# A STUDY ON SHIP BREAKING INDUSTRY

(With Special Reference to India and Bangladesh)

*Project report submitted in partial fulfilment of the requirement for the award of degree of*

**MASTER OF BUSINESS ADMINISTRATION**

**in**

**Port and shipping management**

Submitted by

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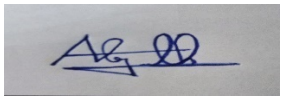
**Chennai – 600119**

**May, 2022**

# DECLARATION

I **ABIJITH.T.R, Registration No. 2003304002** hereby declare the project report entitled " **A STUDY ON SHIP BREAKING INDUSTRY" (With Special Reference to India And Bangladesh)** submitted by me in School of Maritime Management, Indian Maritime University, Chennai Campus under the guidance of **Dr. A Mourougane,** Associate Professor, School of Maritime Management, Indian Maritime University, Chennai Campus in partial fulfilment of the requirements of award of degree **Master of Business Administration in Port and Shipping Management** is a report of original work done by me and the project report has not been submitted either in part or full this or any other university or institution for the award of any degree, diploma or other similar titles.



Place: Chennai

Date: 25-06-2022

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# CERTIFICATE

**School of Maritime Management**

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This is to certify that the project report entitled "**A STUDY ON SHIP BREAKING INDUSTRY (With Special Reference to India and Bangladesh)**" submitted to the School of Maritime Management, Indian Maritime University, Chennai Campus, in partial fulfilment for the award of the degree of Master of Business Administration in Port & Shipping Management, is a record of work carried out entirely by **Abijith.T.R**, **Reg. No. 2003304002**.

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## ACKNOWLEDGEMENT

With great pleasure and sense of obligation, I would like to express my heartly gratitude to **Dr. A. Mourougane** Associate Professor and my project guide for persisting encouragement, perpetual motivation, everlasting patience and excellent expertise in the discussions during progress have benefited me in extent which is far beyond expression.

I would like to express my sincere thanks to **Dr. B. Swaminathan,** Head of Department and Associate Professor, School Maritime Management, Indian Maritime University, Chennai campus.

I would also like to thank all other faculty members of School of maritime management who directly or indirectly guided me.

The completion of this project is not just due to the efforts of one single person; rather it bears the number of persons who directly or indirectly guided me and helped me to complete the project.

Successfully.

**ABIJITH.T.R**

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# EXECUTIVE SUMMARY

Ship recycling is the most ecologically sustainable method of vessel disposal, with practically every element of the ship complex being recovered as scrap metal. Although the industry is beneficial in terms of life-cycle assessment, it has shifted over time to countries with limited environmental enforcement, weak occupational safety regulations, and low labour costs. The worldwide expansion of the sector to countries with comparably weaker regulatory frameworks is especially concerning, as ships carry several risks that, if not managed appropriately, can have major effects on individuals and the environment. South Asia, notably Bangladesh, India, and Pakistan, is now the worldwide hub for ship breaking and recycling. These three countries account for 70–80 percent of the global ocean-going ship breaking market, with China and Turkey accounting for the remainder. Roughly 5% of the overall tonnage of such boats is scrapped beyond those five nations. The sector offers numerous benefits, including the creation of jobs and the supply of a significant amount of scrap steel to the iron and steel industries. Hazardous waste and the accompanying occupational health concerns, on the other hand, are a serious national and worldwide problem. The ship breaking recycling sector also has a huge societal influence in that region. The employees in ship breaking yards are migrant labourers from the poorest sections of each country. This research focuses on the ship breaking recycling sector in India and Bangladesh in order to acquire a better knowledge of the industry's economics and the ecological impact that emerges from such activity, as well as to analyse its negative environmental effects. Ship breaking and its harmful consequences have also increased tremendously, posing significant challenges to the environment and human health. It is necessary to critically examine ship dismantling practises in order to identify waste products generated by the ship breaking industry that can be used in other places. An investigation into ship breaking practises in India and Bangladesh has been carried out in this project.

# CHAPTER- 1

# INTRODUCTION

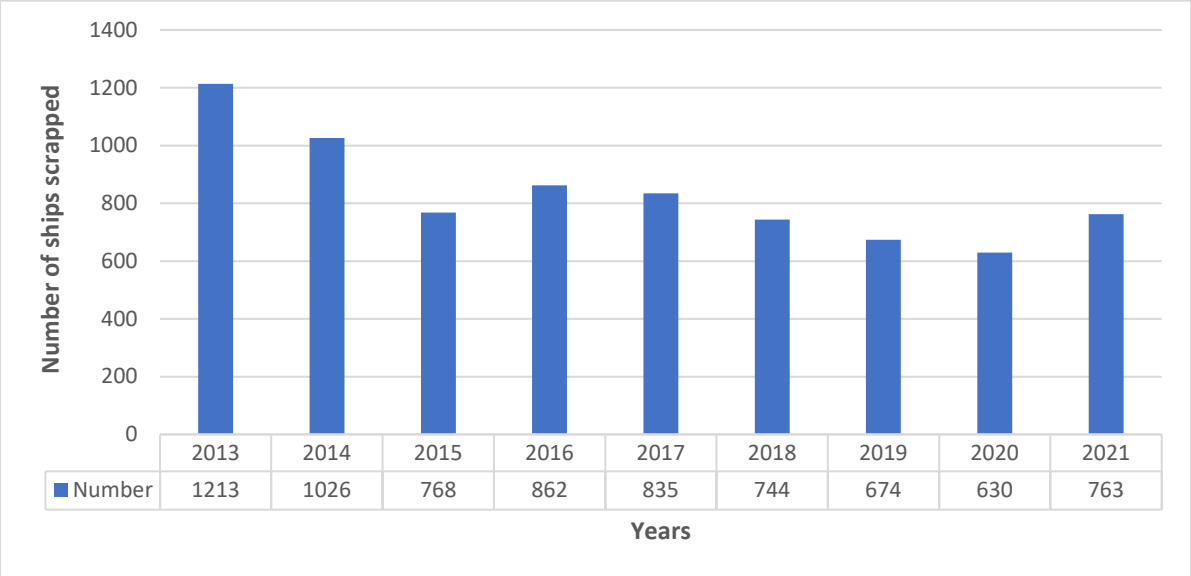
## 1.1 Introduction

The process of dismantling ships and selling them in pieces is known as ship breaking. The ship breaking process is as old as shipbuilding itself. On the one hand, countries such as India, Bangladesh, China, and Pakistan are competing for a larger share of the ship breaking market, while the IMO, ILO, and UNEP are coordinating efforts to reduce the impacts of the ship breaking industry on the marine environment. Full-fledged ship breaking practises in India began in the 1980s in Kolkata and Mumbai. Ship breaking yards in India can be found along the coasts of West Bengal, Andhra Pradesh, Tamil Nadu, and Gujarat. Ship-recyclers usually buy old ships that can no longer sail or have such high maintenance costs that it is more cost effective to scrap them. These vessels incur costs such as port fees, crew salaries, and fuel consumption. As a result, they become a burden to shipping companies. The only safe and cost-effective way to dispose of such vessels is through systematic recycling. Thus, the need to reduce unnecessary ship traffic in a safe and cost-effective manner gave birth to the massive industry known as ship-recycling.

Ship breaking activity like any other sector, activity is determined by supply and demand. Ships often approach the end of their life when the value of their second-hand sale for future commerce falls below the value of recycling. This might happen because the ship's condition deteriorates with age, forcing uneconomical maintenance, because there is a greater demand for ships than there is available supply, or because of certain regulatory requirements. The price of steel and the cost of ship breaking are the two most important demand variables. The cost of ship breaking varies by country, depending on labour costs and the type of workplace safety and environmental regulations in place. Ships have substantial worth even after their economic life, when the ship owner's carrier is no longer commercially feasible. Scrap steel from decommissioned vessel is an important raw material source for steel mills. The structural steel of a ship is believed to be up to 90% of its overall weight. It is a major waste of resources if it is allowed to decay and not retrieved.

The practise of salvaging steel, useful equipment, instruments, gadgets, and other disassembled elements, currently known as ship recycling, was restricted to the European region throughout

the nineteenth century. However, as governments in this region grew and industrialised, and environmental concerns gained support, ship recycling activities migrated to poorer countries striving to attain much-needed industrial expansion. Ship recycling is a labour-intensive industry that produces steel for building at a low cost, but ship breaking is a filthy and hazardous process. Today, the majority of global ship scrapping activity is done manually and laboriously on beaches with almost no facilities and where environmental concerns are often a secondary concern. Over time, there has been a growing concern about ship scrapping in developing countries and the effects it may have on the environment and human health. The Ship Recycling Yard at Alang, located near Bhavnagar in Gujarat State on the western coast of the Gulf of Cambay, is the world's largest ship recycling yard. The area's distinct geographical features, which include a high tidal range, a broad continental shelf, a 15-degree slope, and a mud-free coast, make it ideal for any size ship to be beached easily during high tide. Article coverage in these nations regarding ship scrapping have tremendously contributed in the subsequent identification of relevant international venues to address the problem that the sector poses. Reports from Alang in India, both on television and in print, have persuaded observers that the maritime sector, particularly ship owners, is partially to blame. Scrapping activities are demonstrated to be carried out using simple equipments and without basic protective equipment such as hard helmets and protective boots.




