levels.
2050	Target to achieve net-zero GHG emissions, contingent upon national circumstances.

Table A1: Timelines for important milestones in IMO GHG initiatives

15.2 *Annexure 2 - International Context*

15.2.1 The Case of SS El Faro

On September 30, 2015, the captain of the 40-year-old cargo ship SS El Faro noted a warning sign in the red morning sky as he sailed from Jacksonville, Florida, to San Juan, Puerto Rico, shortly before the ship ultimately sank after encountering Hurricane Joaquin. The vessel's voyage data recorder (VDR) captured critical moments leading up to the disaster, including the captain's last commands as the ship faced catastrophic flooding and a loss of propulsion. Following the wreckage's discovery nearly a year later, the National Transportation Safety Board (NTSB) identified multiple safety shortcomings that contributed to the tragedy, such as inadequate weather information, outdated navigation equipment, and insufficient lifeboat provisions, which led to the tragic loss of life of all 33 crew members on board. This data, along with thousands of images of the wreckage and an evaluation of El Faro's sister ship, El Yunque, clearly illustrated what went wrong. The NTSB's accident report outlined various safety concerns that led to the sinking of the ship and the loss of all crew members, many of which were related to El Faro's seaworthiness. The report noted issues such as flooding in cargo holds, loss of propulsion, down flooding through ventilation closures, and a shortage of adequate survival craft, as well as reliance on outdated weather data, poor company oversight, and an ineffective safety management system. El Faro was ill-equipped to face a storm like Joaquin, and due to limited access to weather information and obsolete navigation tools, the vessel headed directly into the hurricane's eyewall, the most dangerous part of the storm[30].

15.2.2 The Age Crisis in Maritime Trade

The global economy relies on the uninterrupted movement of goods across the oceans, with maritime trade representing a multi-billion-dollar sector where ships transport about 80% of the world's goods. This industry has seen significant growth, as the cargo carried by maritime vessels more than doubled from 4 billion MT in 1990 to nearly 11 billion tonnes in 2021[31]. Despite this expansion, maritime trade is heavily dependent on aging ships. The International Maritime Organization (IMO) reports that the average age of commercial cargo vessels exceeds 20 years, and a BIMCO report from October 2023 indicates that nearly 21% of the world's containerships are over 20 years old, yet the pace of scrapping older vessels remains slow, with only 0.8% of the fleet slated for retirement in that year. These aged cargo ships often exhibit

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[30] For more information, visit: *https://www.arnolditkin.com/blog/maritime/aging-cargo-ships-challenges-risks-responsibilit/*
[31] For more information, visit: https://www.statista.com/statistics/264117/tonnage-of-worldwide-maritime-trade-since-1990/#:~:text=The%20volume%20of%20global%20seaborne,were%20loaded%20in%20ports%20worldwide.

signs of wear, corrosion, and outdated technology, potentially jeopardizing their seaworthiness and crew safety. The tragedy of El Faro, built in 1975, exemplifies these risks.

While the lifespan of a cargo ship can theoretically reach 25 to 30 years with proper maintenance, time and commercial pressures frequently undermine this potential. Corrosion damages hulls, mechanical components deteriorate, and the lack of modern safety technologies, such as advanced fire suppression and navigation systems, becomes increasingly evident. These shortcomings not only heighten the likelihood of catastrophic failures but also hinder the competitiveness of these vessels in an era of rapid technological innovation in maritime operations. For crew members working on such aging ships, the dangers are palpable.

The theoretical lifespan of a cargo ship can reach 25 to 30 years with proper maintenance; however, it is often shortened by the effects of time and the intense pressures of commercial use. Corrosion deteriorates the hulls, mechanical components become worn, and the lack of modern safety features, such as state-of-the-art fire suppression systems and navigational aids, becomes more evident. These shortcomings increase the likelihood of significant failures and also put these ships at a competitive disadvantage at a time when technological innovations are swiftly transforming maritime operations.

For crew teams operating such aging vessels, the risks are alarmingly tangible. While El Faro ultimately sank after being caught in a Category 4 hurricane, her loss could have been avoided. TOTE Maritime, the owner of the ill-fated cargo ship, asserted that it was well-maintained, but a former crew member disagreed, stating, “It was a rust bucket... that ship wasn’t supposed to be on the water.” Other ex-crew members reported seeing rust everywhere, a galley with leaks, and even holes in the deck.

Vessel owners and operators must take the necessary steps to guarantee the seaworthiness of their cargo ships, especially as vessels age. Although ensuring the reliability of older ships can be a significant challenge, it remains an essential obligation that maritime companies must fulfill.

15.2.3 Why Are Old Cargo Ships Still in Operation?

Despite challenges associated with an aging fleet, older ships remain extensively in service across the globe for the following reasons. A recent study in Turkey (Gultekin et al., 2021) looked at the impact of a ship’s age on sales value based on ship type. The results indicated that the ship types most adversely affected in value by aging are those utilized for gas transportation, whereas the ship types least impacted by age are those employed in bulk transportation. This implies that vessels deemed riskier attract higher penalties on a ship's age[32].

Aging cargo ships continue to operate for several reasons, including cost-effectiveness, market dynamics, retrofitting, and regulatory compliance. Older vessels are often cheaper to run since their initial purchase costs have been amortized, making them financially attractive for certain routes where advanced technology or speed are not crucial. Additionally, fluctuations in global trade demand can lead to their continued use during high-demand periods to meet capacity needs, even though they may be less efficient. Ship owners may also retrofit these vessels with new technologies to extend their lifespan and comply with environmental regulations, providing a cost-effective alternative to purchasing new ships. Furthermore, many older vessels remain compliant with regulations in effect at the time of their construction, allowing them to operate under grandfathered rules, with retrofitting helping to meet newer standards[33].

IMO has set a target of reducing 2008-level emissions to half by 2050. Many new and alternative fuels, propulsion, scrubbers, and other parts are under consideration globally across the shipping industry. Confronted with uncertainty regarding long-term fuel choices for reducing greenhouse gas emissions, numerous shipping companies continue to operate outdated fleets. However, these older ships may soon need to reduce their speeds to meet upcoming environmental regulations. IMO guidelines recommend slowing down the vessels or improving them through retrofitting and other means[34].

Further, massive supply chain disruptions have been caused by global events such as the Ukraine war, the Middle East war, a drought in the Panama Canal, and even incidents like the Baltimore Bridge collapse. These have compelled many cargo ships to take longer routes than before, causing a sky-high demand for ships and an upward pressure on freight rates. Thus, companies will be running older ships for a prolonged period,[35] at least in the near future.

15.2.4 Other Factors

Despite the challenges associated with a ship's age, the quality of a ship depends greatly on the level of maintenance, the fuel type being used, competency levels of the manpower, both onboard and offshore, and the overall quality of corporate and regulatory administration. Even with everything well taken care of, an

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[32] Ship categorization can be based on riskiness; need to identify a risk score and its relationship with age.

[33] For more information, visit: https://www.arnolditkin.com/blog/maritime/aging-cargo-ships-challenges-risks-responsibilit/

[34] For more information, visit: https://economictimes.indiatimes.com/small-biz/trade/exports/insights/ships-get-older-and-slower-as-emissions-rules-bite/articleshow/92816832.cms?from=mdr

[35] For more information, visit: https://commercial.allianz.com/news-and-insights/expert-risk-articles/shipping-red-sea-impact.html

extremely adverse natural event can lead to significant accidents and emergencies. To cite an example, the 2015 build container ship, MS Dali crashed into the Francis Scott Key Bridge in Baltimore, Maryland, USA on March 26, 2024[36]. In an earlier incident involving the ship on July 11, 2016, the vessel hit a quay while attempting to leave the North Sea container terminal off the port of Antwerp. An inspection conducted that year revealed that the vessel had a structural issue, specifically hull damage, which impaired its seaworthiness, according to a database[37]. The vessel lost power and controls of the steering system[38]. As per a preliminary report by the National Transportation Safety Board, the first power outage occurred after a crew member mistakenly closed an exhaust damper while doing maintenance, causing one of the ship's diesel engines to stall[39].

Recent maritime disaster events suggest that a ship's age, although an important factor in the seaworthiness and quality of a ship, is one amongst the many other factors that play an important role. In this light, we would like to explore in depth, the factors which impact the quality of India's mercantile maritime tonnage in terms of its impact on trade on the one hand, and environmental and safety implications on the other.

15.2.5 Age-related and Other Qualitative Norms for Mercantile Fleet All Over the World

The International Maritime Organization (IMO) currently lists approximately 175 flag states that have ratified various international maritime conventions and are recognized in the global shipping industry. The global shipping industry has recognized 100 flag states (major or minor), with its own maritime registry where ships can be registered under that nation's flag. However, not all flag states are equally prominent in the shipping industry. Some flag states have large registries with a significant share of the world's shipping tonnage, while others may have smaller or specialized registries. As per tonnage prominent top five flag states — Panama, Liberia, the Marshall Islands, Hong Kong, China, and Singapore — collectively account for a significant portion of the world's merchant fleet tonnage. Numerous smaller nations operate shipping registries, often as open registries (flags of convenience), attracting shipowners through favourable regulatory environments. These flag states are categorised as,

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[36] For more information, visit: https://www.vesselfinder.com/news/6675-VIDEO-Mega-container-ship-Dali-Allided-with-berth-at-Port-of-Antwerp

[37] For more information, visit: https://www.reuters.com/world/us/ship-that-hit-baltimore-bridge-also-involved-2016-antwerp-accident-2024-03-26/

[38] For more information, visit: https://apnews.com/article/baltimore-bridge-collapse-cargo-ship-dali-09aeffc6fa81f3069d4ba226def90555

[39] For more information, visit: https://www.thehindu.com/news/international/baltimore-bridge-collapse-cargo-ship-dali-had-power-blackouts-hours-before-leaving-port/article68177499.ece

1. Open Registries (Flags of Convenience): Countries that allow vessels owned by foreign entities to register under their flag. These flags often offer lower fees, reduced regulation, and favourable tax treatment. Prominent areas include Panama, Liberia, the Marshall Islands, the Bahamas, and Malta.

2. National Registries: Countries that typically only allow vessels owned by their citizens or companies to register under their flag, often with stricter regulations and national requirements. These are United States, Japan, China, Germany, and Greece.

3. International Registries: Some countries have created international registries that operate separately from their national registry, allowing foreign-owned ships to register under specific conditions. They are Norway (NIS – Norwegian International Ship Register), Denmark (DIS – Danish International Ship Register), and France (RIF – French International Register).

The entry and exit age regulations for vessel registration across several major flag states, including Liberia, the Marshall Islands, Panama, Singapore, Hong Kong, and China aim to compare the requirements imposed on vessels, particularly related to the age of the vessel at the time of registration and during its operational life under each flag. Globally, major flag states such as Liberia, the Marshall Islands, Panama, Singapore, Hong Kong, China, European nations, the U.K., Norway, Germany, Greece, and the U.S.A. do not impose strict upper age limits for vessel registration or mandatory deregistration based solely on age. Instead, they apply progressively stringent inspections, condition surveys, and compliance checks as vessels age, typically starting at 15–20 years. Older vessels must meet enhanced safety, environmental, and operational standards, with failure resulting in operational restrictions, mandatory repairs, or eventual deregistration. This creates a regulatory environment that discourages the continued operation of older vessels that cannot meet modern standards, even in the absence of formal age bans. While such practices are effective in phasing out substandard older ships, India may not be ideally placed to follow an inspection-heavy model. Given limitations in maritime inspection capacity and the imperative to promote Ease of Doing Business, relying solely on stricter inspections may not deliver consistent results and could misalign with national objectives for fleet modernization. In this context, age-based norms offer a more practical approach for India to ensure alignment with safety, environmental, and strategic goals.

Liberia: Liberia's flag does not impose a strict age limit for vessel registration. However, vessels over 20 years old are subject to increased scrutiny before being accepted for registration i.e., thorough condition assessment conducted by an approved Classification Society to verify their seaworthiness. Liberia does not enforce mandatory de-registration based solely on vessel age. However, older vessels must meet stringent safety and environmental standards to remain registered. They do not have an automatic de-registration rule as per age criteria.

The Marshall Islands: The Marshall Islands does not levy a strict upper age limit for registration, but applies stricter requirements for vessels over 20 years old. Vessels over 15 years of age have to undergo additional surveys (Condition Survey), and vessels over 20 years may require a comprehensive condition assessment. Vessels over 20 years old must comply with enhanced survey requirements and may face additional operational restrictions if they fail to meet the required standards. Similar to Liberia, the Marshall Islands does not automatically deregister vessels based on age alone – it will be based on non-compliance with safety standards.

Panama: Panama doesn't impose any strict age limits for registration, but vessels over 20 years of age require additional inspections and documentation. Panama requires vessels older than 20 years to undergo more rigorous inspections, particularly if they have been flagged under Panama for the first time. Vessels which fail to meet the necessary standards may face operational restrictions or be required to undergo specific repairs or upgrades.

Singapore: Singapore generally does not set an age limit for vessel registration. However, vessels older than 17 years face increased scrutiny and must meet specific conditions. For vessels over 17-years-old, a pre-registration condition survey is typically required to ensure that the vessel meets the necessary safety and operational standards. While Singapore does not enforce mandatory deregistration based on age, vessels failing to comply with the required standards during inspections may be deregistered or face severe operational restrictions.

Hong Kong: Hong Kong does not impose a strict vessel age limit for registration, but vessels over 20 years old must meet additional requirements. Older vessels are required to undergo detailed inspections before registration to confirm their condition and compliance with safety standards. Further, for vessels over 20 years old, Hong Kong requires more frequent and detailed inspections to ensure that they remain seaworthy and comply with international and local regulations. If a vessel consistently fails to meet inspection standards, it may face deregistration or be required to undergo extensive repairs and modifications.

China: China generally accepts vessels of various ages for registration but imposes stricter entry requirements for vessels older than 18-20 years. Older vessels may need to undergo a comprehensive condition assessment by a Classification Society to ensure compliance with Chinese maritime standards. Vessels that do not meet the required standards during these assessments may be subject to deregistration.

European Countries: Both European countries and the United States do not impose strict upper age limits for vessel registration. However, older vessels (typically over 15-20 years) face increased scrutiny, including mandatory condition surveys and compliance checks. Norway and Germany are particularly stringent, requiring thorough inspections for older vessels to ensure they meet high safety and environmental standards. There is no EU-wide regulation mandating deregistration based solely on vessel age. However, older vessels must comply with stringent safety and environmental regulations. The Paris MoU on Port State Control, which applies to many European countries, subjects older vessels to more frequent inspections. Persistent non-compliance can lead to a vessel being banned from EU ports, effectively pushing it toward deregistration. Environmental compliance is a critical factor in the deregistration process, with particular emphasis in countries such as Norway, Germany, and the U.S.A.

The United Kingdom (U.K.): The U.K. does not impose a strict age limit for vessel registration. However, vessels older than 15 years typically require more rigorous inspections. Older vessels may need to undergo a comprehensive pre-registration survey conducted by a recognized Classification Society to ensure compliance with safety and operational standards.

Norway: Norway, known for its stringent maritime safety standards, imposes rigorous checks on older vessels (typically over 20 years) before registration. A thorough condition survey is required for older vessels to ensure that they meet Norway's high safety and environmental standards.

Greece: Greece does not have a strict age limit but requires vessels over 15 years old to undergo additional inspections before registration. Older vessels are subjected to detailed safety and environmental checks to ensure compliance with both Greek and EU regulations.