Source: NGO ship breaking

**Fig 1.1 Total number of ships scrapped globally**

The figure shows the total number of ships recycled in the world since 2013. The total number of ships recycled has been more or less constant over the years, except for 2013 and 2014, in which a significantly higher number of ships were recycled. Ship recycling peaked around 2013, with 1213 ships being dismantled all over the world.

## 1.2 Scope of study

With over 150 yards along its coast, India has one of the world's largest ship breaking facilities. Every year, close to 6.2 million GT is scrapped in India, accounting for 33 percent of total scrapped tonnage worldwide. By focusing on the issues involved in two South Asian countries, this project presents a clear insight into ship breaking practises in India and Bangladesh. It would also be useful to know about the economic benefits of ship breaking practises and the problems associated with ship breaking practises.

## 1.3 Literature Review:

**1. Dey, A., Ejohwomu, O. A., & Chan, P. W. (2021). Sustainability opportunities and resource recovery industries: A critical analysis of ship-recycling studies, with recommendations for the future. Journal of Cleaner Production.**

Resource recovery industries are critical to global sustainable development. Although existing reviews on how such sectors address sustainability have been conducted, they do not take into account the interconnections between sustainability dimensions at the macro (national/regional, international), meso (industry), and micro firm levels of analysis. Using ship recycling as a focal resource recovery industry, this systematic literature review of 286 studies produces a taxonomy of three sustainability challenge (environmental, social, and economic) and three enabler (law and policy, technology, and management) themes. To date, studies have primarily focused on identifying challenges, typically in a one-dimensional manner, with less emphasis placed on developing enabling solutions. Across the challenge dimensions, sustainability is more valued at the macro and meso levels of analysis, while the micro level operations remain challenging and poorly understood. As a result, the industry is said to be facing a "multi-level sustainability paradox" in its current state.

**2. Solakivi, T., Ojala, Kuusinen, T., L Kiiski, &. (2021). The European Ship Recycling Restriction and its Market Implications: Capacity for Ship Recycling and Market Potential. Study on Cleaner Production.**

End-of-life, ship dismantling in substandard conditions is harmful to the environment, labour rights, and occupational health. The European Union introduced the European Ship Recycling Regulation to guide the industry's transition to more sustainable practises, which includes a list of certified shipyards that are permitted to recycle EU-flagged fleet. The functionality of the SRR, particularly the sufficiency of the recycling capacity included in the European List, has raised concerns among academics and practitioners. To gain a better understanding, this article compares the recycling demand posed by existing EU-flagged fleet to the recycling capacity available at the start of 2020. The Clarkson World Fleet Register's most recent fleet statistics are subjected to descriptive statistical analysis, regression analysis, and ANOVA. The results show that the EL's current capacity is insufficient to meet the anticipated recycling demand. This implies that significant additional capacity located outside of the EU is required. At current commodity price levels, the estimated market potential is unlikely to attract enough newcomers who meet the market's requirements. Scrapping prices may fall significantly, raising the cost of replenishment for the shipping industry. In terms of evaluating the implications of the SRR and providing valuable insights for the future in a context in which policymaking is constantly evolving, the article makes a strong policy contribution.

**3. Siva Prasad, K., & Nandakumar, C. G. (2010). Best practises for ship recycling processes (Doctoral dissertation, CUSAT).**

Ship recycling has long been thought to be the best way to dispose of an obsolete ship. The current state of the art of technology, combined with the demands of sustainable developments from the global maritime industrial sector, has transformed the status of the former'ship breaking' involving ship scrap business into a modern industry undertaking ship dismantling and recycling/reusing the dismantled products in a supply chain of pre-owned product market by adhering to recycling principles. In Industries will need to develop a set of best practises and integrate them with engineering activities in order to produce higher-quality products, increase productivity, and achieve better performance in terms of sustainable development. Improved performance by industries in terms of sustainable development can only be achieved by incorporating the 4E principles, namely ecofriendliness, engineering efficiency, energy conservation, and ergonomics, into their core operations. The current study conducted a thorough investigation into various ship recycling operations in order to develop a set of best practises.

**4. Ozturkoglu, Y., Kazancoglu, Y., & Ozkan-Ozen, Y. D. (2019). A risk management model that is both sustainable and preventative for the ship recycling industry. Cleaner Production Journal.**

When examining the dynamic environment of ship recycling, many various serious threats may develop. These dangers affect people, the environment, and the economy in a variety of ways. The study's purpose is to create a framework to help managers and even policymakers in ship recycling risk management efforts. This framework, which is proposed for sustainable risk management in the ship recycling industry, suggests that risk areas related to occupational safety, fluctuations in the steel industry, economic cycles in the construction sector, and direct and indirect environmental impacts be considered. Several actions are proposed to address the aforementioned risk areas, including implementation of the Occupational Health and Safety Assessment Series for people-related risks, responsiveness as a competitive strategy for economic risks, and green supply chain management implementation for environmental risks. Several sub factors are established from the literature, and the fuzzy DEMATEL approach is utilised to analyse the causal relationship between these factors for successful implementation. Finally, the implications of management for long-term risk management in the ship recycling sector are examined.

**5. Kurt, R. E., McKenna, S. A., Gunbeyaz, S. A., & Turan, O. (2017). Occupational noise exposure is being examined at a ship recycling yard.**

Ship recycling companies are routinely chastised for weak worker health and safety practises. Quantitative data on the effects of ship recycling practises on health and safety are urgently needed to help the development of technical solutions and new regulatory rules. This study studied hazardous noise exposure in ship recycling yards by identifying noise sources, assessing potential worker impacts, and giving improvement recommendations. According to the results of this study, ship recycling employees are at risk of acquiring occupational noise-induced hearing loss as a result of extended exposure to dangerous noise levels. Those who use torch cutting equipment are more vulnerable, according to this study. According to the report, proper hearing protection is presently not employed in ship recycling yards.

**6. Du, Z., Zhang, S., Zhou, Q., Yuen, K. F., & Wong, Y. D. (2018). Analysis of hazardous materials and disposal procedures during ship recycling Conservation and recycling of resources.**

End-of-life ship dismantling in an environmentally sound and safe manner is a major problem and task today. When a vessel is demolished, hazardous materials such as asbestos, polychlorinated biphenyls, solid foam, and waste oil can have major environmental and human health repercussions. This article examines the characteristics and risks of hazardous items on board. The present procedures for the removal and disposal of hazardous items are investigated. Additional practical procedures and recommendations are provided for dealing with hazardous chemicals at ship breaking yards.

**7. Hsuan, J., & Parisi, C. (2020). Mapping the ship recycling supply chain. Policy Concerning the Seas.**

The practise of deconstructing ships in order to extract and recover components for reuse, particularly steel, is known as ship recycling. The goal of this article is to outline the supply chain for ship recycling. This exploratory and qualitative study gives light on how inter-organizational relationships effect supply chain management. It takes into account the trade-offs and combinations of financial and long-term values that form these inter-organizational partnerships in a variety of ways. According to early results, ship recycling stakeholders have conflicts of interest.

**8. Garmer, K., Tilwankar , H., Asolekar, A. M., Sjöström, A. K., Kinigalakis, G., & Hiremath, S. R. (2015). The creation and validation of a three-step risk assessment method for the ship recycling industry. Science of safety.**

End-of-life vessel disposal that is both ecologically sound and safe is a serious concern today. To reduce risks and improve safety at ship recycling yards, the study attempted to develop a three-step methodology that provides a systematic pedagogic approach again for analysis consisting of production managers, safety officers, safety supervisors, and the designated expert monitor. The three-step risk assessment was carried out in 35 ship breaking yards using questionnaires distributed and door-to-door contact.

**9. Zhou, Q., Liang, J., Z. Jiao, Y, Zhu, H., & Du. (2021). A study of the factors that influence worker safety during ship recycling. Ocean Engineering.**

It is an environmentally friendly and cost-effective method for shipowners to send end-of-life ships for dismantling and recycling. As more governments express worry about the pollution created by ship disassembly, green ship recycling options are being developed. The goal of this

study is to identify the elements that influence green ship recycling and to evaluate their interrelationships and impacts on green ship recycling. After researching ship dismantling processes and contaminants, customised parameters impacting green ship recycling were offered. Managers, and ship recycling employees created and administered a questionnaire survey. The data were analysed using structural equation modelling and a proposed theoretical model.

**10. Alcaide, J. I. Piniella, F., & Rodríguez-Díaz, E. (2017). A stakeholder survey on European ship recycling policies. Marine Policy.**

Following over a decade of rigorous regulatory operations focused on ship recycling across the world, a specific emphasis is being made on tackling the issues of ship dismantling practises on the ports of Southern Asian countries. The EU, on the other hand, has devised a uniform approach to the adoption of a new legislative framework in the globalised marine transport industry, where the majority of ship owners utilise Open Registries. . In order to give a standard approach to ship breaking management, the Hong Kong International Convention was approved in 2009.

## 1.4 Objectives of the study:

The main objectives of the study are:

- To conduct a Study on leading Ship breaking countries
- To analyse Problems of Ship breaking
- To examine the ship breaking practice
- To study the environmental impact of the ship recycling activity

## 1.5 Research Methodology

Due to the fact that the selected topic is current, the collection of information has proved not to be as easy as expected. The research began with the collecting of papers and data however, due to the lack of published books on this subject, the majority of the material is derived from magazines and technical reports. For analysis, simple statistical tools like tables, graphs, and charts are used.

## 1.6 Limitation of Study

- The main limitation of this study is that the entire research is conducted using secondary data only.
- This study has been conducted over a limited period of time and hence not sufficient to make a detailed report.

# CHAPTER - 2

# INDUSTRY PROFILE

## 2.1 Introduction:

### Ship breaking, Ship Scrapping, or Ship Recycling

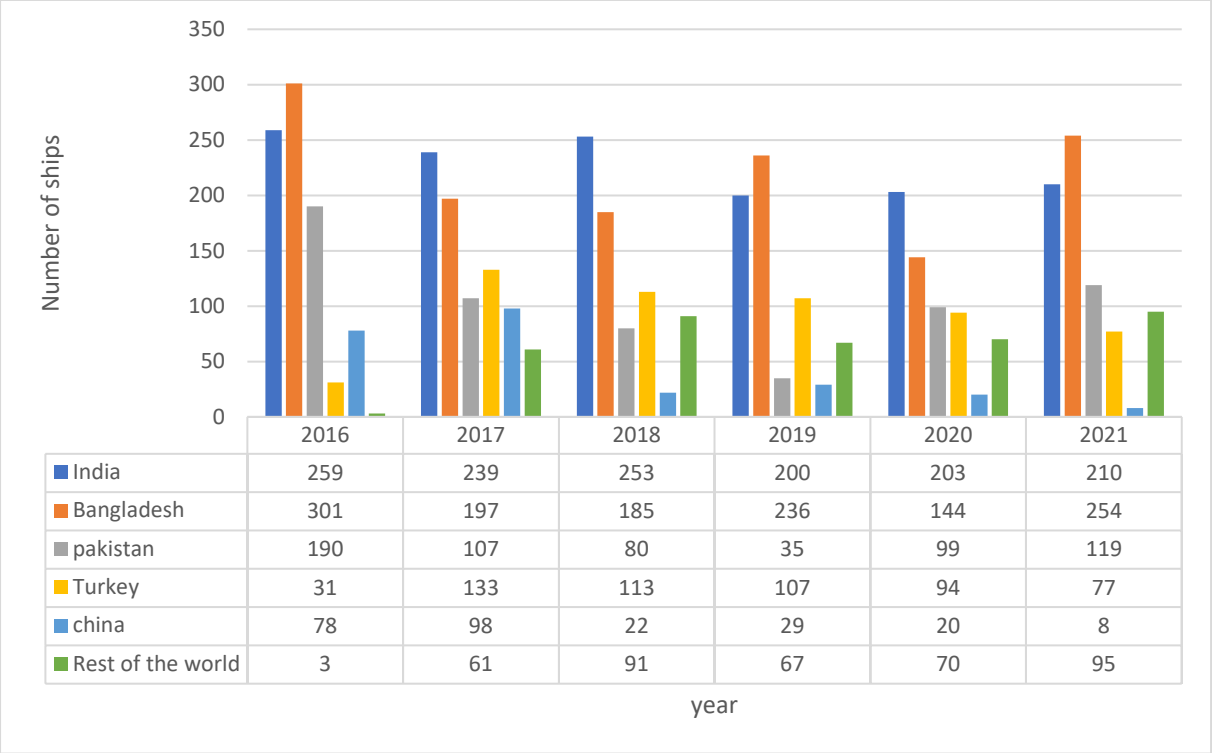
When the industry first began in the 19th century, it was simply known as ship scrapping. Both expressions denote that the ship has reached the end of its economic life and that its worth has been determined to be zero. The ship's hull and main engines are then dismantled and cut off as scrap materials to be utilised elsewhere. As the business grew, some writers referred to ship breaking as ship disposal. This was the popular word until the International Maritime Organization highlighted the issue that the business poses to the less-regulated parts of the world, including the transfer of dangerous chemicals and ship breaking practises. The IMO's Marine Environmental Protection Committee addressed this so-called industry on its agenda, and it was referred to as Ship Recycling in its report.

Ship manufacturers are being forced to take greater responsibility for the disposal of their goods because to environmental concerns. Organisations concerned in this transnational problem have begun to evaluate how they may contribute. Plans and norms are being formed, but the industry's name is also being updated. According to the Basel Action Network, while the phrase recycling has a good connotation in its actual sense, it is simply another shadow that offers a cover for the danger of depositing hazardous waste on board the ship during its final disposal.

Controlling hazardous waste dumping is a difficult topic, and when representatives of international organisations set out to explore the safe practises of ship scrapping, other concerned groups began to promote the sector under a new face, ship recycling. The only purpose of the environmental group is to manage the transit of hazardous material on board the ship and to enhance safe working practises at disposal sites. The industry's ultimate purpose remains the same obsolete ships may be disposed of in such a way that the interested party can recoup a portion of their investment in the ship.

| SI. No. | Country | Location Yard |
|---|---|---|
| 1 | India | Alang in state of Gujarat |
| 2 | Pakistan | Near Karachi at Gadani beach situated Balochistan |
| 3 | Bangladesh | Sitakunda coastal strip situated north port of Chittagong |
| 4 | Turkey | Aliaga, situated on north of Izmir port. |
| 5 | China | Yard located along the Yangtze river, close to Shanghai and Pearl river in Guangdong province. Some of yards also located at Tianjin, North of Shanghai |

**Table: 2.1 Major ship breaking yards' locations around the world.**




| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| India | 259 | 239 | 253 | 200 | 203 | 210 |
| Bangladesh | 301 | 197 | 185 | 236 | 144 | 254 |
| pakistan | 190 | 107 | 80 | 35 | 99 | 119 |
| Turkey | 31 | 133 | 113 | 107 | 94 | 77 |
| china | 78 | 98 | 22 | 29 | 20 | 8 |
| Rest of the world | 3 | 61 | 91 | 67 | 70 | 95 |

(Source: NGO ship breaking)

**Fig 2.1 Total number of ships scrapped globally**

The data shows the major ship-breaking countries and the number of ships scrapped each year. In the year 2016, Bangladesh was the top ship scrapping location with 301 ships scrapped. In 2017, 2018, and 2020, India was the leading location for ship scrapping. One of the main reasons for the decrease in Chinese ship scrapping is the strict policies implemented by the Chinese government.

## 2.2 Importance

• The ship-recycling industry benefits the shipping industry by assisting it in gaining financial value for its zero-value vessels.

• The ship-recycling sector reduces the maritime burden of dealing with such incapable vessels.

• The ship-recycling industry generates a large amount of re-rollable steel without depleting natural resources. It conserves non-renewable natural resources.

• The ship-recycling industry recovers valuable machineries and equipment, which are then sold at low prices to various industries. As a result, small-scale industry is encouraged by lowering capital investment in machinery.

• Kitchen appliances, kitchen machinery, office and home furniture, photos, lamp shades, plastic buckets, cupboards and sideboards, crockery and cutlery and light fittings, wood, partition sheets Locals, as well as hotels and restaurants, make use of the recovered goods. The products are extremely inexpensive. As a result, people with lower incomes can enjoy a higher standard of living.

• The ship-recycling industry benefits society by employing thousands of people from various states across the country.

• The ship-recycling industry supplies raw material to many re-rolling mills across the country.