Germany: General Entry Requirements: Germany does not strictly limit the age of vessels for registration, but requires vessels older than 20 years to undergo comprehensive surveys. A detailed pre-registration survey is mandatory for older vessels to ensure that they meet Germany's high safety and environmental standards.

The United States of America (U.S.A.): The United States has its own set of regulations for vessel registration under the U.S. flag, which is governed by the U.S. Coast Guard and other relevant maritime authorities. The U.S. does not impose a strict upper age limit for registering vessels under its flag. However, older vessels, especially those over 20 years, are subject to more detailed inspections and regulatory scrutiny. Older vessels must undergo a comprehensive survey to verify their seaworthiness, compliance with safety standards, and environmental regulations. Vessel exceeding 20 years, must submit to detailed condition surveys to ensure compliance with U.S. maritime safety and environmental standards. Older vessels that do not meet the U.S. Coast Guard safety standards may face operational restrictions or be required to undergo extensive repairs to remain registered.

Most old aged vessels in service over 15 years have to undergo a thorough inspection as part of the Annual Survey, Intermediate Survey, and Renewal Survey to be part of their flag of registry. The inspections include:

> Enhanced Surveys: These are aimed specifically at bulk carriers and oil tankers to ensure their structural integrity. The inspections are more rigorous and comprehensive as the vessel age reaches 20 years. This may include detailed hull inspections, ballast tanks, cargo holds, machinery surveys, and structural integrity assessments
>
> Special Surveys: Many classification societies require special surveys for vessels at 20 years, which involve thorough examinations of the vessel's condition, including non-destructive testing, thickness measurements, and close-up surveys of critical areas.
>
> Condition Assessment Program (CAP): CAP is the voluntary program required by cargo owners for the older vessels such as tankers, gas carriers, bulk carriers, and nowadays, offshore vessels of age 15 years or more. This third-party service grades vessels through a detailed evaluation of the vessel's condition, and assigns it a rating based on its suitability for continued operation.

Globally older vessels, especially those over 20 years old, are termed as high-risk vessels so often that they are subject to more rigorous inspections by Port State Control (PSC) authorities. These inspections focus on ensuring compliance with international conventions such as SOLAS (Safety of Life at Sea), MARPOL (Marine Pollution), and the ISM (International Safety Management) Code.

Conclusion

Most of the flag states including Liberia, the Marshall Islands, Panama, Singapore, Hong Kong, and China, do not impose strict age limits for vessel registration. Vessels older than 15-20 years typically face additional inspections and documentation requirements before they can be registered. The rules for entry and exit based on vessel age across these flag states emphasize the importance of maintaining high safety and operational standards, particularly as vessels age. Many maritime authorities and flag states have specific regulations concerning the inspection of vessels that are 20 years old or older, and some have policies that could lead to deregistration or impose operational restrictions after a certain age. Vessels reaching or exceeding 20 years of age are typically subject to enhanced inspections, more frequent surveys, and stricter regulatory scrutiny across major flag states. These inspections often focus on structural integrity, machinery condition, and compliance with environmental regulations.

While most flag states do not mandate automatic deregistration based solely on age, they do impose strict requirements on older vessels, although vessels over 20 years old after compliance with enhanced survey requirements may face additional operational restrictions if they fail to meet the required standards. A failure to meet these requirements can result in deregistration or severe operational restrictions, particularly in jurisdictions with stringent maritime safety standards. While there is no uniform global regulation mandating deregistration based on vessel age, the consistent theme across jurisdictions is that older vessels must demonstrate ongoing compliance with safety and environmental standards to remain in service. Given limitations in maritime inspection capacity and the imperative to promote Ease of Doing Business, relying solely on stricter inspections may not deliver consistent results and could misalign with national objectives for fleet modernization. In this context, age-based norms offer a more practical approach for India to ensure alignment with safety, environmental, and strategic goals.

15.3 Annexure 3 - Extant literature on the impact of ship's age on shipping quality

We present a brief summary of extant research on the impact of age and related factors on dimensions of shipping quality.

Research Publication	**Data source**	**Results**
Papanikolaou, A., & Eliopoulou, E. (2008). *Impact of ship age on tanker accidents*. Greek Section of Society of Naval Architects and Marine Engineers, September, Athens.	Casualty information of the LRFP and LMIU databases from 1990-2007	More than a ship's age, the actual condition of ship's structure in terms of maintenance and building quality are the decisive factors for non-accidental structural failure accidents.
Eliopoulou, E., Papanikolaou, A., & Voulgarellis, M. (2016). *Statistical analysis of ship accidents and review of safety*	Data source: casualty data is the IHS Sea-web® database, and the investigation pertains to the	• Bulk carriers show increased accident frequency with age, going up to 3 times for older ships than newbuild. • Above 20 years of age, bulk

level. Safety science, 85, 282-292.	generic ship types between 2000–2012.	carriers and car carriers show higher frequency; fatigue and structural failure are gradually getting more serious • LNG ships show higher frequency above 20 years age • Other vessel types did not show much difference
Aalberg, A. L., Bye, R. J., & Ellevseth, P. R. (2022). *Risk factors and navigation accidents: A historical analysis comparing accident-free and accident-prone vessels using indicators from AIS data and vessel databases*. Maritime Transport Research, 3, 100062.	The analysis compares cargo vessels with at least one registered navigation accident (grounding or collision) within Norwegian waters with those that have none, in the period 2010–2019.	• Older vessels show a significantly higher risk of accidents, potentially indicating technical condition issues. •A positive predictor, indicating a relationship between vessel size and accident likelihood. Collinearity with length overall is noted.
Antão, P., Sun, S., Teixeira, A. P., & Soares, C. G. (2023). *Quantitative assessment of ship collision risk influencing factors from worldwide accident and fleet data*. Reliability Engineering & System Safety, 234, 109166.	Maritime accident data from the IMO's GISIS1 database and world fleet data provided by the EQUASIS database	Six Risk Influencing Factors on the collision probability, namely Ship length, Ship type, age of the ship, Classification Society, flag and geographical area. Ship type, length and geographical area have a very high impact, while age having comparatively much lower impact.

Bye, R. J., & Aalberg, A. L. (2018). *Maritime navigation accidents and risk indicators: An exploratory statistical analysis using AIS data and accident reports.* Reliability Engineering & System Safety, 176, 174-186.	The accident data used in this analysis were obtained from two main sources, NMA's accident database and historical records of AIS data. These two sources were merged to explore the possibility to using AIS to obtain more reliable accident data, especially regarding operational conditions.	Vessels involved in navigation incidents had higher age and smaller size comparatively.
Fan, S., Yang, Z., Blanco-Davis, E., Zhang, J., & Yan, X. (2020). *Analysis of maritime transport accidents using Bayesian networks*. Proceedings of the Institution of Mechanical Engineers, Part O: Journal of Risk and Reliability, 234(3), 439-454.	Manual case-by-base analysis of recorded maritime accidents from the Marine Accident Investigation Branch (MAIB) and Transportation Safety Board of Canada (TSB) that occurred from 2012 to 2017 is undertaken to develop a primary database to support this study.	With regard to the vessel factors, the probability of collision is the highest among 'accident type' if a ship is in the following states: older than 20years'
Xue, J., Papadimitriou, E., Reniers, G., Wu, C., Jiang, D., & van Gelder, P. H. A. J. M. (2021). *A comprehensive statistical investigation framework for characteristics*	Ship accidents occurred in FBA of Chongqing MSA	Ship's old age along with poor maintenance is one of the important factors.

and causes analysis of ship accidents: A case study in the fluctuating backwater area of Three Gorges Reservoir region. Ocean Engineering, 229, 108981.		
Demirci, S. E., Canımoğlu, R., & Elçiçek, H. (2023). *Analysis of causal relations of marine accidents during ship navigation under pilotage: A DEMATEL approach.* Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment, 237(2), 308-321.	32 factors contributing to ship accidents were identified based on accident investigation reports obtained from Global Integrated Shipping Information System (GISIS) and expert opinion. Expert interviews were conducted to assess the impact of various factors.	Impact on ship's condition due to old age and lack of maintenance are important factors.

Table A2: Summary of Published Academic Papers

Summary of findings:

- Age vs. Condition: The age of a ship alone is not as significant as its maintenance and construction quality when assessing the risk of structural failure.
- Accident Frequency by Age:
  - Bulk carriers have an increased accident frequency with age, particularly for ships over 20 years old, where incidences can be up to three times higher compared to newer vessels.
  - Similar trends are noted for LNG carriers, which also show higher accident rates above 20 years of age.
  - Less correlation with age is observed for other vessel types.
- Risk Factors: Six factors influence collision probability:
  - Ship length
  - Ship type

- Age of the ship
- Classification Society
- Flag
- Geographical area
- Among these, ship type, length, and geographical location have the strongest impacts on accident probabilities, while the age has a comparatively smaller effect.

- Size and Age Correlation: Older vessels tend to be smaller and exhibit a higher risk of accidents, possibly due to aging-related degradation and maintenance issues.
- Maintenance Importance: Poor maintenance, along with advanced age, is a critical contributor to accident risk.

In conclusion, while older vessels are generally at a higher risk for structural failure and accidents, the emphasis on proper maintenance and construction quality plays a crucial role in mitigating these risks. For improving safety, focusing on maintenance practices and considering vessel size and type when evaluating risks could be beneficial.

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15.4 Annexure 4 - A Summary of Indian Flagged Vessels

The Box Plot in Figure below shows the median, quartiles, and possible outliers of two age groups: "Age" and "Age, GT > 5000". The medians are around 7 and 20, with the "Age, GT > 5000" group having a wider spread. The illustration at the bottom employs a histogram to display the frequency distribution of the same age groups with a Kernel Density Estimate (KDE) overlay, providing a smooth approximation of the data distribution. The "Age" group is skewed to the right, peaking around 7, while the "Age, GT > 5000" group is more focused around 20.

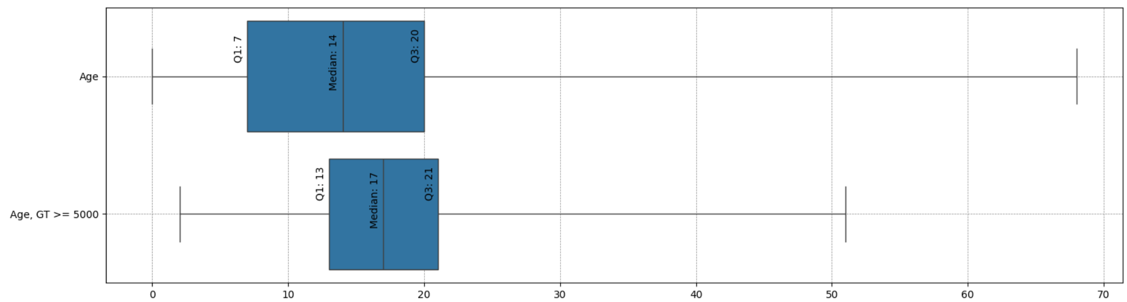

Figure A1: Age distribution of Indian flagged vessels

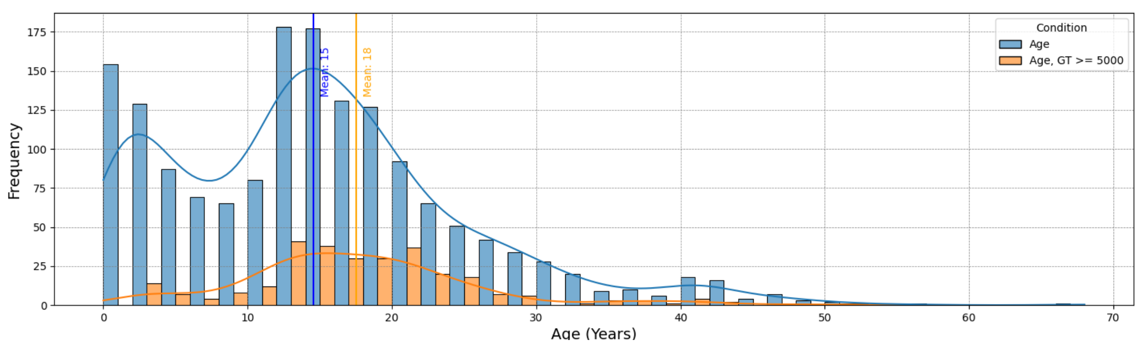

Figure A2: Age distribution of Indian flagged vessels

The figure below displays a box plot and a histogram of GT (Gross Tonnage) under the freight category.

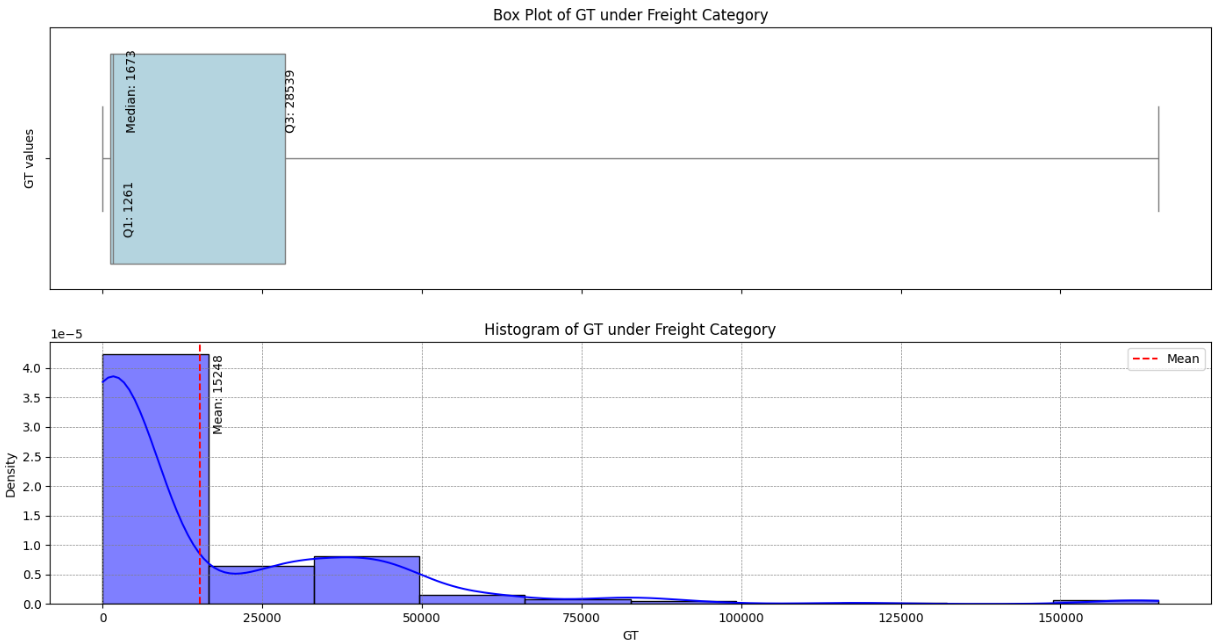

Figure A3: Gross tonnage distribution of freight carrying vessels in the Indian flag

Box Plot Overview:

1. The box plot shows the distribution of GT values.
2. The median is marked at around 1874.
3. The first quartile (Q1) is at 1328, and the third quartile (Q3) at 2799, indicating a right-skewed distribution with some large outliers.

Histogram Overview:

1. The histogram reflects the frequency of GT values.
2. It is right-skewed, with most values concentrated towards the lower end.
3. A dashed red line indicates the mean of the data.
4. A few higher GT values extend the tail on the right side.

These plots suggest that while most freight GT values are relatively low, there are some significantly higher values affecting the overall distribution.

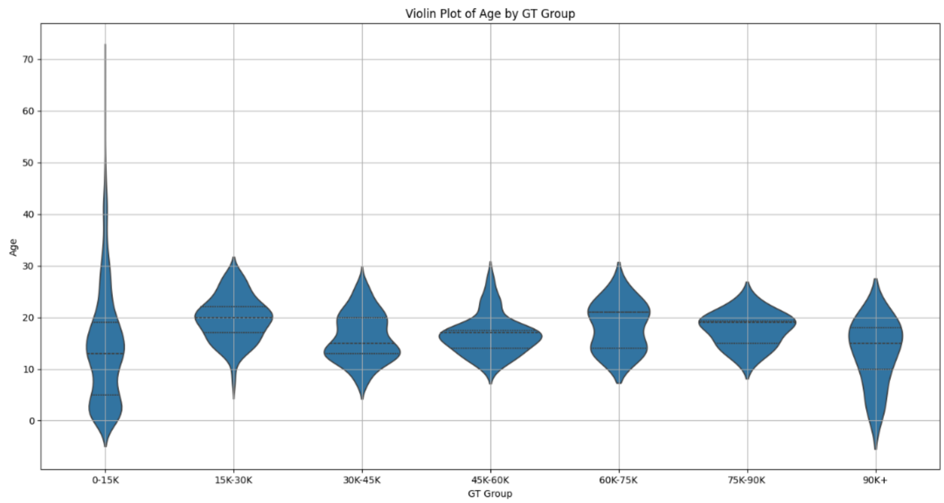

Figure A4: Age distribution across GT categories in freight carrying vessels

The plot above shows the distribution of ages for different GT (Gross Tonnage) groups. Here's a breakdown of the distribution:

1. Age Distribution: Each violin represents the distribution of ages within a specific GT group.
2. GT Groups: The GT ranges are divided into segments: 0-15K, 15K-30K, 30K-45K, 45K-60K, 60K-75K, 75K-90K, and 90K+.
3. Observations:
   i. The shape and width of each violin indicate the density of age data for each GT group. Wider sections represent more data points at that age.
   ii. The groups show varying distributions, with some groups having more concentrated mid-range ages while others have a broader spread.

Overall, this plot visually compares how the age distribution varies across different GT categories.

1. 0-15K Group: Shows a widespread with a concentration of younger ages.
2. 15K-30K Group: Shows a more even distribution across ages, with peaks at certain points.
3. 30K-45K Group: Shows a bimodal distribution, indicating two common age ranges.
4. 45K-60K to 75K-90K Groups: Generally, show a narrower distribution with peak concentrations, reflecting more specific age trends.
5. 90K+ Group: Indicates less variability with concentrated age points.

The plot suggests that age trends and variability differ across GT categories, with some groups showing concentrated age ranges and others more diverse distributions.

GT_Group	0-5K	5K-10K	10K-15K	15K-20K	20K-25K	25K-30K	30K-35K	35K-40K
Age								
0-10	463	26	1	0	0	1	0	0
11-20	544	21	3	3	8	25	21	5
21-30	179	11	4	4	4	19	2	10
31-40	57	9	2	0	0	0	0	0
41-50	32	4	0	0	0	0	0	0
51-60	3	1	0	0	0	0	0	0
61-80	1	0	0	0	0	0	0	0

GT_Group	40K-45K	45K-50K	50K-55K	55K-60K	60K-65K	75K-80K	80K-85K	85K-90K	90K+
Age									
0-10	6	0	0	0	0	0	0	0	3
11-20	35	17	0	6	4	0	9	1	8
21-30	4	2	1	1	5	1	1	0	0
31-40	0	0	0	0	0	0	0	0	0
41-50	0	0	0	0	0	0	0	0	0
51-60	0	0	0	0	0	0	0	0	0
61-80	0	0	0	0	0	0	0	0	0

Table A3: Crosstab of Age and GT of freight vessels

Table A3 presents a cross-tabulation of two categorical variables, GT (Gross Tonnage) and Age, with values representing the count of occurrences for each combination. Here are some observations:

1. Structure: Each cell contains the number of occurrences for a specific category combination.
2. High counts are observed in the top-left cell (463), decreasing as you move to the right and down.
3. The diagonal has a noticeable clustering of values, possibly indicating common pairings.

Overall, most vessels under the Indian flag are younger vessels with a smaller GT. The total tonnage of non-passenger vessels is 10.9 million GT out of which 0.63 million GT, i.e., 5.8% falls outside the exit age limit as per the DGS Order No. 06 of 2023.

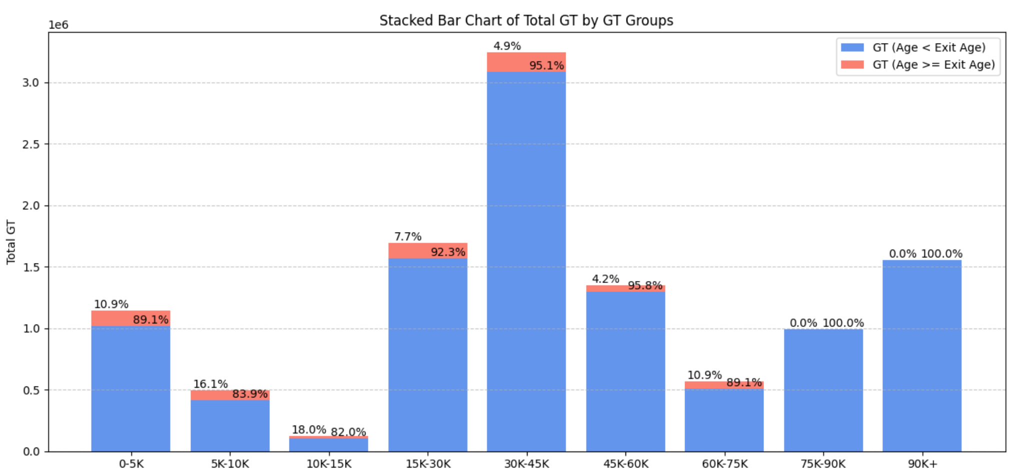

Figure A5: Exit tonnage based on the age limit specified by the Order

The bar chart shows the total GT (Gross Tonnage) by GT groups, divided by age criteria (Age < Exit Age vs. Age ≥ Exit Age). Here are the insights:

1. A majority of the GT in each group is attributed to Age < Exit Age.
2. The percentage labels indicate the proportion of total GT with Age < Exit Age in each GT group.
3. The 30K-45K group has the highest percentage (95.1%) of its total GT from Age < Exit Age.

Overall, the chart highlights the dominant role of younger ages in contributing to the total GT across most groups. At this point in time, a small percentage of vessels under the Indian flag will go out of service as per the Order.

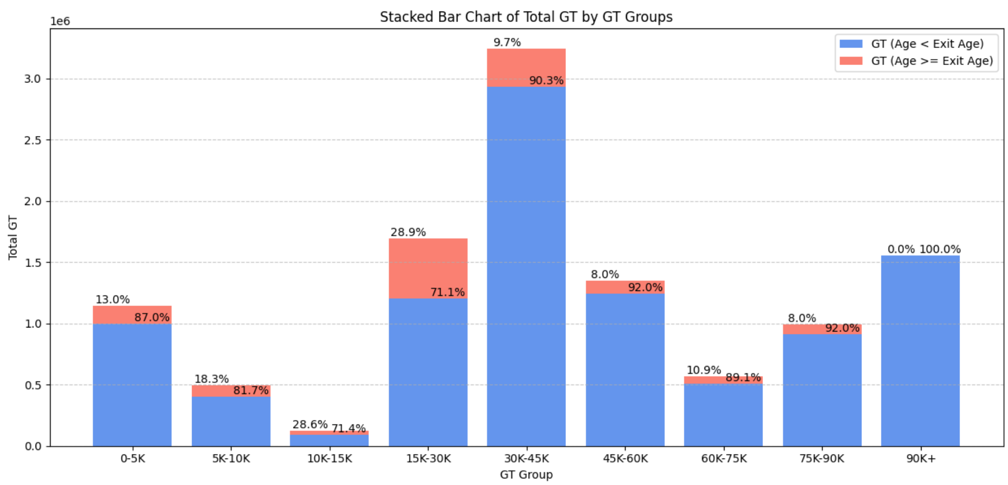

Figure A6: Exit tonnage based on the age limit specified by the Order after 3 years

The figure above shows a stacked bar chart classifying vessels under various GT categories into those that will remain in service and those that will be discontinued as per the Order after three years from this time.

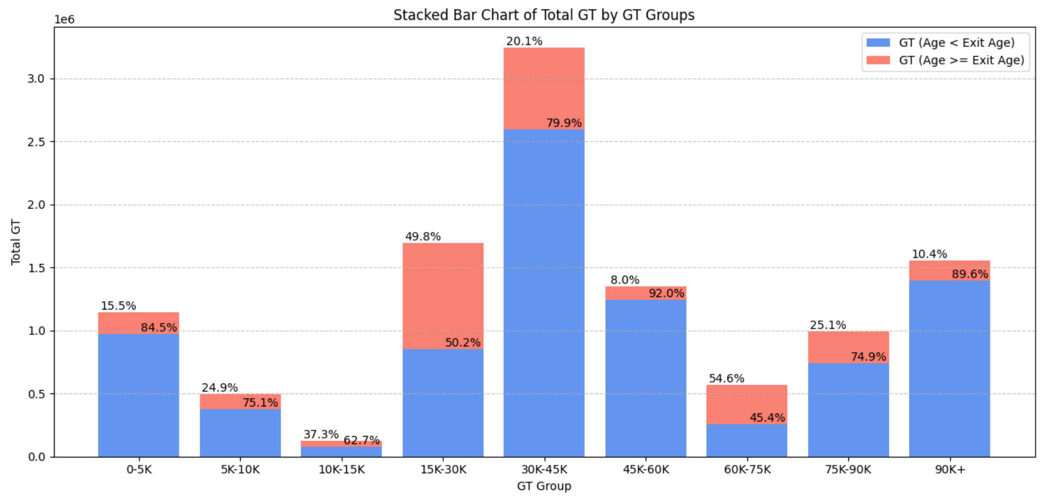

Figure A7: Exit tonnage based on the age limit specified by the Order after 5 years

The figure above shows the stacked bar chart classifying vessels under various GT categories into those that will remain in service and those that will be discontinued as per the Order after five years from this time.

Overall, one can see that a substantial GT of the Indian flag will get discontinued after 5 years as per the existing Order.

15.5 Annexure 5 - Findings from the Initial Stakeholder Survey and Follow-Up Interviews

A detailed open-ended questionnaire was administered to a diverse group of respondents, who were direct stakeholders in the Indian mercantile marine trade. The questionnaire was designed as a structured survey meant to solicit level of satisfaction with various aspects of the study and open-ended responses. Responses ascertained from the questionnaire are outlined in this section.

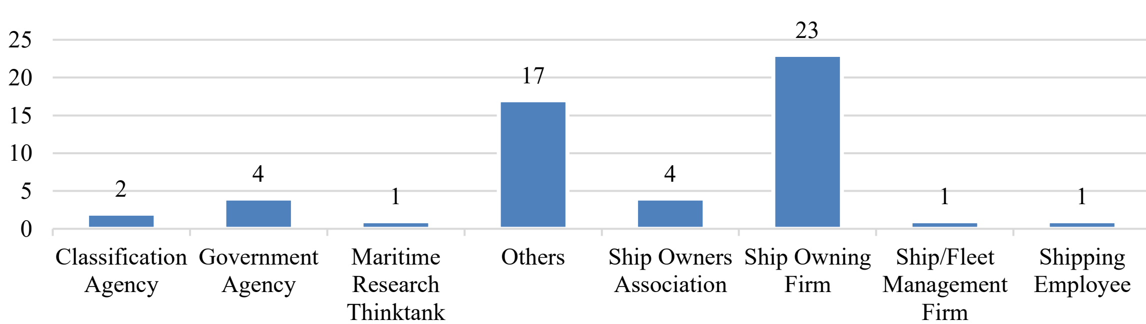

Figure A8: Distribution of survey respondents

Level of satisfaction with the DGS Order No. 6 of 2023.

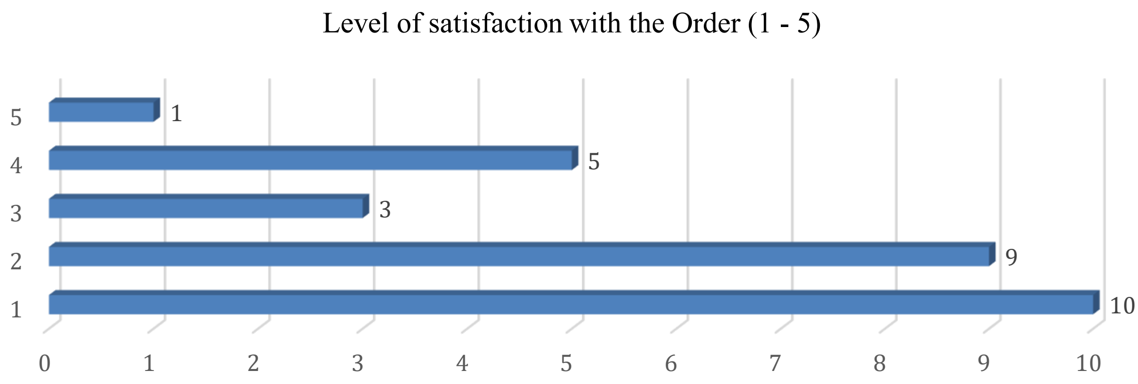

Figure A9: Level of satisfaction with the Order

The recent DGS Order No. 6 of 2023 stipulates stringent age restrictions on Indian ships, particularly impacting the dredging and specialized vessels, which has raised several significant concerns within the maritime industry.

4. Impact on the Indian Shipping Industry: The Order aims to improve the quality of Indian tonnage but may inadvertently hinder the growth of both existing and new Indian shipping companies. By prioritizing vessel age over operational certifications, it places local companies with older tonnage at a disadvantage, potentially leading to significant financial losses.
5. Effect on Dredging Operations: The Order restricts the ability of foreign dredgers older than 20 years from being reflagged or imported in situations where local alternatives are unavailable. This could disrupt pressing dredging projects critical to national infrastructure, such as port expansions and maintenance dredging, thus impacting future operations and delivery timelines.
6. Operational Concerns with Specialized Vessels: Key operators like ONGC have expressed dissatisfaction, noting that specialized vessels, such as diving support vessels that are integral to safe offshore operations, may be unjustly de-registered based solely on their age despite being well-maintained and operational. The high acquisition and replacement costs of such vessels could lead to increased operational expenses and hinder oil and gas production.
7. Lack of Consultation and Potential Discrimination: The Order was issued without sufficient engagement with stakeholders and lacked empirical data supporting the age norms. Critics argue that the criteria appear arbitrary, often benefiting larger companies while imposing burdens on smaller operators. Exemptions for certain vessel categories have led to perceptions of discrimination.
8. Need for Reassessment: The current age restrictions may not reflect the true safety and quality of the vessels. Stakeholders recommend a focus on the overall condition and operational capabilities of vessels

rather than a strict age limit. Many suggest that the Order could be amended to better align with the realities of the industry, especially for specialized vessels that are crucial for complex operations in the oil and gas sectors.

While the Order has the potential to enhance safety and quality standards within the Indian fleet, it raises numerous concerns about its feasibility and impact on existing industry dynamics. A more balanced approach that considers the operational condition of vessels, alongside safety requirements, could serve the industry better.

Confidence Levels About the Positive Impact of the DGS Order No. 6 of 2023 on the Total Tonnage of Indian Flag Ships.