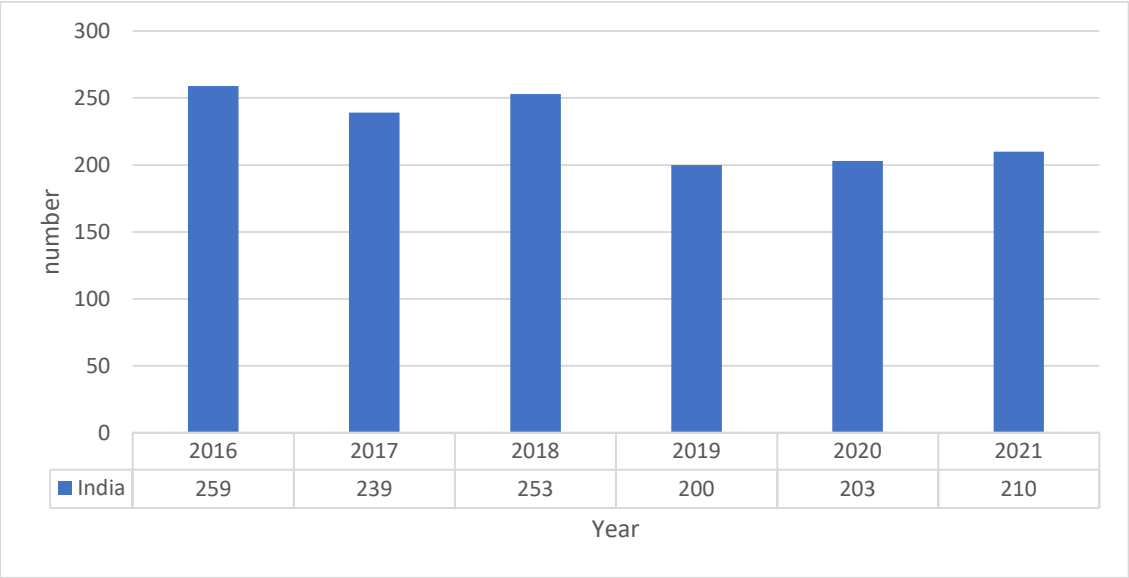
• Shipping agents, ship brokers, marine traders and brokers, transporters, gas plants, and other businesses can benefit from the ship-recycling industry.

• The ship recycling industry helps to balance the countries steel sector. Alang Ship Recycling Yard is the only source of steel generation in Western India.

## 2.3 Ship Breaking In India

Ship recycling is not a new concept in India, it began in 1912 in Kolkata and Mumbai. Ship recycling was part of the larger colonial economy, which included mining. Steel scrap was valuable even back then, and countries with ship recycling yards were often regarded as prosperous. When the first economic downturn hit in 1984, fleet owners decided that it was better to scrap ships than to maintain them, there was a massive backlog of ships to be demolished. With the recession underway and steel scrap yielding far lower prices, ships were forced to look for cheaper labour elsewhere. At this point, India stepped in. India did not

directly adopt the activities from the West. With economic growth in these countries stabilising and wages and living standards rising, ship recycling activity shifted to the next level of developing countries in the Indian subcontinent, China, and Vietnam, the laggard among South East Asian countries. Ship recycling came to India as part of the industrial relocation that began in the middle of the 1980s, when low-skilled and low-wage jobs were relocated to Third World countries. Indeed, the arrival of ship recycling in India was a result of globalisation.

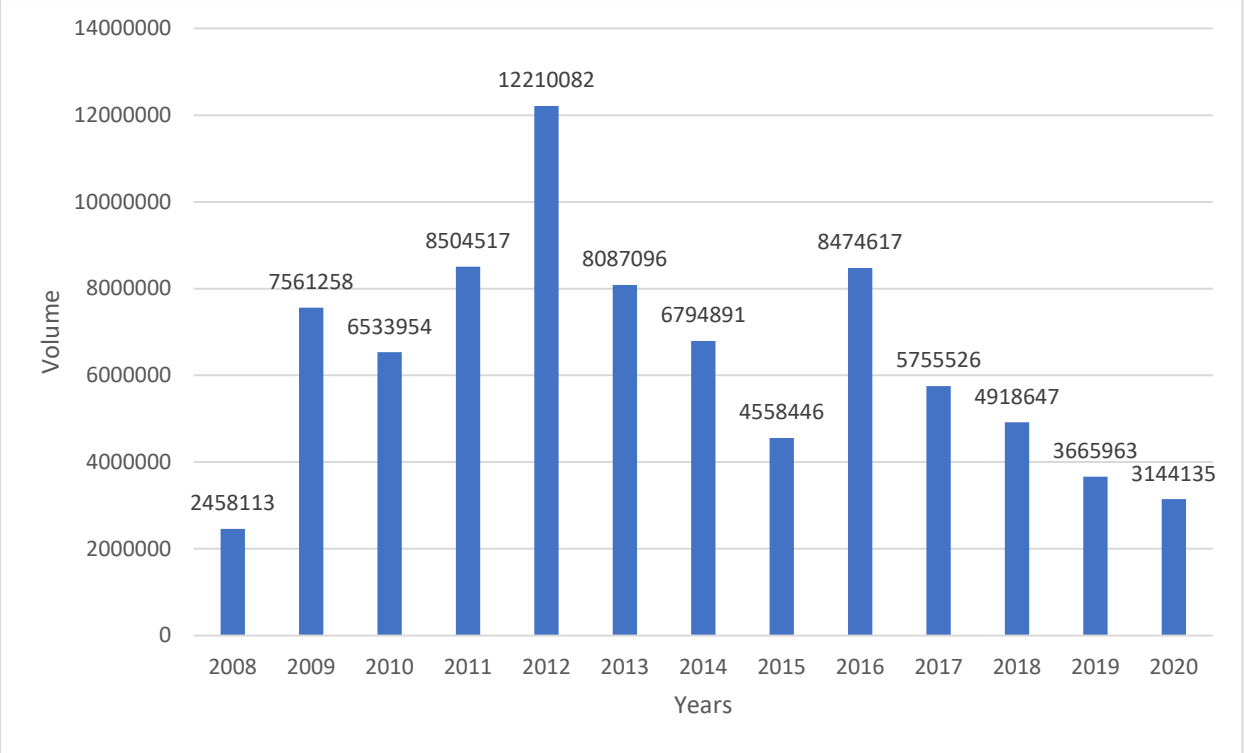



**(Source: NGO ship breaking)**

**Fig 2.2 Total number of ship scrapped in India**

The graph shows the number of ships recycled in India since 2016. The total number of ships scrapped has remained nearly constant over the years, but there has been a decrease in each year, one of the main reasons being increased competition. There is a decline in ship breaking in 2019 due to the COVID-19 restriction.

Because of the growing trend of importing ships for breaking in India, there was a focus on researching various sites suitable for this activity. Given the favourable beaching parameters such as firm seabed, gentle seaward slope, high tidal range, and so on, it was decided to establish a ship breaking yard near Alang village on the western coast of the Gulf of Cambay. As a result, Gujarat's Alang became an ideal host for ship recycling in its new form in India. The first vessel, the KOTA TENJONG, was beached at Alang on February 13, 1983. Since then, the yard has expanded significantly and has emerged as the world's leading ship breaking yard.




**(Source: NGO ship breaking)**

**Fig: 2.3 Annual ship recycled volume in India**

The annual LDT in India is decreasing. One of the main reasons for this is the increasing competition in the field of ship breaking. The development of ship recycling yards in countries like Bangladesh and Pakistan is also one of the major reasons for the decline in LDT in India. The total number of ships scrapped in India is similar to that of Bangladesh, but ship size is an important factor in determining the LDT. As a result, we can conclude that India scraps fewer smaller vessels than Bangladesh.

| Type of ships | Percentage |
|---|---|
| Bulk carrier and General cargo | 60-65% |
| Refrigerator Cargo Vessel | 15-20% |
| Oil tanker | 10% |
| Passenger ship and war ship | 5% |
| Cruiser | 5% |

**Table: 2.2 Types of ships broken in India**

Around 60 to 65 percent of ships scrapped in India are bulk carriers and general cargo, with refrigerated cargo vessels accounting for the remaining 15 to 20 percent. The rest are oil tankers, passenger ships, and cruise ships.

Full-fledged ship breaking began in India around the 1980s, and Alang in Gujarat was built for ship breaking due to the multiple benefits described below, and it is currently regarded the world's largest ship breaking facility. Following 1991-92, Alang became a global centre for ship breaking. Alang has been a consistent player in ship breaking from 1991-92 to 2016-17, demolishing nearly 6899 ships. It accounts for 98% of all ships recycled in India.

1. The location is in the high tide zone, where the highest tide can reach 10 to 11 metres. This is considered to be one of the most favourable reason for beaching.
2. Alang's coast is sloping and has a long dry area that allows vessels to reach up.
3. Even during the monsoon, the seabed at Alang dries up quickly, making it easier to handle various materials and equipment.