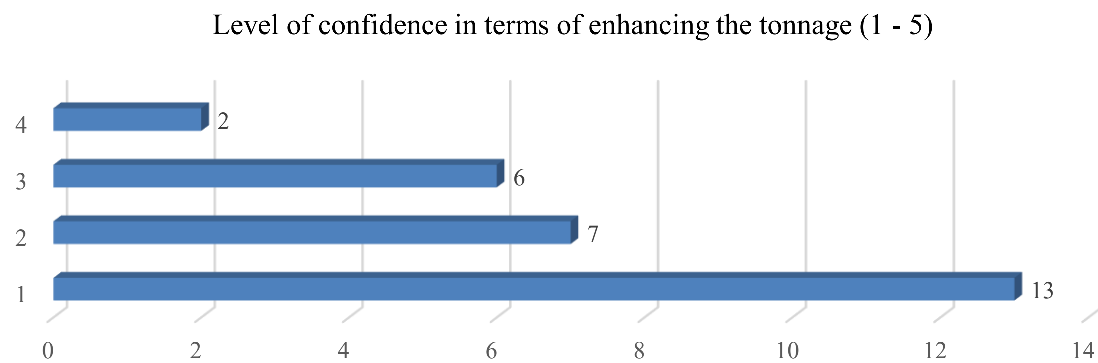

Figure A10: Level of confidence that the Order will lead to increase in tonnage

The Indian shipping industry faces significant challenges that have led to a small domestic tonnage, exacerbated by DGS Order No. 6 of 2023. Key reasons include:

1. Support for Indian Cargo: There is minimal support for Indian-controlled EXIM cargo being restricted to Indian-flagged vessels. Implementing policies to secure this cargo for Indian vessels would gradually increase Indian tonnage.
2. Financing Challenges: Long-term financing for ship purchases, typically required for vessels with a lifespan of 25 years or more, is often unavailable in India. Indian banks prefer to finance for shorter periods, necessitating government intervention or the establishment of specialized financing entities.
3. Dredging Equipment Concerns: Dredging vessels, which are capital-intensive and built to last 40 to 45 years, may not be able to meet the new age norms imposed by the Order. This could lead to de-registration of efficient and safe vessels, adversely impacting dredging projects and increasing reliance on foreign tonnage.

4. Economic Viability: The DGS Order could result in the scrapping of up to 30-35% of the current fleet, significantly reducing Indian tonnage over the next few years. As a result, there will be substantial foreign exchange outflows due to reliance on foreign shipping.
5. Investment Dilemmas: High costs associated with acquiring new vessels and insufficient operational contracts hinder investment in new tonnage. Many shipowners may be forced to exit the industry, further reducing the domestic fleet.
6. Lack of Consultation: The Order was perceived as having been implemented without adequate input from industry stakeholders, potentially creating an unstable investment environment. This has raised concerns about the impact on small and medium-sized enterprises (SMEs) within the sector.
7. Future Implications: The unavailability of specialized vessels during construction periods and the potential loss of tonnage could severely impact critical offshore operations, like oil and gas production, while creating a trust deficit regarding future government policies.

While the intention behind the DGS Order may be to enhance safety and quality, it could lead to a significant reduction in Indian tonnage, financial strain on shipowners, and increased dependency on foreign vessels. A comprehensive review of the Order considering economic realities and stakeholder input is essential to avoid detrimental consequences for the Indian shipping industry.

The level of Confidence About the Positive Impact of the DGS Order No. 6 of 2023 on the Overall Safety and Compliance to Safety Requirements in the Sector.

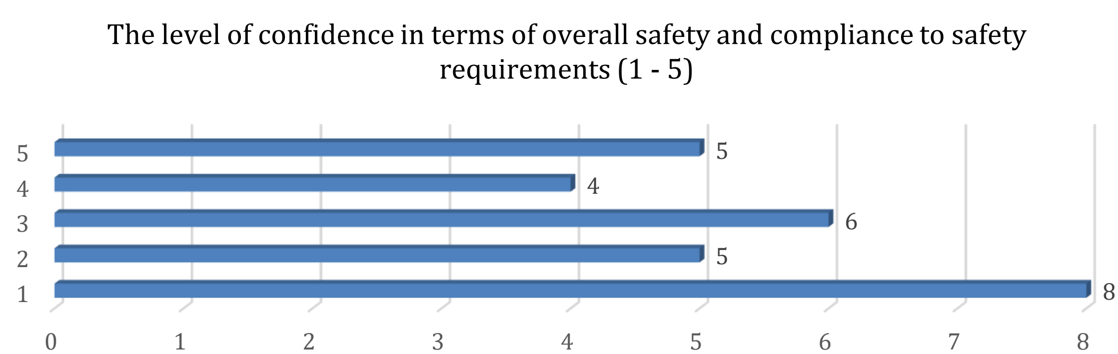

Figure A11: Level of confidence that the Order will improve overall safety and its compliance

The responses to this question suggest a nuanced relationship between ship age and safety compliance within maritime operations, particularly in light of the DGS Order No. 6 of 2023, which emphasizes hardware condition as a primary factor for safety. It argues that safety and compliance must be ingrained as a culture across organizations, supported by policies, training, and management commitment.

1. Safety Not Solely Age-Dependent: The responses assert that safety is not inherently linked to the age of a vessel. While younger ships may meet modern safety norms, older vessels can operate safely if well-maintained and properly managed.
2. Importance of Maintenance and Inspection: Regular inspections and maintenance are crucial for safety, regardless of age. It highlights that older ships can still pass safety regulations and that the culture of safety among operators significantly impacts compliance.
3. Regulatory Framework: Safety requirements are set by international conventions such as SOLAS and Class Regulations, which mandate inspections regardless of vessel age. Vessels older than 20 years undergo more rigorous inspections, but adherence to safety standards is ultimately dependent on quality maintenance.
4. Cultural Factors in Safety: Emphasis is placed on the mindset of ship operators. A well-maintained older vessel can be safer than a poorly maintained newer vessel, indicating that operator culture affects safety compliance.
5. Research and Evidence: The text references studies lacking conclusive evidence linking age to safety while suggesting that well-maintained older vessels can match younger ones in compliance. It calls for stringent safety norms that focus on quality rather than imposing strict age limits.

While the Order aims to phase out older vessels to enhance safety, it cautions against relying solely on age as a criterion and stresses the need for continuous quality control and safety culture across all vessels, regardless of age. Overall, the responses suggest that vessel safety and compliance hinge more on maintenance, management culture, and adherence to regulations than on the age of the vessels themselves.

Recommendation/Analysis: The level of confidence on the positive impact of the DGS Order No. 6 of 2023 on the sustainability of the sector.

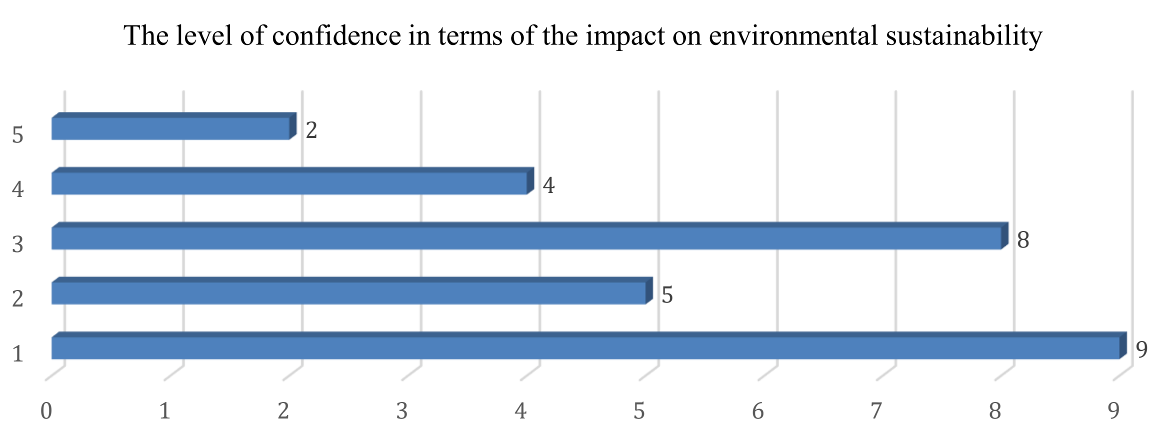

Figure A12: The level of confidence about whether the Order will improve environmental sustainability

Here, we discuss the implications of the DGS Order No. 6 of 2023 regarding the age of vessels and sustainability in Indian shipping. Here's a summary of the main points:

1. Advantage of Younger Vessels: Newer ships are inherently more fuel-efficient and can be upgraded with modern technologies, which older ships cannot accommodate. The push for new builds aligns with sustainability and greenhouse gas (GHG) emission reduction targets.
2. Challenges to New Builds: Due to limited long-term contracts and financing issues, it's unlikely that Indian companies will significantly invest in new vessels, which are essential for improving sustainability.
3. Current Sustainability Compliance: Older dredgers that comply with international codes can still ensure sustainability in the sector. While new dredgers utilizing cleaner fuels like LNG are emerging, the full transition to green vessels remain distant.
4. Maintenance over Age: Emission control largely depends on maintaining good machinery and adopting alternative fuels rather than merely the vessel's age. It must be noted that emission reductions require proactive measures from owners.
5. Impact of Age Restrictions: Implementing age norms could deter ship owners from registering in India, leading to a potential decline in national tonnage and sustainability in the sector, as older vessels might simply reflag under less stringent regulations elsewhere.
6. Minor Contribution to Global Emissions: Indian shipping contributes a small fraction of global emissions, with older vessels representing a negligible impact. The Order aims to portray older ships unfairly as unsafe without considering their proper maintenance.
7. Broader Context of Emissions: The text emphasizes that shipping is a comparatively environmentally friendly transport mode, contributing to around 3% of global emissions. Investments and technological advancements are necessary for transitioning to cleaner fuels.
8. Challenges in Fuel Transition: The transition to alternative fuels, such as methanol or LNG, faces infrastructure and economic barriers. The responses call for a more thoughtful approach that considers the existing fleet's performance and the actual availability of these fuels.
9. Technological Advances: Improved designs and technologies in newer vessels lead to enhanced efficiency, thus reducing emissions. It highlights that merely retiring older vessels will not achieve sustainability goals, and a comprehensive strategy is necessary to achieve that.

This discussion explores and contends that focusing solely on the age of vessels is insufficient for achieving sustainability and reducing greenhouse gas emissions; maintenance, technology, and adaptive use of resources are equally, if not more, important.

Alignment of the DGS Order No. 6 of 2023 with Similar Age Restriction Policies Globally.

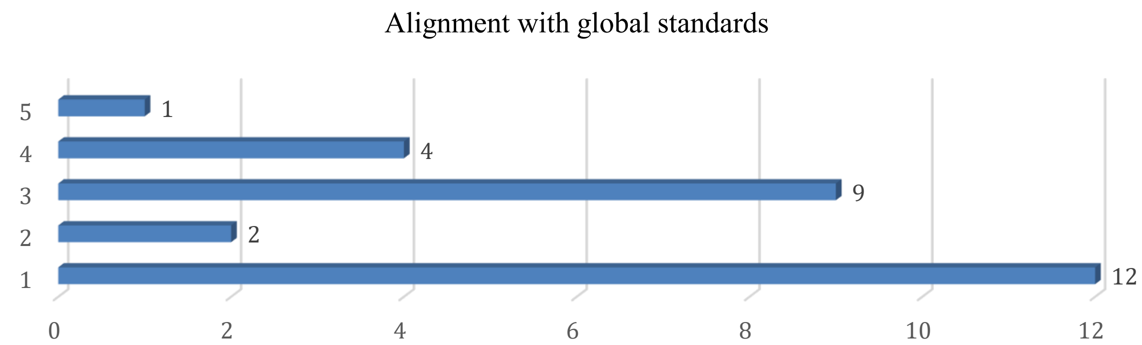

Figure A13: The level of confidence in alignment with global standards

This section summarizes discussions on the global context of age restrictions for vessels, particularly in light of India's DGS Order No. 6 of 2023, which addresses the use of older tonnage. Some of the most vital points are:

1. Lack of Universal Age Restrictions: Major maritime nations such as the U.S.A., U.K., and Australia do not impose age limits on vessels, and there is no globally accepted rule regarding age restrictions for specialized vessels, including dredgers.
2. Global Practices: While some countries have stricter regulations for older vessels, especially simpler categories like tankers or bulk carriers, specialized vessels usually rely on owner and charterer agreements rather than flag state restrictions.
3. Charterer Authority: Many charterers set age limits based on commercial considerations, often dictating age norms rather than regulations from flag states. For example, some companies have their own age restrictions for vessels depending on contractual agreements.
4. Age vs. Safety: The text emphasizes that age alone does not determine a vessel's safety or operational viability. Instead, a vessel's condition, maintenance, and compliance with international standards are more critical factors.
5. Concerns Over Cost-Cutting: The introduction of age limits may lead to unsafe practices by shipowners, who might be tempted to cut maintenance costs as vessels approach cut-off ages, raising safety concerns.
6. Economic Implication: Reducing the operational age of specialized vessels could harm the offshore oil and gas industry in India, potentially leading to economic losses.
7. Comparison with Other Countries: The policies of various flag states regarding the age of vessels can differ significantly. While some may impose certain restrictions, others do not emphasize age as a determining factor for safety.

8. Regulatory Context: The International Maritime Organization (IMO) does not advocate for restrictions based on age; rather, it emphasizes increased audits and inspections for older vessels.
9. Operational Criteria: Various flag administrations allow vessels over 40 years old to operate, provided they meet safety and maintenance criteria, indicating that condition is a more relevant measure than age.

In conclusion, it can be argued that there is a lack of global consensus on age restrictions for vessels, particularly specialized ones, and that focusing on vessel condition and safety culture is more effective than merely imposing arbitrary age limits.

Contribution of the DGS Order No. 6 of 2023 to the Competitiveness of the Indian Shipping Sector.

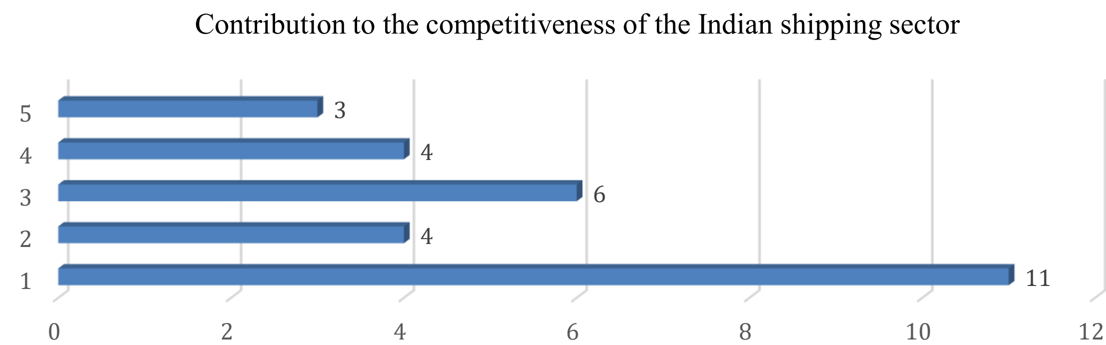

Figure A14: The level of confidence about the Order's impact on the Indian shipping sector's competitiveness

Here, we discuss the implications of DGS Order No. 6 of 2023 on the competitiveness of the Indian shipping sector, particularly in light of introducing age restrictions for vessels. Here's a summary of the key points:

1. Impact on Competitiveness: The responses argue that younger, safer vessels can boost the global competitiveness of the Indian fleet. However, age limitations from the DGS Order could disadvantage Indian shipowners compared to competitors in regions such as Singapore, where older vessels can operate for longer, resulting in lower depreciation costs and operational expenses.
2. De-classification of Vessels: The Order is expected to de-classify many Indian flag diving support vessels, which may lead to reduced available tonnage and increased dependence on foreign vessels, further diminishing the competitiveness of the Indian shipping industry.
3. Need for Time and Investment: While the Order may encourage new vessel construction with the latest technology, the capital expenditure and time required to build these boats presents significant challenges for many Indian shipowners.

4. Economic Implications: If older, efficient dredgers and other vessels are phased out, it could increase import costs and lead to a monopolized market dominated by large players. This may also reduce opportunities for entrepreneurs and small shipowners within the Indian shipping industry.
5. Quality Versus Age: The Order aims to enhance safety standards but may not effectively address the competitiveness of Indian ships. Improving safety requires vessel maintenance and management practices rather than merely focusing on age.
6. Global Practices: Most international registries do not impose upper limits on vessel ages. Competitors from other countries may take advantage of the age restriction, further squeezing Indian operators out of the market.
7. Industry Concerns: There are serious concerns about the Order's potential to create a monopoly and diminish the Indian fleet, which currently represents only about 1% of the global market. Long-term charterers are reportedly reluctant to extend contracts due to age norms, which could further erode competitiveness.
8. Need for a Balanced Approach: A call for a level playing field emphasizes that regulatory frameworks should be fair, transparent, and focused on the vessel's operational condition rather than just age.
9. Future of Indian Shipping: If implemented without adequate support, the Order could significantly reduce Indian shipping capabilities, challenge existing operators, and lead to an exodus of businesses seeking more favorable conditions abroad.

The collected views acknowledge the importance of maintaining high safety standards for vessels and contend that focusing solely on age limits is detrimental to the competitiveness of Indian shipping and could lead to significant economic repercussions in the sector.

Steps India Should Take to Achieve Effective and Sustainable Growth in Total Tonnage

The suggestions that follow recommend various strategies and recommendations to enhance the competitiveness and growth of the Indian shipping industry, particularly by increasing the tonnage of Indian-flagged vessels. A summary of the key points is enlisted below:

1. Encourage Investment: To increase Indian tonnage, sustainable ship financing and funding mechanisms are required to support shipowners in investing in modern vessels or new builds.
2. Support Indian Exim Cargo: It must be emphasized that if Indian-controlled export-import cargo is reserved for Indian-flagged vessels, it would likely lead to a significant increase in Indian tonnage.
3. Overcome Long-Term Financing Challenges: A consistent challenge faced by Indian shipowners is the lack of available long-term financing (15 years), which is critical for supporting aging vessels that typically have a lifespan of at least 25 years.

4. Address Economic Losses: India loses about 75 billion US$ annually in foreign exchange due to the operation of foreign tonnage on Indian cargo.
5. Regulatory Improvements: Suggestions include relaxing statutory guidelines, reducing compliance burdens, providing subsidies for building new vessels, and creating a single-window system for vessel registration.
6. Focus on Indian Shipbuilding: It advocates for building vessels in India to create jobs and promote a sustainable shipping economy, as opposed to merely improving flagging requirements.
7. Create a Level Playing Field: To ensure effective growth, it is crucial to maintain equitable taxation and operating costs for Indian shipowners compared to international competitors.
8. Collaborate with Oil PSUs: Establishing independent commercial pools of crude tankers managed within a framework is proposed, such that it supports domestic oil import requirements without restrictions tied to flags.
9. Infrastructure Investment: Highlights the need for investment in port facilities and enhancing connectivity to boost operational efficiency and the capacity for handling larger vessels.
10. Streamline Regulations: Regulatory frameworks should be streamlined to balance safety with industry growth; tax relief for ship owners, financial incentives, and faster customs clearance for spare parts.
11. Research and Development: Advocacy for increased research into environmental impacts and alternate fuel sources is recommended, emphasizing the long-term need for a robust ecosystem to support Indian shipping.
12. Holistic Policy Approach: Some suggestions emphasize the necessity for policymakers to take a holistic and long-term view, addressing the challenges faced by various types of shipowners to create a viable and sustainable business environment in the Indian shipping sector.

In conclusion, while emphasizing sustainable development and industry competitiveness, suggestions call for comprehensive reforms in financing, regulation, and infrastructure development to bolster the Indian shipping industry effectively.

Steps India Should Take to Ensure Overall Safety & Compliance to Safety Regulations in the Sector.

We summarize various recommendations and concerns to improve safety standards and compliance for Indian-flagged vessels considering DGS Order No. 06 of 2023, which imposes age norms for vessels. Here’s a summary of the key points:

1. Need for Stronger Enforcement: While existing rules and regulations are deemed adequate, there is a call for more stringent enforcement of safety standards, particularly for older ships, rather than simply imposing age limits.

2. Identifying Issues with Older Ships: Instead of focusing on age alone, the text proposes addressing specific safety concerns associated with older vessels, such as maintenance of the main deck, updating navigation equipment, and renewing safety equipment periodically.
3. Commitment to Compliance: Stakeholders express a commitment to adhering to safety regulations and suggest that skill development, systematic training, and continuous oversight could enhance safety culture.
4. Improved Inspection Regimes: Recommendations include implementing unannounced audits for older vessels, creating a public database for vessel detentions and deficiencies, and tackling issues of corruption within inspections.
5. Collaboration and Skill Development: Recommendations advocate for collaboration among shipyards, research institutions, and industry players, alongside investing in maritime education to develop a skilled workforce.
6. Technology Utilization: The use of digitalization and AI for more efficient fleet management is encouraged, along with retrofitting older ships with modern technology to improve safety and fuel efficiency.
7. Critiques of DGS Order No. 06: Concerns are raised regarding the rationale behind the DGS Order and whether existing regulations adequately address safety issues. There is a call for a comprehensive inquiry into incidents and near misses to improve safety standards.
8. Data Collection and Analysis: Emphasizing accurate data collection and incident analysis, the suggestions argue that better insights could lead to actionable improvements in safety and compliance.
9. Support for Older Ships: It is asserted that even older ships can remain operational with modern retrofits as long as the hull is in good condition, stressing the importance of technological upgrades rather than outright age restrictions.
10. Industry Cooperation: Emphasizes the necessity of involving industry views when introducing new safety regulations and aligning them with global standards to foster a safer and more competitive shipping sector.

In conclusion, the responses argue for a holistic approach that focuses on improving safety and compliance without rigidly adhering to age norms, while also promoting technological advancements and thorough data analysis to enhance operations within the Indian shipping industry.

Steps India Should Take to Ensure Environmental Sustainability in the Industry.

Responses received for recommending strategies to enhance sustainability in the Indian shipping industry emphasized the need for younger and more modern vessels under the Indian flag. Here's a concise summary of the main points:

1. Sustainable Fuel Options: The government should clearly mark out the fuel types available for coastal trade and ensure that companies align their new vessel purchases with these. Green methanol blended with standard fuels is suggested as a viable option for the coastal trade.
2. Inspection and Environmental Compliance: Increasing inspections on dredgers older than 20 years could promote environmental sustainability without imposing additional costs on the government or owners. It is noted that shipping's contribution to pollution is minimal compared to land-based industries, thus suggesting a focus on first improving land pollution.
3. Incentives for New Technologies: The government may introduce incentives to adopt new technologies to reduce carbon footprints, including the establishment of LNG and LPG bunkering facilities along the coast.
4. Support for Green Practices: Low-interest loans should be made available for shipping companies to acquire green vessels. Eco-friendly vessels and collaboration with research institutions should be encouraged to innovate in sustainable practices.
5. Adoption of International Standards: India should align its maritime policies with IMO regulations to ensure environmental sustainability. The text emphasizes the importance of creating a comprehensive roadmap for transitioning to green and alternate fuel systems, which includes supply chain management and capital infusion.
6. Economic Measures: The government should impose carbon taxes on foreign-flagged ships based on their emissions in Indian ports, incentivizing cleaner operations. Suggestions include providing budgetary support for Environmental Ship Design (ESD) and decarbonization efforts, along with subsidizing new green technologies.
7. Lifecycle Focus: The industry should adopt a holistic approach that encompasses the entire lifecycle of vessels — from efficient design and construction to operation and recycling through environmentally sound practices.
8. Regular Maintenance: Periodic inspections and adherence to Original Equipment Manufacturer (OEM) maintenance schedules are essential to ensure operational efficiency and sustainability.

In conclusion, the findings recommend a comprehensive strategy involving regulatory support, financial incentives, technological advancement, and collaborative efforts to enhance sustainability within the Indian shipping sector while ensuring compliance with international standards.

Other Relevant Factors to be Considered for the DGS Order No. 6 of 2023.

Here, we summarize the concerns and recommendations regarding the DGS Order No. 06 of 2023, which enforces age norms for Indian-flagged vessels. Here’s a summary of the main points:

1. Impact on Older Vessels: The Order may adversely affect owners of very old vessels, particularly those involved in specialized operations. However, it is expected that the industry will evolve, and new owners will emerge, operating modern vessels.
2. Irony of Safety Regulations: The Order cites safety concerns, yet exempts passenger ships from age restrictions, raising questions about the rationale behind focusing on age as a criterion for safety and compliance.
3. Economic Viability: The requirement to renew fleets during a high asset price cycle could financially harm mid and small shipowners, leading to depletion of their resources. A more nuanced approach is needed to manage acquisitions during such cycles.
4. Comprehensive Feedback: The authors believe they have provided balanced feedback to the DGS and suggest sharing insights from industry associations to enhance understanding and strategy.
5. Request for Exemptions: An exemption for specific vessels, particularly ONGC-owned ones, is advocated, allowing them to operate under existing conditions for an additional five years to ensure public interests are met.
6. Regulatory Framework: There is a call for a fair and open policymaking process, emphasizing that ship safety and quality should not solely hinge on vessel age. It highlights the need for performance-based evaluations rather than blanket age restrictions.
7. Support for Coastal Vessels: Owners of coastal vessels stress their importance for supplying essential goods to remote areas and argue against deregistering vessels simply due to age, especially when these vessels are well-maintained and compliant with regulations.
8. Stakeholder Involvement: The responses suggest expanding consultations to include various stakeholders, such as charterers, oil companies, and shipyards, to ensure a holistic understanding of the implications of the Order.
9. Challenges of Competition: The imposition of age norms could lead to higher operational costs and diminished competitiveness for the Indian shipping industry, particularly against foreign vessels that are not subject to the same age restrictions.

10. Fundamental Recommendations: Recommendations include evaluating the performance of Indian-flagged vessels, examining international standards, and considering financial support for shipowners affected by new emissions regulations.
11. Long-term Perspectives: The call for investment in new vessels and modernization focuses on aligning with international practices while also ensuring that operational and financial realities for existing vessels are considered.

In summary, the emphasis is on the need for a balanced approach to safety and compliance that takes into account vessel performance, operational viability, and financial impacts on vessel owners while advocating for dialogue among stakeholders and consideration of exemptions in specific cases.

15.5.1 Findings of surveys with Technical Superintendents and Shipyard executives

In the next round, we administered the same survey to executives on the technical side of ship operations to gain their perspectives. A detailed open-ended questionnaire was administered to a group of Technical Superintendents, Managers and Shipyard executives. The questionnaire was designed as a structured survey meant to solicit level of satisfaction with various aspects of the study and open-ended responses. Filled surveys were followed up with personal interviews. Responses ascertained from the questionnaire and interviews are outlined in this section.

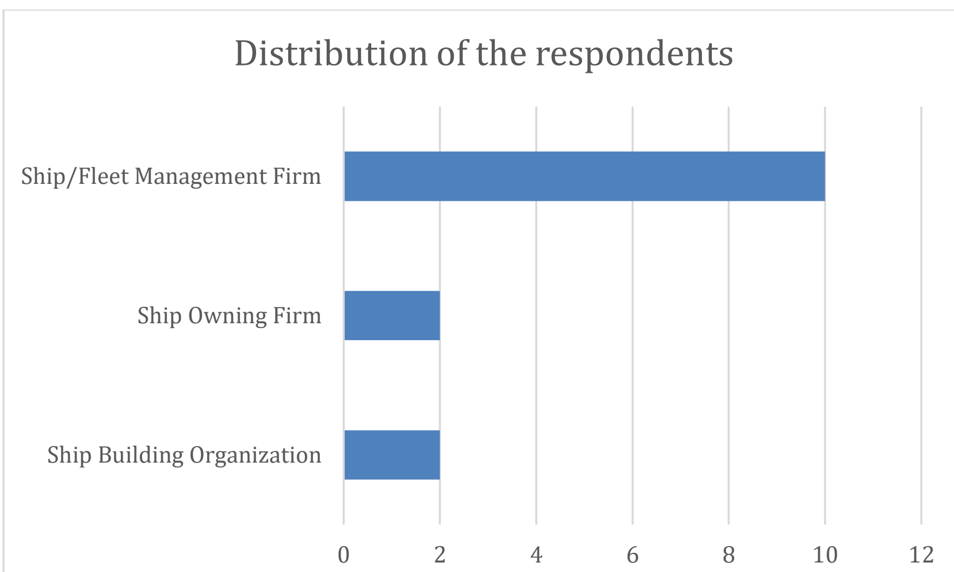

Figure A15: Distribution of respondents in the second round of surveys

Level of satisfaction with the DGS order number 06 of 2023

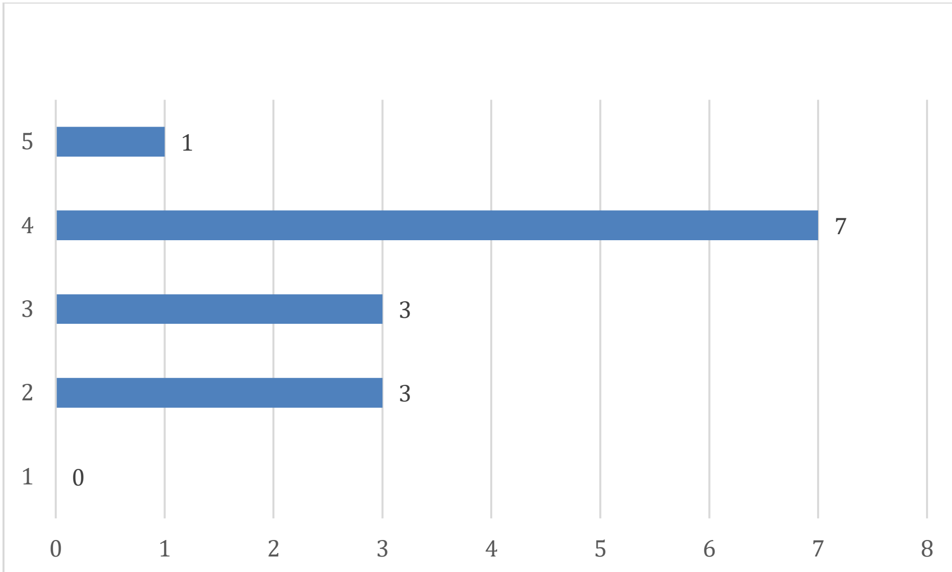

Figure A16: Level of satisfaction with the order- tech executives

Key Arguments in Favor of Phasing Out Older Vessels

1. Promotes Modernization & Sustainability
    - Incentivizes investment in newer, technologically advanced, and eco-friendly ships.
    - Aligns with global trends toward reducing GHG emissions, though age in not equal to emission efficiency alone.
2. Improves Safety & Flag Reputation
    - Prevents India from becoming a "dumping ground" for poorly maintained older vessels.
    - Enhances compliance with safety/environmental standards, boosting trust in Indian-flagged ships.
3. Economic Benefits
    - Stimulates domestic shipbuilding through new orders.
    - Reduces operational inefficiencies (older ships are harder/expensive to maintain; retrofits may not be viable).
4. Operational Efficiency

- Smoother cargo operations and fewer breakdowns, improving India's competitiveness in global trade.