## 2.4 Geography

The intertidal gradient in India ship breaking is extremely high. This allows the ship to beach right on the beach during high tide, and when the tide recedes, the ship resembles a dry-dock. This not only makes work easier, but it also makes collecting valuables and waste items from the sand easier. Larger ships can come straight into the shore due to the high tidal gradient. This reduces the total amount of time spent on each ship.

Because the beach is sandy, heavy items do not sink into the mud, and hazardous waste matter such as paint and other heavy metals, as well as other deposits, do not leach into the soil. The rainfall is moderate, and work can be done all year. Because Alang is protected from high-velocity winds and excessive humidity, ship recycling is a year-round and risk-free activity. A layer of hard rock just beneath the sand prevents rainwater and even seawater from penetrating the subsoil. As a result, the risk of subsoil contamination is eliminated.

Because of the relatively low rainfall and shelter from severe tides and winds, as well as the absence of rocks in the vicinity, the Alang yard can readily recycle smaller ships. As a result, this yard can accommodate a significant number of ships. Gaddani, Pakistan, and Chittagong, Bangladesh, on the other hand, have severe winds and tides that can only destroy extremely big warships. Because the Chinese seacoast is prone to typhoons during the monsoon season, ship recycling cannot take place all year.

| State | Ship breaking locations |
|---|---|
| Gujarat | Alang |
| | Sachna |
| Andhra Pradesh | Vishakhapatnam |
| Kerala | cochin |
| | Bypore |
| | Azhical |
| West Bengal | Kolkata |
| Tamil Nadu | Tuticorin |
| Maharashtra | Mumbai |
| Karnataka | Mangalore |
| | Malpe |
| | Tadri |

**Table: 2.3 Major ship recycling location in India**

## 2.5 Prevailing Practice

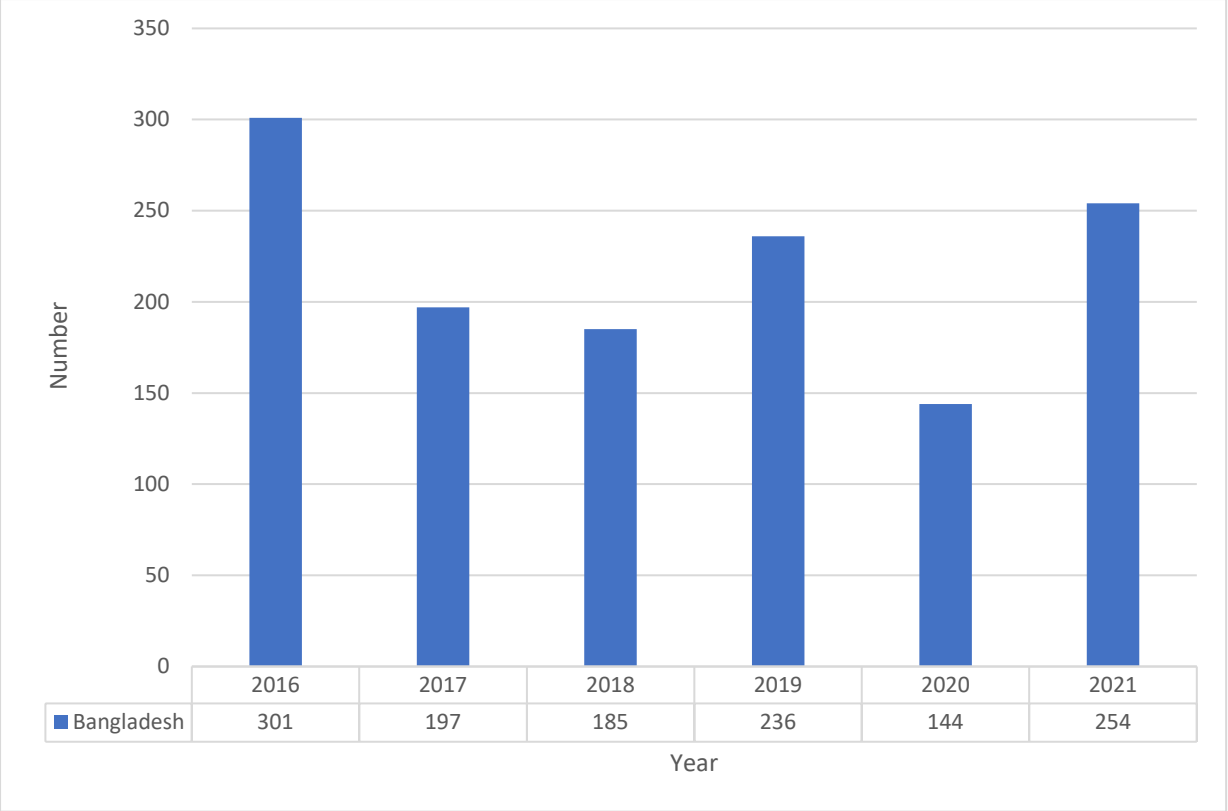
Indian ship breaking activity is primarily the beaching process. Obsolete vessels are towed or sailed onshore using tidal range and then mostly manually dismantled. The ship-breakers' responsibility begins when the ship is anchored close to the yard. The Gujarat Maritime Board has established guidelines for safety and precautions during ship-breaking yard cutting operations (GMB). It covers various safety initiatives to be taken by shipbreakers as mentioned in various statutes, such as the Factories Act, the Explosives Act, the Gas Cylinder Rules, the Static and Mobile Pressure Vessels Rules, and so on, and is monitored by GMB. After the vessel is anchored, officials from the Gujarat Maritime Board, Customs, and the Explosives Department inspect it. In accordance with Rule 43(c) of the Petroleum Rules, 1976, an official of the Explosives Department issues the Gas Free Certificate. It attests that the vessel is safe to enter a beach. The ship is allowed to beach after obtaining the necessary certificates from the officials of these Departments. After obtaining the Naked Light Certificate, the gas cutting operation begins. The ship breaking process begins at the bow and progresses to the stern. The ship's bow can accommodate anchor chains and poses no risk of fire or explosion during gas cutting with an oxy-acetylene torch. As a result, the bow portion of the ship is gas cut first, followed by an adequate number of openings in the ship's hull and structures to allow for natural ventilation. This process alleviates the accumulation of dangerous gases in ship tanks and holds. All fittings and equipment, such as furniture, refrigerators, communication systems, fire extinguishers, lifting tackles, and so on, are removed from the ship prior to the cutting operation. Following that, various types of pipes are detached, and the remaining fuel is drained

and removed from the ship. Other types of pipes, such as brass, copper, and steel, are cut and stacked on the shore. Following that, the bare ship structure is nearly lined for cutting in a three-tier system. The unit is labelled and cut with gas cutters. The ship is then laced through holes with wire ropes and connected to the shore-based winches. The cut pieces are then hauled to the shore by cranes and cut into manageable smaller pieces before being sold to re-rolling mills. Compressors, Diesel Generator (D.G.) sets, evaporation pumps, and other equipment are sequentially detached from the ship's structure, lowered, and brought to shore. The rear section of the ship structure, which houses the propulsion engines, is hauled to shore and sold separately.

## 2.6 Ship Breaking Industry in Bangladesh

A major cyclone in 1960 created Bangladesh's ship breaking industry. The Greek ship M D Alpine was stranded on the Fauzdarhat seashore in Sitakunda, Chittagong, by the catastrophic tidal storm. The vessel was bought by Chittagong Steel House and demolished in 1964. The scrapping of the warship took years, but the process gave birth to the Bangladeshi industry. Following that, during Bangladesh's 1971 war for independence, the Pakistani ship "Al Abbas" was heavily shelled. The ship was rescued from Chittagong port by a Soviet rescue team and brought to the Fauzdarhat seashore. This war-torn ship was purchased as scrap by 'Karnafully Metal Works Ltd' in 1974. The dismantling of that Pakistani ship is considered the beginning of commercial ship dismantling in Bangladesh.

Ship breaking in Bangladesh experienced its first boom at the beginning of the 1980s. As developed countries in Asia, Europe, and Scandinavia sought to eliminate industry, Bangladeshi industrialists seized opportunities enticed by large profits. Businessmen in the industry began to import more ships, and Bangladesh gradually began to play a pivotal role. As a result, Bangladesh swiftly developed a monopoly in the global market for big ship scrapping. The sector is critical to Bangladesh's socioeconomic development and progress. Bangladesh expects to demolish 300 ships by the end of 2012, representing a 36% increase over 2009. In February 2012, the government designated ship-breaking as an industry as part of a long-term plan to promote labour standards and safe toxic management.