Key counterarguments against strict age restrictions

1. Age is not the only factor resulting in vessel condition
    - A well-maintained 25–30-year-old vessel (e.g., passing RightShip inspections) can outperform a neglected 5-year-old ship.
    - Suggestion: Case-by-case assessments instead of blanket bans.
2. Financial & Logistical Strain
    - Shipowners face high costs to replace fleets; shipbuilding delays could cause short-term capacity gaps.
    - Risk of higher freight rates and supply chain disruptions.
3. Inspection Gaps
    - Poor enforcement of existing inspections (not age) may be the root cause of substandard vessels.

Balanced Recommendations

1. Hybrid Approach
    - Strict Inspections: Enforce rigorous audits (e.g., RightShip) for older vessels (20+ years) to ensure compliance.
    - Gradual Phase-Out: Set incremental age limits (e.g., 25 years for bulk carriers) with exemptions for compliant ships.
2. Support Mechanisms
    - Offer subsidies/tax breaks for newbuilds or retrofits to ease financial burdens.
    - Partner with shipyards to expedite construction timelines.
3. Flag-State Incentives
    - Reward high-performing older vessels with longer flag privileges, penalizing non-compliant ones.

In summary, while phasing out older vessels can elevate India's shipping standards, a flexible, inspection-driven policy (not just age) would mitigate economic risks while ensuring safety/environmental goals.

Level of confident that the DGS order no. 6 of 2023 will be able to increase the total tonnage of Indian flag ships

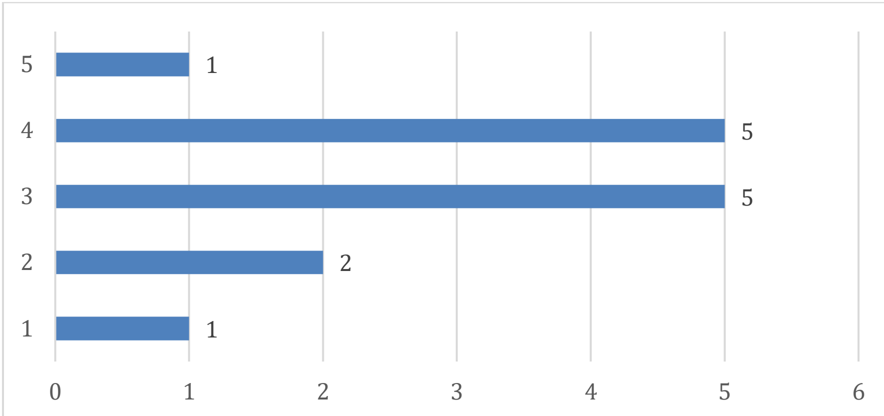

Figure A17: Distribution of level of confidence in order leading in increase in tonnage

Key Concerns Raised

1. Financial Burden on Shipowners
   - Upgrading/replacing older vessels requires high Capex, especially challenging for small operators.
   - Past reliance on cheap, old tonnage (for coastal trade) may no longer be viable.
2. Risk of Tonnage Reduction
   - Strict age limits could shrink available tonnage if owners flag vessels elsewhere (e.g., flags with lax rules).
   - Newbuilding orders are capital-intensive; without incentives, owners may resist investing.
3. Inspection & Enforcement Gaps
   - No inspection regime: Age alone is a blunt tool; poorly maintained new ships may slip through.
   - PSC (Port State Control) historically lenient in India, reducing pressure to maintain standards.
4. Bureaucratic & Tax Barriers

- While red tape has reduced, taxes, clearance delays, and lack of infrastructure still deter registration under the Indian flag.

Proposed Solutions

To align the policy with tonnage growth and safety/environmental goals, the government could:

1. Financial Incentives
   - Tax Breaks: Exemptions on GST, import duties for newbuilds/retrofits.
   - Subsidized Loans: Low-interest financing via SBI or EXIM Bank for Indian-flagged vessels.
   - Scrapping Premiums: Cash incentives for recycling old ships (like China's subsidy scheme).
2. Flexible Compliance for Older Vessels
   - Performance-Based Waivers: Allow older ships (20+ years) if they pass enhanced inspections (RightShip/IACS audits).
   - Phased Timeline: Gradual phase-out (e.g., 5 years) to ease the transition.
3. Strengthen Inspection Regime
   - Mandatory Audits: Enforce annual structural/emission checks for vessels >15 years.
   - Blacklist Non-Compliant Flags: Ban reflagging of substandard ships (e.g., vessels deregistered from India for safety violations).
4. Boost Flag Attractiveness
   - Fast-Track Clearances: Single-window approvals for Indian-flag registration.
   - Cabotage Relaxation: Prioritize Indian-flagged ships in coastal cargo (e.g., LNG, containers).
   - Security & Infrastructure: Invest in port facilities to reduce operational costs.

The DGS circular's age restrictions are justified for safety/environment, but without financial support and inspection reforms, it risks:

- Reducing tonnage (if owners flag out).
- Stifling small operators (due to high Capex).

Recommendation is to pair age limits with incentives for newbuilds, strict but fair inspections, and policy stability to make the Indian flag competitive.

Level of confidence that the DGS order no. 6 of 2023 will be able to increase the overall safety and compliance to safety requirements in the sector.

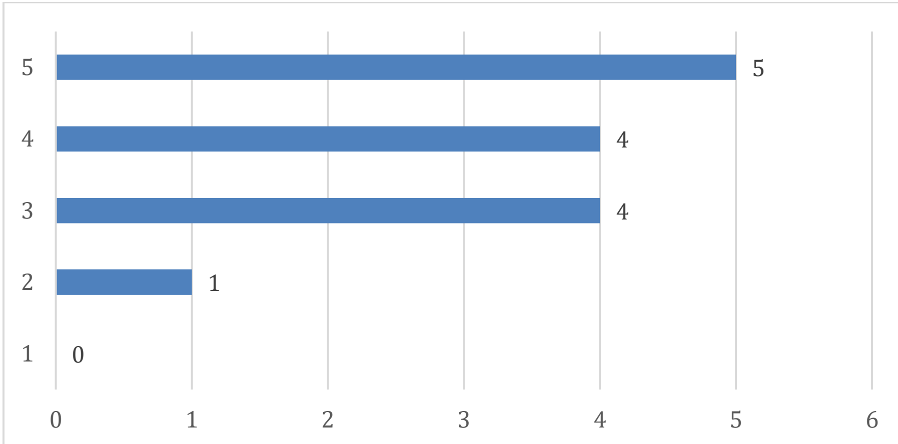

Figure A18: Level of confidence that the order will improve safety

Balancing Safety, Compliance, and Practical Challenges in Indian Shipping

1. Benefits of High-Rated, Younger Tonnage Under Indian Flag

- Enhanced Safety & Compliance: Newer/well-maintained vessels inherently reduce risks (accidents, pollution, crew safety).
- Market-Driven Quality: Substandard operators with poorly maintained old ships will exit, improving overall fleet standards.
- Global Reputation: Attracting high-quality tonnage elevates India's flag reputation, aiding trade and insurance terms.

2. Challenges in Implementation

- Diverse Industry: Coastal traders, small operators, and regional disparities complicate uniform enforcement.
- Mentality Shift: Indian owners often prioritize low OPEX over maintenance, degrading vessel conditions.
- Enforcement Gaps: Without trained personnel and rigorous PSC inspections, loopholes may persist.
- Age ≠ Safety: A 25-year-old ship with top-tier maintenance can outperform a neglected 5-year-old vessel.

3. Key Recommendations

A. For the Government (DGS/Port Authorities)

- Strengthen PSC Inspections:
  - Frequency: Mandate quarterly audits for vessels >15 years.
  - Training: Upskill surveyors to detect substandard ships (e.g., structural corrosion, engine malfunctions).
- Hybrid Age Policy:
  - Ban: Ships >25 years (with exemptions for exceptional RightShip-rated vessels).
  - Incentivize Newbuilds: Tax holidays, scrapping subsidies, or duty-free imports for eco-friendly ships.
- Transparent Flagging:
  - Blacklist Operators: Penalize owners who reflag substandard ships to avoid Indian regulations.

B. For Shipowners

- Adopt OPEX Discipline: Invest in maintenance to extend vessel life and avoid forced scrapping.
- Leverage Incentives: Utilize govt. schemes for fleet modernization (e.g., FAME subsidies for green ships).
- C. For Classification Societies
- Strict Audits: Enforce IMO/ISO standards uniformly, especially for older vessels.
- Tech Solutions: Promote digital tools (AI-driven wear-and-tear monitoring) to predict failures.

4. Addressing Counterarguments

- "New ≠ Safe": True, but newer ships have modern safety tech (ECDIS, ballast treatment systems).
- "Age Bans Reduce Tonnage": Mitigate by allowing case-by-case exemptions for top-tier older ships.
- "Cost Burden": Offset via phased implementation (e.g., 5-year transition) and financial support.

In summary, the DGS policy is a step forward for safety and environment, but success hinges on:

1. Strict but fair inspections (not just age bans).
2. Financial support to ease the transition.

3. Cultural shift among owners to prioritize long-term compliance over short-term cost-cutting.

An actionable suggestion is to pilot the policy in high-risk segments (e.g., oil tankers, passenger vessels) before full rollout.

Level of confident that the DGS order no. 6 of 2023 will be able to increase the sustainability of the sector and reduce the production of Green House Gasses in the sector.

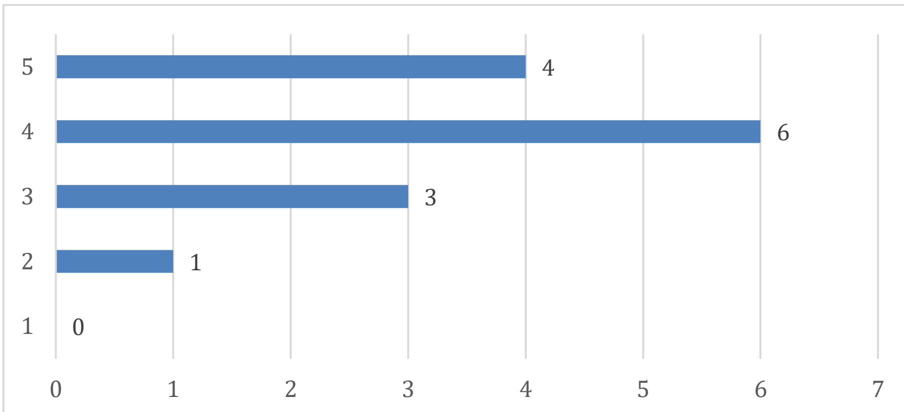

Figure A19: Level of confidence that order will improve environmental sustainability

Impact of Younger, High-Rated Tonnage on GHG Emissions & Sustainability

1. Benefits of Modern Fleet for GHG Reduction

- Fuel Efficiency: Newer ships optimize fuel consumption (lower CII ratings) due to advanced hull designs, engines, and propulsion tech.
- Alternative Fuels: Built for biofuels, LNG, ammonia, or methanol, reducing reliance on fossil fuels.
- Retrofit Challenges: Older ships struggle with costly/complex retrofits (e.g., scrubbers, energy-saving devices).
- Operational Reliability: Fewer breakdowns = fewer emissions from emergency operations or delays.

2. Counterarguments & Nuances

- Lifecycle Emissions:
  - Shipbreaking Impact: Recycling old ships (e.g., in Alang) can offset gains if not done sustainably (toxic waste, CO_2 from cutting).

- Newbuild Footprint: Steel production and construction emit CO_2; a 25-year-old ship may have lower *cumulative* emissions than a newbuild.

- Short-Term Supply Crunch:
  - Reducing tonnage may force remaining ships to sail faster (increasing emissions) to meet demand.

3. Policy Recommendations

A. For DGS/Government

- Green Incentives:
  - Subsidize LNG/ammonia-ready newbuilds under Sagarmala/SBFAP.
  - Tax breaks for retrofits (e.g., waste heat recovery systems) on younger old ships (<20 years).
- Sustainable Recycling:
  - Mandate green shipbreaking standards (ISO 30000) to offset lifecycle emissions.
- Phase-Out Flexibility:
  - Allow exemptions for older ships with top CII/EEXI ratings to avoid supply shocks.

B. For Shipowners

- Adopt Digital Tools: Use AI for route/fuel optimization (e.g., AI-powered trim adjustments).
- Chartering Strategy: Prioritize eco-designed vessels to meet future carbon pricing (EU ETS, CII).

C. For Class Societies

- Enforce Retrofit Audits: Ensure even older ships meet minimum EEXI standards before permitting operation.

Key Takeaways

- Pro: Younger fleets *do* cut GHG operationally, but lifecycle emissions require a balanced approach.
- Con: Overly strict age bans risk supply-chain emissions (speed boosts) and ignore well-maintained older ships.
- Solution: Hybrid policy combining age limits + performance metrics (CII/RightShip) + green recycling incentives.

In summary, the DGS policy aligns with IMO 2050 goals, but must avoid unintended consequences (e.g., pushing substandard ships to weaker flags).

Alignment of the DGS order no. 6 of 2023 with similar age restriction policies globally.

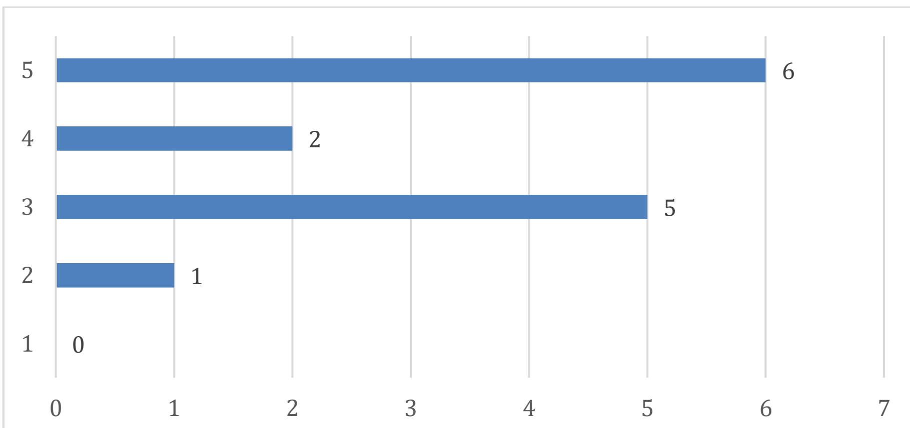

Figure A20: Alignment with global policies

DGS Age Policy Alignment with Global Standards & Industry Realities

1. Global Alignment of DGS Policy

- Developed-World Parity:
  - Most major flags (EU, Singapore, Japan) restrict or discourage vessels >20–25 years.
  - Exceptions: Some registries (e.g., Panama, Comoros) have no age limits but enforce inspections.
- Market-Driven Compliance:
  - CII/EEXI/RightShip already push owners to retire/retrofit older ships. DGS formalizes this shift.

- Charterer Preferences: Oil majors and ESG-focused firms avoid >15-year-old bulkers/tankers anyway.

2. Industry Concerns & Solutions

Issue	Owner Perspective	Recommended Fix
High Retrofit Costs	CII/EEXI mods are expensive for old ships	GOI subsidies for energy-saving devices (e.g., FAME-II for shipping)
Lack of Govt Support	No tax breaks/scrapping incentives	Link policy to SBFAP (green ship funding)
Operational Viability	20–25-year ships may still be seaworthy	Case-by-case waivers for high-RightShip-rated vessels
Flagging-Out Risk	Owners may shift to lax registries	Blacklist substandard flags in Indian cargo contracts

3. Comparative Flag-State Policies

Flag	Age Policy	Inspection Standard	Notes
India (DGS)	Ban >25 years	RightShip/CAP-driven	New, but lacks incentives
EU (MRV/ETS)	No age ban, but CO_2 taxes penalize old ships	EMSA audits	Market forces drive phase-outs
Singapore	Discourage >15 years	Enhanced MARSEC checks	Tax breaks for green ships
Panama	No age limit	Minimal (targeted by PSC)	Dumping ground for old tonnage

India’s policy is aligned on paper, but lags in execution support (e.g., EU’s carbon pricing, Singapore’s incentives).

4. Way Forward for DGS

1. Incentivize, Don’t Just Regulate:
    - Offer tax holidays for Indian-flagged newbuilds/retrofits.
    - Fast-track approvals for high-rated vessels (<10 years) to boost flag attractiveness.
2. Tiered Compliance:

- 15–20 years: Stricter PSC + mandatory CII upgrades.
- 20–25 years: Operational ban unless RightShip A/B rated.

3. Level the Playing Field:
    - Penalize reflagging: Impose higher port dues for ships that de-flag India to avoid rules.

In summary, the DGS circular is globally competitive in intent, but risks falling short without financial/operational support. By pairing age limits with targeted incentives and smarter enforcement, India can phase out old tonnage without losing fleet share. Pilot the policy on high-risk segments (e.g., bulk carriers) first. Engage shipowners to co-design transition support (e.g., low-interest loans).

Level of confidence that the DGS order no. 6 of 2023 will contribute to the competitiveness of the Indian Shipping Sector.

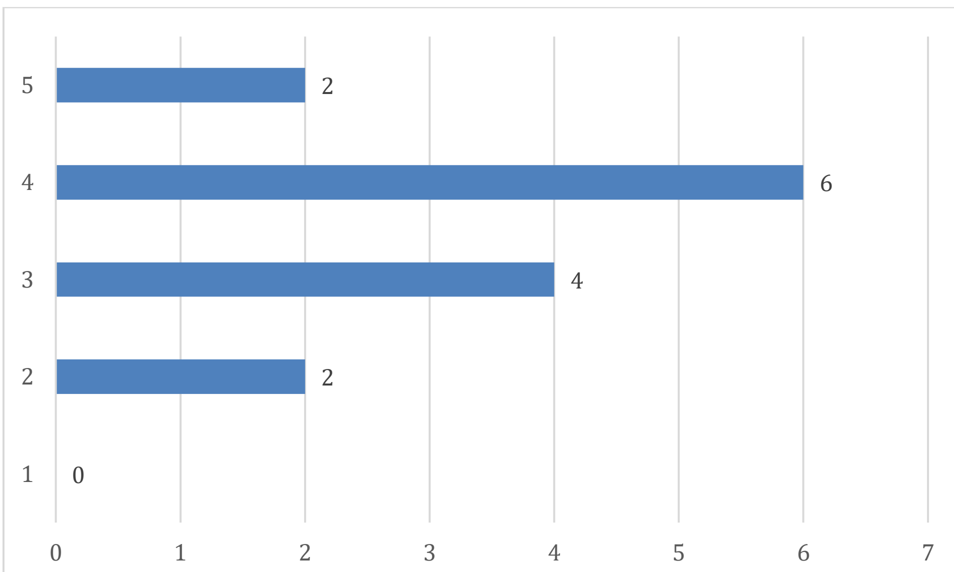

Figure A21: Level of confidence that the order will improve Indian fleet competitiveness

Improved ship maintenance and investment in modern, efficient vessels will enhance the competitiveness of Indian shipping. Aadopting these measures aligns Indian ships with global standards, attracting more charterers and boosting trade. While there may be short-term challenges like fluctuating cargo prices, long-term benefits include a more modern fleet, better fuel efficiency, reduced emissions, and increased global competitiveness. The initiative may lead to the phasing out of older ships and encourage good shipowners to participate, although some owners avoid Indian-flag registration due to disadvantages.

Overall, increased tonnage and modernization are expected to improve profitability and competitiveness in the long run, despite some initial sector impact and infrastructure issues.

Steps India should take to ensure an effective and sustainable increase in total tonnage.

Key Measures to Boost Indian Tonnage & Flag Attractiveness

To ensure the success of the DGS age policy and enhance India's shipping competitiveness, the following measures are critical:

1. Financial & Tax Incentives

- Tax Rebates: Exempt Indian-flagged vessels from GST/tonnage tax for 5–10 years.
- Low-Interest Loans: Offer subsidized financing (5–7% interest) via SBI/EXIM Bank for newbuilds/retrofits.
- Scrapping Subsidies: Provide ₹10–15 crore/ship for recycling old vessels in India.

2. Operational & Regulatory Reforms

- Fast-Track Registration: 48-hour clearance for high-rated (RightShip A/B) vessels.
- One-Window Clearances: Digitize licensing, surveys, and PSC inspections.
- Cargo Support: Reserve 50% coastal cargo for Indian-flagged ships (like U.S. Jones Act).

3. Flag-State Competitiveness

- Global Promotion: Market Indian flag benefits (e.g., lower port dues, tax holidays) in shipowning hubs (Greece, Singapore).
- Flexible Compliance:
    - CAP1 Rating: Stricter standards for new vessels, case-by-case waivers for older high-performing ships.
    - Age-Based Levies: Higher fees for ships >20 years to discourage substandard tonnage.

4. Strengthening Oversight

- Zero Corruption: Implement transparent online systems for certifications/audits.
- Enhanced Inspections: Double PSC checks for vessels >15 years.

5. Infrastructure & Partnerships

- Green Ports: Develop LNG/ammonia bunkering at JNPT, Vizag, and Kandla.
- PSU Charters: Mandate long-term contracts (e.g., IOC, ONGC) for Indian-flagged ships.
- Conclusion

The DGS policy can transform India into a high-quality flag, but requires financial muscle, bureaucratic agility, and global marketing. A Panama-style flexible yet regulated approach—paired with targeted incentives—will attract tonnage without compromising safety.

Immediate Steps:

1. Draft a Ship Financing Policy (e.g., 50% loan guarantees).
2. Launch an Ease-of-Flagging Portal for seamless registration.
3. Engage Global Owners via roadshows in Dubai/Athens.

Steps India should take to ensure an overall safety and compliance to safety regulations.

To enhance safety, compliance, and global competitiveness of Indian-flagged vessels, the following measures are essential:

1. Strengthen Inspections & Enforcement

- Rigorous Flag-State Inspections:
    - Monthly audits for vessels >15 years, quarterly for others.
    - Unbiased surveyors with IMO-trained expertise.
- Port State Control (PSC):
    - Adopt USCG/AMSA-level strictness—blacklist repeat violators.
    - Terminal Accountability: Mandate ports to enforce safety before berthing.

2. Crew Training & Workforce Development

- STCW-Plus Certification: Advanced firefighting, ECDIS, and ESG compliance.
- Competitive Wages: Match global standards to retain skilled seafarers.

3. Modernize Infrastructure & Processes

- Digital Port Clearances: Single-window systems for faster turnaround.
- Green Ports: LNG/ammonia bunkering at major hubs (JNPT, Vizag).

4. Public-Private Partnerships (PPPs)

- Shipbuilding Clusters: Integrate R&D (e.g., hydrogen fuel tech) with tax breaks.
- PSU Collaboration: ONGC/IOC to prioritize Indian-flagged charters.

5. Incentivize Compliance

- Rewards for Top Performers: Tax rebates for RightShip A-rated vessels.
- Penalties for Non-Compliance: Hefty fines for pollution/accidents.

Key Outcomes

- Reduce Incidents/Pollution: Align with IMO 2030 goals.
- Improve Flag Attractiveness: Compete with EU/Singapore on safety.
- Skilled Workforce: Bridge India’s officer shortage (currently 15% gap).

Steps India should take to ensure environmental sustainability of the industry.

Roadmap for Environmental Sustainability in Indian Shipping

To align with global environmental standards and enhance India’s maritime competitiveness, the following actionable strategies are proposed:

1. Strict MARPOL Enforcement & Inspections

- Zero-Tolerance Policy:
  - Mandate monthly unannounced PSC inspections for all vessels in Indian waters.
  - Blacklist repeat violators from Indian ports.
- Advanced Waste Handling:
  - Develop port reception facilities for sludge/oily waste (100% coverage by 2027).

2. Green Fleet Transition

- Incentivize Sustainable Fuels:
  - Tax exemptions for LNG/ammonia-powered ships.
  - 50% subsidy for retrofits (scrubbers, shaft generators).
- Bunkering Infrastructure:

    - Improved supply at competitive prices across Indian ports
    - More LNG bunkering hubs (e.g., JNPT, Kochi) in one-two years time.

3. Port & Ship Recycling Upgrades

- Green Ports:
    - Solar-powered terminals + cold-ironing (shore power) at major ports.
- Sustainable Shipbreaking:
    - Enforce HKC compliance in Alang with cash rewards for green recycling.

4. Crew & Surveyor Training

- MARPOL Certification:
    - Compulsory advanced pollution-control training for officers.
- AI-Powered Monitoring:
    - Use drones/sensors to detect fuel sulphur violations in real-time.

5. Global Benchmarking

- EU-Style Incentives:
    - CII-linked port fee discounts (e.g., 20% lower dues for A-rated ships).
- China-Style Scrapping Subsidies:
    - ₹5–10 crore/ship for recycling pre-2000 vessels.

Other Relevant Factors Concerning DGS Order No. 6 of 2023

Strategic Roadmap for Modernizing Indian Shipping & Ports

To ensure the success of the DGS age policy and elevate India's maritime sector, a multi-pronged approach is essential:

1. Eliminate Corruption & Red Tape

- Digital Transparency:
    - Blockchain-based clearance systems for customs/port calls to prevent bribery.
    - AI-driven monitoring of officer decisions (e.g., flagging excessive delays).

- Strict Accountability:
    - Public dashboards for vessel inspection results + whistleblower protections.

2. Boost Flag Attractiveness

- Rebranding the Indian Flag:
    - Market as "High-Safety, Low-Cost" (like Singapore in the 1990s).
    - Offer 24-hour vessel registration for RightShip A-rated ships.
- Joint Ventures:
    - Partner with global lessors (e.g., MSC, Maersk) to bring tonnage under Indian flag.

3. Autonomous & Green Shipping Push

- Inland Waterways Pilot:
    - Driverless cargo barges on Ganga-Brahmaputra by 2027 (partner with Rolls-Royce Marine).
- Emission Monitoring:
    - Drones + IoT sensors at ports to detect smoke/CO_2 violations in real-time.

4. Incentivize Fleet Modernization

Policy	Impact
Scrapping Premium (₹10cr/ship)	Phases out >25-year vessels
10-Year Tax Holiday for Indian-built ships	Revives shipyards (e.g., Cochin)
Cargo Reservation (50% coastal for Indian flag)	Guarantees demand

5. Upgrade Ship Recycling

- Alang 2.0:
    - Robotic cutting + zero-waste docks to meet EU green recycling standards.
    - Tax breaks for HKC-compliant yards.

Critical Challenges to Address

- Corruption: "Honest DGS officers alone can’t fix this—need CVC oversight."
- Infrastructure: "Without LNG bunkering at ports, green ships won’t register here."
- Global Trust: "RightShip ratings mean nothing if PSC inspections are inconsistent."

Action Plan (2024–2030)

1. 2024: Launch digital port clearances + autonomous barge trials.
2. 2025: Enact scrapping incentives + blacklist 10+ substandard flags.
3. 2030: Achieve Top 10 flag-state ranking (currently #26 by Clarksons).

The DGS policy is a bold start, but India must match ambition with execution.

In conclusion, the above section (4.2) can be summarized as follows. Key arguments in favour include promoting sustainability, improving flag reputation, and boosting operational efficiency, while counterarguments highlight the financial strain on shipowners, inspection gaps, and the need for case-by-case assessments of vessel condition. Recommendations advocate a hybrid approach, combining strict inspections (e.g., RightShip audits) for older vessels with gradual phase-out timelines, alongside financial incentives like tax breaks, scrapping subsidies, and low-interest loans for newbuilds. The policy aligns with global standards (e.g., EU, Singapore) but risks reducing tonnage if owners flag out due to lack of support. To ensure success, the document emphasizes eliminating corruption through digital transparency, rebranding the Indian flag as competitive, investing in green infrastructure (e.g., LNG bunkering), and enforcing MARPOL compliance via rigorous PSC inspections. Additional measures include crew training, PPPs for shipbuilding, and sustainable ship recycling (e.g., Alang upgrades). While the policy is seen as a positive step for long-term competitiveness and environmental goals, its effectiveness hinges on balancing regulation with incentives, addressing infrastructure gaps, and fostering stakeholder collaboration. Immediate actions proposed include piloting the policy in high-risk segments, launching fast-track registration, and promoting global partnerships to attract tonnage. Overall, the DGS order has potential but requires robust execution to overcome challenges like bureaucracy, cost burdens, and inconsistent enforcement.

15.6 *Annexure 6 - Logistics regression results*

Figure A22: Regression output of Age on Attained EEXI

OLS Regression Results

Dep. Variable:	NumDeff	R-squared (uncentered):	0.533
Model:	OLS	Adj. R-squared (uncentered):	0.519
Method:	Least Squares	F-statistic:	37.42
Date:	Fri, 31 Jan 2025	Prob (F-statistic):	4.58e-76
Time:	21:49:02	Log-Likelihood:	-1789.5
No. Observations:	540	AIC:	3611.
Df Residuals:	524	BIC:	3680.
Df Model:	16		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
GT	-3.595e-05	1.81e-05	-1.988	0.047	-7.15e-05	-4.21e-07
YearBuilt	0.0029	0.002	1.477	0.140	-0.001	0.007
ShipType_bulk carrier	0.5249	4.043	0.130	0.897	-7.417	8.467
ShipType_chemical tanker	-2.8599	5.192	-0.551	0.582	-13.059	7.339
ShipType_container ship	1.9408	4.240	0.458	0.647	-6.389	10.270
ShipType_gas carrier	-0.0049	4.101	-0.001	0.999	-8.061	8.051
ShipType_general cargo/multi- purpose ship	2.4717	4.103	0.602	0.547	-5.589	10.533
ShipType_high speed cargo craft	-4.047e-15	7.46e-15	-0.543	0.588	-1.87e-14	1.06e-14
ShipType_high speed passenger craft	-2.1681	4.944	-0.439	0.661	-11.880	7.544
ShipType_offshore	-4.7111	7.802	-0.604	0.546	-20.038	10.616
ShipType_offshore service vessel	5.8337	4.098	1.424	0.155	-2.216	13.884
ShipType_oil tanker	3.7116	4.042	0.918	0.359	-4.229	11.652
ShipType_other types	10.2305	7.803	1.311	0.190	-5.099	25.560
ShipType_other types of ship	2.8489	3.962	0.719	0.472	-4.935	10.633
ShipType_passenger ship	-1.6795	4.165	-0.403	0.687	-9.861	6.502
ShipType_special purpose ship	0.9305	6.170	0.151	0.880	-11.190	13.051
ShipType_tugboat	-0.3375	3.967	-0.085	0.932	-8.131	7.456

15.7 Annexure 7 - Comparison of financial returns (NPV) for a sample of vessels

The maritime industry faces increasing pressure to balance economic viability with environmental and regulatory compliance. One key consideration is determining the optimal operational lifespan of vessels, as older ships tend to be less efficient and more costly to maintain. This study evaluates the financial implications of imposing an age restriction (25-year exit) compared to extended operations (40 years) across different vessel types. The analysis focuses on four key segments:

- Container ship (1000 TEU)
- Handysize bulker
- Panamax bulker
- Panamax tanker (75,000 DWT)

Using Net Present Value (NPV) analysis, we assess whether retiring ships earlier improves financial returns, considering different acquisition scenarios: newbuilds, 5-year-old, 10-year-old, and 15-year-old secondhand vessels.