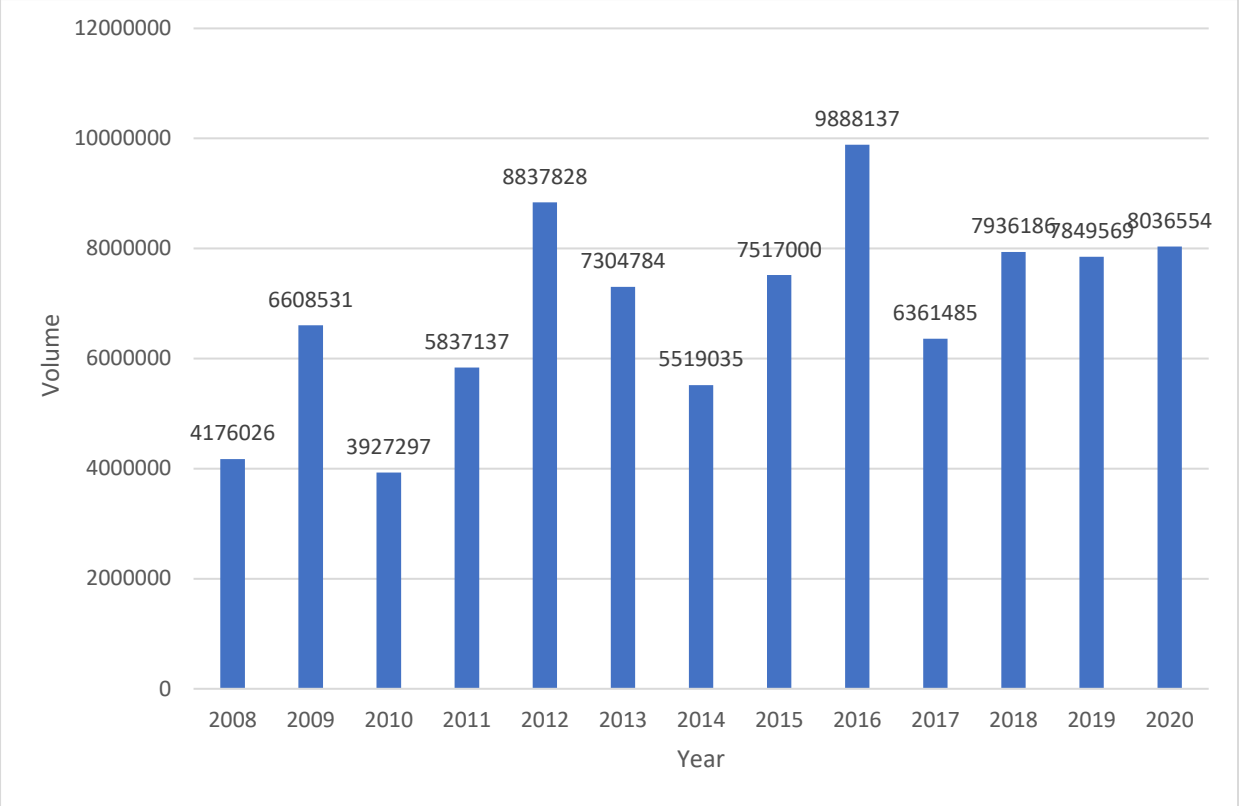



**(Source : NGO ship breaking)**

**Fig 2.4 Total number of ship scrapped in Bangladesh**

In comparison to India, the total number of ships scrapped in Bangladesh rises year after year. In 2016, 301 ships were scrapped, which is the highest ever, and since then, there has been constant ship breaking. In 2021, there is an increase in ship breaking, that is, 254 when compared to 144 ships scrapped in 2020.

Ship breaking recycling industry concentrations in these two nations have grown over time into bigger metropolitan complexes that encompass the greater urbanised areas of Chittagong and Alang. This has also helped the SBRI achieve the economies of scale essential for it to expand and succeed.




**(Source: NGO ship breaking)**

**Fig: 2.5 Annual ship recycled volume in Bangladesh**

Although India has a similar number of ships dismantled, the gross tonnage retrieved from dismantling was the highest in Bangladesh, which suggests that Bangladesh is a more preferred destination for dismantling for larger ships.

## 2.7 Employment

Ship breaking is a labour-intensive activity in India. The availability of labour is important to the existence of the industry. Because the work at the ship-recycling yard is stressful, labour will not be attracted unless and until earnings are high. Breaking a ship can take anywhere from 2 to 5 months, depending on the type and size of the vessel. Each ship breaking yard employs 150 to 200 employees. The sector is far from international norms and 'environmentally sound' ship breaking practises, with insufficient adoption of management principles, environmental and occupational conditions on sites.

| | India | Bangladesh |
|---|---|---|
| **Number of Employees** | 60000 | 40,000 |
| **Wages** | Rs 100-200 | 225 TK |
| **Workers** | Orissa, Uttar Pradesh and Bihar | Sitakund,Kalurghat, Nairabad |
| **Hours** | 8 hours | 8 hours |

**Table 2.4 Employment policies of India and Bangladesh**

In India alone, the ship recycling business employs around 60000 people per year. The vast majority of labourers are uneducated and come from India's poorest states, such as Orissa, Uttar Pradesh, and Bihar. The yards pay between Rs 100 and Rs 200 each eight-hour work. Aside from that, the ship recycling business indirectly employs another 500,000 people through downstream industries.

The ship breaking business directly employs roughly 40,000 people in Bangladesh, with up to 200,000 people indirectly engaged through auxiliary operations. The great majority of workers are young, male, and illiterate; there are relatively few women in the yards. Migrant labourers from Bangladesh's poorest areas are believed to account up up to 95 percent of the workforce.

Men in a particular household are likely to follow elder male relatives to the yards. Chittagong's workforce consists of both paid and hourly employees Wages are decided by the amount of expertise necessary in both circumstances. Employees perform eight-hour shifts with four-hour overtime paid at the same rate. Work is done in two shifts, day and night, for around 24 days each month. New personnel who join the yards have no official training.

## 2.8 THE SHIP BREAKING YARD AND ITS NEIGHBORING VILLAGES

There are multiple lots of ship breaking yards in Alang, India, and Chittagong, Bangladesh. A single ship breaking yard may occupy many lots, providing the owner with a competitive edge over other shipbreakers in the vicinity. A longer coastline offers a competitive advantage in managing larger ships, but development costs a significant amount of cash, which developing-country lack.

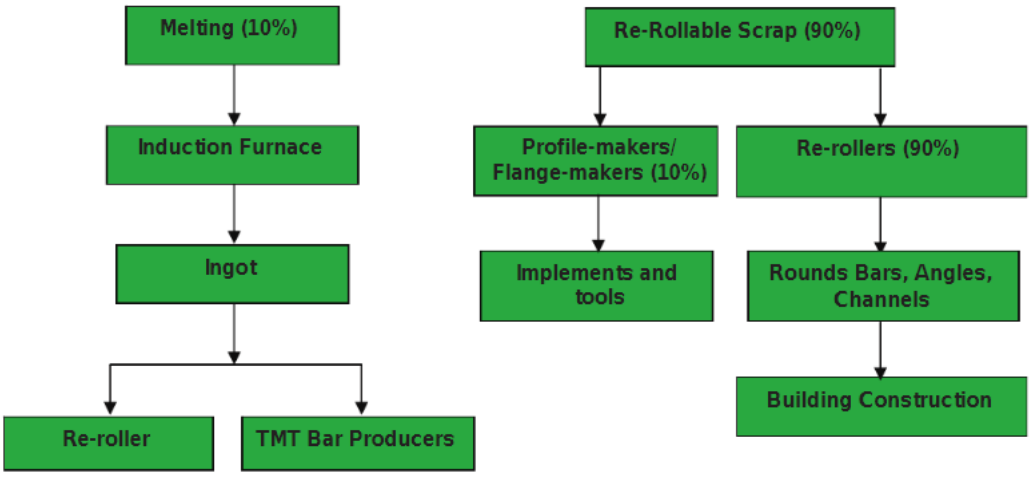
According to the article, the government-owned beaches in Chittagong are leased to ship breaking yards for 99 years and typically stretch for several kilometres. Bhatiary, a fishing village originally located in northern Sikatunda, was relocated in 1986 to a location between two ship breaking yards in southern Sikatunda. The people of the community were left with barely one to two hundred yards of beach on which to moor their fishing boats and nets. It was claimed that between sixty and seventy fishing communities throughout the entire district of Chittagong were relocated. Small fisherman who must throw their nets where the ships are docked face risk because of the manner the ships are split up along the beach. The village's residents are not immune to the tremendous disturbances produced by the ship breaking process, especially when large sections of steel that have been chopped off fall onto the shore.

As a result of the increase in ship breaking activities and the region's general industrialisation, the villagers, whose primary source of income is fishing, have encountered difficulties. Because of the restricted fish resource that must be divided among these local fishermen, as well as the incursion of larger fishing boats, their daily profits will suffer if the authorities leave them alone. The country's established social structure, which must be preserved, would be upset.

## 2.9 Role in Steel Economy

One of the reasons why ship recycling became a boon for India was that the mid-1980s saw the rise of electric arc furnaces and an increase in demand for steel melting scrap. Around the middle of the 1970s, re-rolling mills began to expand, and they grew rapidly in North and West India. Ship recycling has become a source of steel scrap, either for melting or for directly re-rollable material in re-rolling mills. Ship scrap has traditionally proven to be a direct competitor of integrated steel mills in their market for semis. Steel scrap from ships is a main source of raw material for ship recycling country's re-rolling mills. Normally, at least 70% of a ship's total light displacement tonnage is made up of re-rollable scrap. These are then processed into rods and bars for use in the construction industry. Scrap from ship breaking sells for a high price on the market. This is because the steel in the form of re-rollable scrap from ships is of high quality. Steels used to build ships have the ability to withstand pressure, high impact, and strain due to extreme cold. These characteristics, if translated into the manufacture of bars and rods, may result in similar steel qualities with equal strength. It has a constant chemical composition and a low phosphorus and sulphur level. Steel from ships has been normalised,

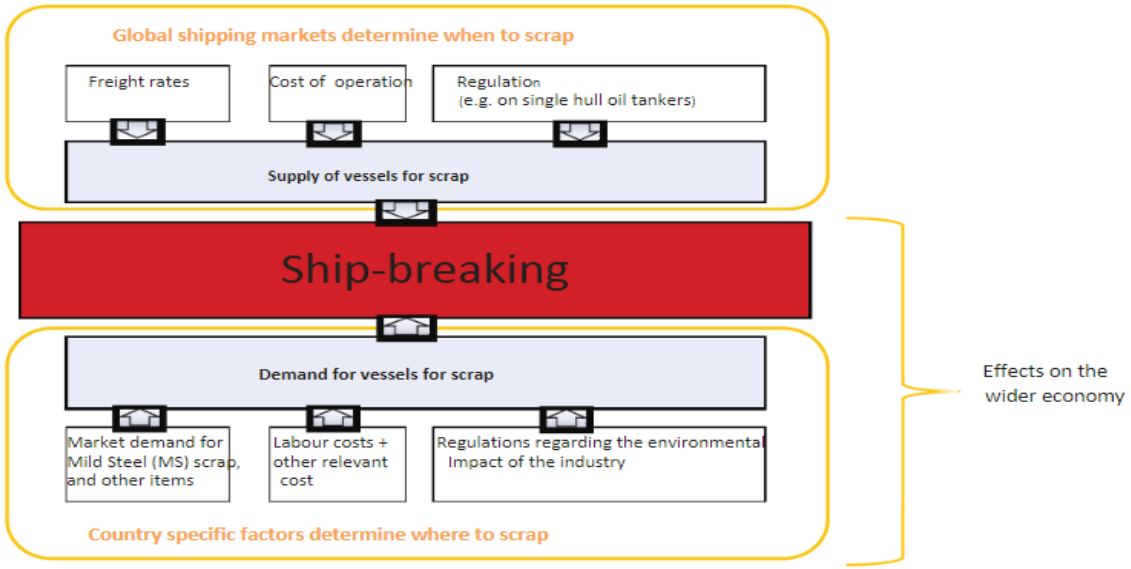
resulting in a finer and more compact grain structure with no inclusions, pores, or fractures, as well as austenitic characteristics.




**Source: EU commission**

**Fig 2.6 End of life ships: Ferrous scrap market structure**

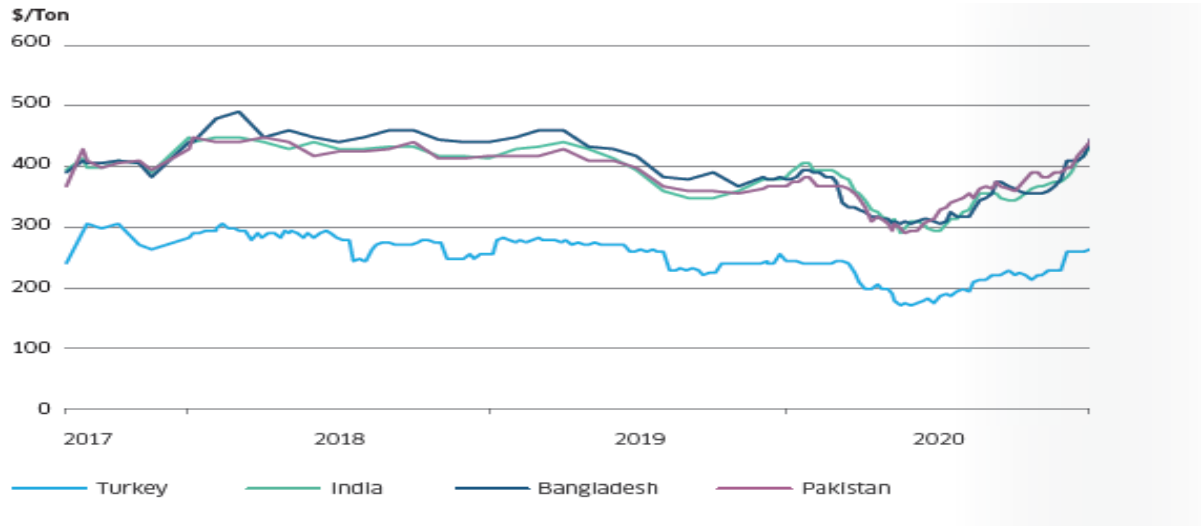
Steel derived from ship breaking scrap has therefore been proven to be more suited than steel derived from ingots and billets for all applications requiring impact resistance, corrosion resistance, machinability, bendability, and formability. In addition, while scrap from demolished ships is typically sent to melting furnaces around the world, India is the only country which has the technique of re-rolling scrap into producing construction steel without first casting scrap as billets.




**Source: Marine insight**

**Fig: 2.7 ship breaking Supply and Demand**

To produce a tonne of steel through integrated steel plants, more power and fuel are consumed, as well as non-renewable resources such as coal, iron ore, limestone, and other minerals. The sunk costs of capital employed are higher in integrated steel plants, and integrated plants create far fewer jobs.




**Source: ship breaking Bd**

**Fig 2.8 price offered in major Ship breaking countries per ton**

Bangladesh's domestic steel output is insufficient to fulfil national demand, which is projected to be 5 million tonnes per year. According to the country comparison, the industry is more profitable in Bangladesh, owing to two factors: high steel prices and low labour costs. Currently, the country has between 250 and 300 rolling mills in operation. Their production is essentially Bangladesh's domestic steel output, which is expected to be roughly 2.2 million tonnes per year with $1.2 billion in sales. A few significant corporations provide around 30% of this output. The present yearly usage of bars and rods in construction is between 2 million and 2.5 million tonnes. For the ship recycling industry, 2020 was a truly eventful and disruptive year. Ship recycling industry experienced significant price volatility across all four major ship recycling destinations, with prices falling from the high 300's per lt/ldt in the subcontinent to the high 200's by end-2020 for most tonnage. Aside from the massive price fluctuations, all destinations were operationally disrupted by the Covid-19 pandemic, which caused a halt in demolition in April and May. As a result, many vessels and, more importantly, their crews faced serious difficulties and lengthy wait times before being repatriated, and the vessels were beached. Using the most recent annual average of 1–1.25 million tonnes of scrap output from

Bangladesh ship breaking yards, it is believed that Bangladesh's ship breaking recycling industry contributes significantly to the country's steel production, maybe up to 50%. This downstream demand for steel scrap has been a major driver of Bangladesh's ship breaking recycling industry growth. Ship breakers in Chittagong estimate that around 85 percent of a ship is recyclable steel in the form of immediately re-rollable steel (75 percent) and melted scrap (10 percent). Due to high steel prices, India's income is quite substantial; nevertheless, this is more than offset by a high level of taxation.

## 2.10 Implication of Ship-Breaking on Economic Growth and Development

In comparison to capital-intensive shipbuilding industries, the ship breaking industry is heavily labour-intensive. Ships are expensive to build, but they are purchased for recycling at a highly negotiated price per lightweight tonne. Although ship breakers can use mechanised methods to break a ship, increasing their productivity, they mostly rely on labour to dismantle the massive ships because such a large one-time investment would not be profitable due to the margins they earn. The hull, machinery, equipment, fittings, generators, batteries, and even furniture are all reusable ship parts. Although steel scrapes contribute for the majority of ship recycling yard tonnage revenue, non-ferrous commodities such as motors, furnishings, and so on are the most profitable. Nothing is wasted when the ship recycling way of ship disposal is applied. As a result, the economy may profit by giving jobs and raw resources to a variety of businesses.