This analysis will help shipowners and investors determine whether enforcing a 25-year exit policy enhances profitability compared to prolonged operations. The findings will also inform decisions on newbuild investments vs. secondhand acquisitions, ensuring optimal financial and environmental outcomes.

1. Data Source: Clarksons Research data on vessel operations, including costs, earnings, and depreciation trends.
2. Comparative Analysis:
    - Scenario 1: Vessel operates until 25 years, then is scrapped or sold.
    - Scenario 2: Vessel operates for 40 years, accounting for higher maintenance, fuel inefficiency, and potential regulatory penalties.
3. Vessel Acquisition Scenarios:
    - Newbuild (highest initial cost, longest remaining lifespan)
    - 5-year-old secondhand (moderate cost, slightly reduced lifespan)
    - 10-year-old secondhand (lower cost, shorter remaining lifespan)
    - 15-year-old secondhand (lowest acquisition cost, limited operational years)
4. Key Financial Metrics:
    - Net Present Value (NPV) – Discounted cash flows over the vessel's lifespan.
5. Financials considered for analysis
    - Reported historical earnings/Daily charter rates
    - OPEX (operating expenses)

1. Repair and maintenance cost is assumed as 30% of OPEX
2. Assumed a 2% increase in repair and maintenance cost every year

- Vessel acquisition price
- WACC (weighted average cost of capital for NPV)
- Tonnage tax
- Dry docking cost (conducted every 2-3 years)
- Bank loan interest, etc.

6. Simulation modeling to derive NPV
    - Monte Carlo simulation model
    - Level, trend, seasonality model to forecast data for the coming years and estimation of mean and standard deviation
    - Normal distribution assumed for OPEX
    - Lognormal assumed for earnings estimates
    - Expected values generated for 25-year and 40-year NPV

Figure A23: Estimated expected financial returns comparison 25-year exit vs 40-year exit

Results:

- Shipping markets are highly volatile.
- Running vessels beyond 25 years generally yields substantial financial benefits.
- Although in bad markets, running vessels beyond a certain age may not be beneficial.
- Additional cost pressure related to carbon credits and enhanced qualitative norms have the potential to make running older vessels unprofitable and incentivize for scrapping in appropriate time.

15.7.1 Stochastic Dynamic Programming (SDP) model for determining optimal scrapping age of vessels

We experiment with an SDP to determine the optimal ship scrapping age. The same four vessel categories and data used in the previous section (NPV analysis) are used for the SDP modelling.

15.7.2 Mathematical Model for Optimal Ship Scrapping with Financing

1. State Variables

Let:

- $t \in \{0, 1, ..., T\}$ = Discrete time steps (years)
- R_t = Stochastic revenue at time t (modeled as GBM)
- S_t = Stochastic scrap value at time t (modeled as GBM)
- C_t = Deterministic operating cost at time t
- L_t = Remaining loan balance at time t

2. Stochastic Processes

Revenue Process (Geometric Brownian Motion):

$$R_t = R_0 \exp\left(-\frac{1}{2}\sigma_R^2 t + \sigma_R W_t^R\right)$$

where σ_R is revenue volatility and W_t^R is a Wiener process.

Scrap Value Process (Geometric Brownian Motion):

$$S_t = S_0 \exp\left(-\frac{1}{2}\sigma_S^2 t + \sigma_S W_t^S\right)$$

3. Financing Structure

- **Loan Amount**: $L_0 = \text{Ship Price} - \text{Down Payment}$
- **Annual Payment** (Annuity Formula):

$$P = L_0 \frac{r(1+r)^n}{(1+r)^n - 1}$$

where r = loan interest rate, n = loan term.

Remaining Loan Balance at time t:

$$L_t = P \frac{1-(1+r)^{-(n-t)}}{r} \cdot \mathbb{I}_{t \leq n}$$

4. Dynamic Programming Formulation

Value Function:

$$V_t = \begin{cases} S_T - L_T & \text{if } t = T \\ \max \left\{ \underbrace{S_t - L_t}_{\text{Scrap Now}}, \underbrace{(R_t - C_t - P_t) + \frac{\mathbb{E}[V_{t+1} | \mathcal{F}_t]}{1+\rho}}_{\text{Keep}} \right\} & \text{if } t < T \end{cases}$$

where:

- ρ = discount rate
- $P_t = P \cdot \mathbb{I}_{t \leq n}$ = loan payment
- $\mathcal{F}_t$ = information available at time t

5. Solution Algorithm

1. **Backward Induction**:
   - Initialize $V_T = S_T - L_T$
   - For $t = T-1, ..., 0$:

$$V_t = \max \left\{ S_t - L_t, (R_t - C_t - P_t) + \frac{\mathbb{E}[V_{t+1}]}{1+\rho} \right\}$$

2. **Monte Carlo Simulation**:
   - Generate N paths of $\{R_t, S_t\}_{t=0}^T$
   - Compute expectations via sample averages

6. Key Financial Metrics

- **Net Present Value**:

$$\text{NPV} = V_0 - \text{Down Payment}$$

- **Optimal Scrapping Time**:

$$\tau^* = \inf\{t \geq 0 : V_t = S_t - L_t\}$$

```
[Initial State]
  ↓
[Year 0: Pay Down Payment + Start Loan]
  ↓
[Year t: Observe (R_t, S_t, C_t, L_t)]
  ↓
Make Decision:
    ┌────────────────┴────────────────┐
Scrap Now                     Keep Operating
(Receive S_t - L_t)          (Pay P_t, Continue)
```

We use the formula for "fixed yearly payment** (also known as the "annuity payment") required to fully pay off a loan over a specified term, including both principal and interest. It's commonly used in 'amortized loans', such as mortgages or car loans, where payments are equal over time.

Breaking Down the Formula:

$$\text{yearly\_payment} = \text{loan\_amount} \times \frac{\text{loan\_interest\_rate} \times (1 + \text{loan\_interest\_rate})^{\text{loan\_term}}}{(1 + \text{loan\_interest\_rate})^{\text{loan\_term}} - 1}$$

Variables:

- `loan_amount` = The initial amount borrowed (principal).
- `loan_interest_rate` = The **annual interest rate** (expressed as a decimal, e.g., 5% = 0.05).
- `loan_term` = The total number of **years** (or periods) to repay the loan.

Key Components:

1. **Numerator (** `loan_interest_rate × (1 + loan_interest_rate)^loan_term` **)**:
   - This calculates the **interest component** adjusted for compounding over the loan term.
   - `(1 + loan_interest_rate)^loan_term` accounts for the effect of **compound interest**.
2. **Denominator (** `(1 + loan_interest_rate)^loan_term - 1` **)**:
   - This normalizes the payment to ensure the loan is fully paid off by the end of the term.
   - It effectively "discounts" the payments back to present value.

Intuition:

- The formula **spreads the loan cost evenly** over each period while accounting for interest.
- Each payment covers:
  - **Interest** (based on the remaining balance).
  - **Principal repayment** (gradually reducing the debt).

15.7.3 Experiments and results

Numerical parameters and data inputs

The historical data on ship operations of this category are taken from the Clarkson's database. The following is a list of data taken for analysis.

- OPEX (Operating Expenses)
  - Historical data used to generate a forecast through which we derived mean and standard deviation of OPEX as OPEX_av and OPEX_sd for the next period.
  - Historical data is inflation-adjusted and minimum OPEX across the data years was taken as OPEX_mn
  - A 5% increase per year in OPEX was assumed to generate future financial outflows
- Vessel Utilization (vessel_util) was considered as 90%, which means ships were assumed to be used 90% of the days in a year.
- Revenue
  - Earnings data of the vessel type taken from the historical data and used to generate a forecast giving a mean value for the next period (initial_revenue)
  - As maritime earnings are highly volatile, we use Geometric Brownian Motion (GBM) model to simulate future revenues.
  - Volatility measured in terms of Coefficient of Variation is assumed as 10% on initial_revenue.
  - We consider a multiplier to revenue (mult_factor), as reported historical earnings are almost similar to OPEX, which makes profitable shipping infeasible. And, it has been found that

reported earnings and charter rates are highly correlated, we use a multiplier to ensure revenue is reasonably higher than OPEX.

- Scrap value (ship disposal return)
    - Earnings data of the vessel type taken from the historical data and used to generate a forecast giving a mean value for the next period (scrap_av) and standard deviation (scrap_sd)
    - Scrap volatility is taken as (scrap_sd/scrap_av)
    - As scrap rates are highly volatile, we use Geometric Brownian Motion (GBM) model to simulate future revenues.
- A discount rate of 12% is considered for net present value calculations
- New building ship price
    - Historical data are used to generate forecast expected value for the next period.
    - A down payment ratio of 20% is considered
    - A loan payback period of 15 years is considered
    - An interest rate of 6.25% is considered

A total of 100-time steps and 1000 simulation runs are evaluated to report the outcomes

15.7.4 Container ship 1000 TEU

- Mean optimal scrapping age: 25.8 years
- Std dev of scrapping age: 8.3 years

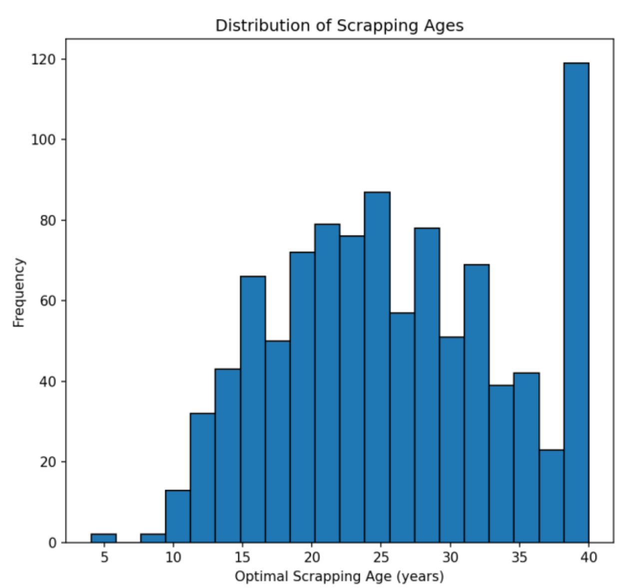

Figure A24: Distribution of optimal scrapping age for a 1000 TEU container ship

15.7.5 Handymax bulker

- Mean optimal scrapping age: 11.7 years
- Std dev of scrapping age: 9.1 years

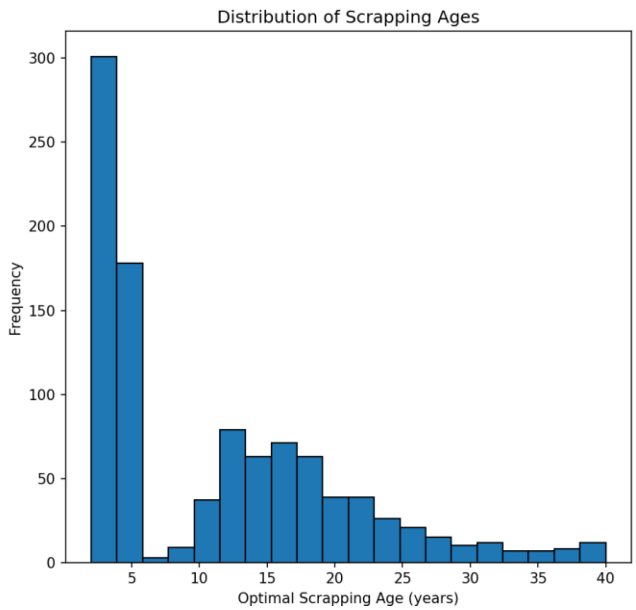

Figure A25: Distribution of optimal scrapping age for a Handymax bulker

15.7.6 Panamax bulk carrier

- Mean optimal scrapping age: 18.8 years
- Std dev of scrapping age: 8.9 years

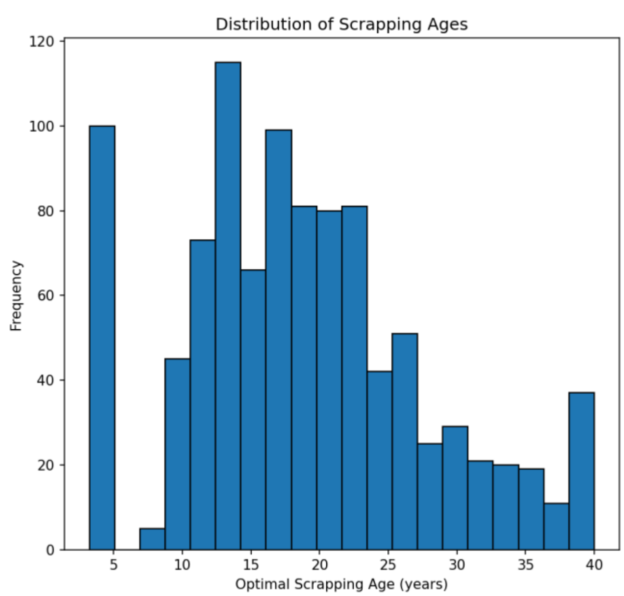

Figure A26: Distribution of optimal scrapping age for a Panamax bulker

15.7.7 Panamax Tanker

- Mean optimal scrapping age: 20.8 years

- Std dev of scrapping age: 9.1 years

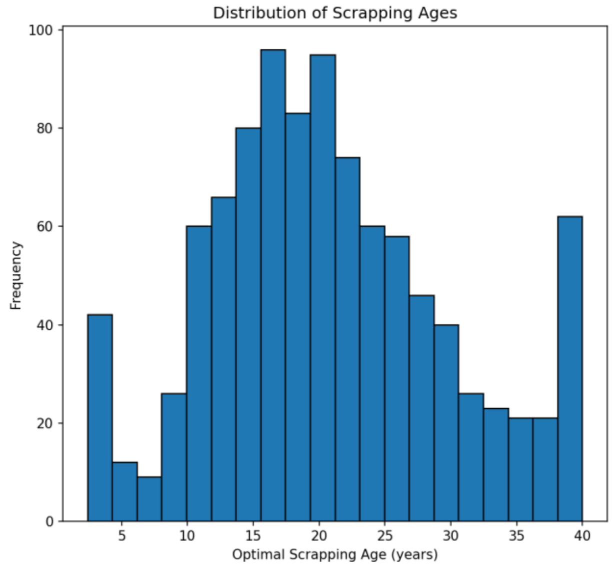

Figure A27: Distribution of optimal scrapping age for a Panamax tanker

Results of the SDM analysis

- Optimal ship scrapping age is an uncertain decision, varying considerably based
- Optimal expected scrapping age is below 25 years in all the test cases, with high variation across cases.
- The results also resonate with global average age of ships, which usually varies between 20 and 25, as per UNCTAD data.