Whereas the majority of shipbuilding businesses are centred in significant areas of Western countries, the majority of ship-breaking industries are concentrated in the Indian subcontinent, which has an abundance of cheap labour. Bangladesh has led the market in recent years in terms of tonnage produced by ship breaking. In this context, the Indian market has not followed far behind, as it is by far the most popular destination for ship-breaking, based on the number of ships transferred from flag-state for ship-breaking. With China's recent decision to stop importing end-of-life ships beginning in 2019, India, Bangladesh, and Pakistan (the major ship-breaking industry players) will benefit the most. Sixty-eight (77 percent) of the 862 ships sent for dismantling were sent to yards in the South Asian region.

## 2.11 Policy and Business Environment

### 2.11.1 The Recycling of Ships Bill, 2019

The Indian government chose to enact this Act in order to regulate ship recycling by establishing specified international standards and a statutory system for enforcing such

requirements. The Recycling of Ships Act of 2019 prohibits the use or installation of hazardous materials onboard ships, whether intended for recycling or not. Such limitations or prohibitions on the use of hazardous materials will apply to new ships immediately, that is, from the day the legislation takes effect, whilst older ships will have five years to comply. Hazardous materials would be restricted or prohibited on government-operated warships and non-commercial ships. The hazardous materials inventory on ships must be evaluated and confirmed. Under this Act, ship recycling facilities must be authorised, and ships must be recycled only at such authorised ship recycling facilities. Ships must also be recycled in accordance with a ship-specific recycling strategy, according to this Act. Ships destined for recycling in India must get a HKC Ready for Recycling Certificate. Admitting India to the Hong Kong Convention and passing the Recycling of Ships Act in 2019 will raise the status of our ship recycling industry as environmentally friendly and safety conscious, and would go a long way toward securing India's market leadership.

**Benefits of the bill**

- The law predicts a large increase in the number of worldwide ships recycled at Indian shipyards.
- Ship recycling would boost business and job prospects while also enhancing India's standing in the recycling industry.
- It will increase the brand value of our Ships Recycling Yards in Alang, Gujarat, Mumbai, Kolkata, and Azhikkal, Kerala.
- As a result of ship recycling, 10% of the country's secondary steel needs will be met in an environmentally friendly manner.
- Ship recycling facilities will be brought up to international standards, and ships will only be recycled in such authorised facilities.
- The tremendous expansion of business activities will boost the country's GDP.

**Applications of the bill**

The Bill will apply to:

- Any new or existing Indian-registered ship.
- Ships entering an Indian port or terminal, or entering Indian territorial waters
- Recycling facilities operating in India.

**Ship Recycling**

- The Bill defines ship recycling as the disassembly of a ship at a facility in order to salvage the components and materials for reuse, as well as the disposal of the hazardous waste created.
- It comprises material and component storage and treatment on-site.

**Recycling facilities**

- An application to authorise such a facility, along with a ship recycling facility management plan and the prescribed fee, must be submitted to the Competent Authority.
- Existing facilities must seek for authorisation within 60 days of the Act going into effect.
- The authorization certificate will be valid for the specified period of time, not to exceed five years.
- Violations of these laws will result in up to a year in prison or a fine of up to Rs 10 lakh, or both.
- Each Ship Recycler shall maintain suitable measures for emergency readiness and response, worker safety, health, training, and welfare in line with the Factories Act of 1948. It must also cover both permanent and temporary staff with insurance.

### 2.11.2 Bangladesh Ship Recycling Act 2018

The Act establishes a Board to supervise ship recycling and assure compliance with the 2009 Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, as well as other international agreements. They may offer national-level implementation recommendations.

Ships are only to be recycled and broken down in zones designated by the competent authorities. In accordance with national laws and the Labour Act of 2006, all employers must provide adequate life insurance policies to their employees.

### 2.11.3 Bangladesh Government policy

The government of Bangladesh does not recognise ship breaking as an industry; instead, ship breakers must get a commercial licence from a government body. As a result of their unauthorised status, Bangladeshi shipbreakers get no government grants, subsidies, or tax

breaks. Ship breaking, on the other hand, is controlled by environmental rules, some of which appear to be contradictory in practise. The Ministry of Shipping's Department of Shipping has assumed some of the industry's obligations, and recent reports indicate the development of a draught Ship-breaking and Recycling Policy.

The land on which Bangladesh's ship breaking yards are built is partially leased and partially owned. Because the business is unofficial, the government only supplies minimal infrastructure, and yard owners must pay for repairs to access roads that are heavily used by yard traffic. Although the yards have 24 hour power, it is intermittent, thus yard operators must rely on generators retrieved from ships. Because there is no link to the city water supply, they have also erected tube wells for workers.

### 2.11.4 Ship Building and Ship Recycling Board (SBSRB)

The "Ship Building and Ship Recycling Board is being developed as a one-stop service provider under the MoI. In collaboration with other responsible departments and ministries, it will provide integrated services such as granting necessary permissions and certificates for ship breaking, recycling, and other related activities.

### 2.11.5 India Accedes to the Hong Kong Convention

India has signed the IMO Hong Kong International Convention, which will define worldwide standards for safe and environmentally sound ship recycling. The Convention is one step closer to entering into effect with India's membership, as the requisite 15 States have already signed on, and India's ship recycling volume contributes considerably to the required recycling capacity. The Secretary of Shipping and Director General of Shipping deposited the instrument of accession to the treaty with IMO Secretary-General Kitack Lim on November 28, at the 31st Session of the IMO Assembly.

### 2.11.6 The Gujarat Maritime Board (GMB)

The Gujarat Maritime Board (GMB) has approved a project to upgrade existing environmental infrastructure at the Alang Sosiya ship recycling yard for a total cost of US$ 111 million, including a soft loan of US$ 76 million from JICA. On September 15, 2017, JICA and the Ministry of Finance signed a loan agreement.

The cost of the project will be shared as follows:

| Item | Cost in million US $ |
|---|---|
| Loan from JICA | 76 |
| Taxes & Admn cost to be borne by GMB | 25 |
| Balance to be shared between GMB and M/o Shipping | 10 |
| Total cost | 111 |

**Table: 2.5 cost of project**

Source: govt of India, Ministry of shipping

The project has the following main components:

a) Upgrading 70 yards, providing impervious floors to prevent pollutants

b) Enhancement of the existing Environmental Facility

c) Mobile Decontamination Units are now being introduced. (Pollution Response Equipment to avoid oil spill and fire) d) Large Mobile Cranes Are Being Introduced

## 2.12 LEGAL REGULATION GOVERNING THE SHIP BREAKING INDUSTRY

### 2.12.1 The Basel Convention

For decades, the ship breaking sector lacked specialised waste disposal or management regulations, agreements, or treaties. The overarching convention used to control waste management in the ship-scrapping sector was the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal 1989. It was used as a regulatory mechanism for the ship-breaking industry, and ship waste was classified as 'waste.' The main concern that this convention addresses is the 'transboundary' movement of wastes, which became a problem in the 1980s as waste dumping in third-world countries became a problem. Although dumping waste became a source of income and employment for developing countries, it still posed a greater threat to the environment as well as the safety and health of the workers.

The convention is based on three fundamental principles. To begin, the principle of minimisation suggests that hazardous waste production be reduced entirely. It even makes the producers or exporters of the same liable. Second, the 'proximate principle' suggests that waste be disposed of as close to its point of origin as possible, as stated in Article 4 (2). (d). Third,

the hazardous waste must be disposed of in an 'environmentally sound' manner, and the exporter must believe that the waste will be managed properly.

There have been many debates about whether a ship is a ship or a hazardous waste in scenarios involving ships. The convention recognises that a ship becomes a hazardous waste when it contains such wastes. However, this does not resolve the BASEL convention's fully operational applicability to the ship scrapping industry. The first principle followed by the convention is somewhat haphazard for the ship scrapping industry because it would be difficult to identify the true owner of the ship responsible for such waste because end-of-life ships are sold for dismantling after the ship has provided 20-30 years of operational profits. Furthermore, the ships may have contained materials that were legal to use at the time of manufacture, but the consequences of those materials are now known and, as a result, are prohibited. In this industry, the second principle also fails to rationalise because ships are transferred inter-country many times before being disposed of. The third principle has also been shown to be ineffective due to the debate over the nature of end-of-life ships. Because there was no specialised convention for the ship recycling industry, this issue was raised at the 47th session of the International Maritime Organization's Marine Environmental Protection Committee which proposed that the IMO develop regulatory guidelines for the ship-recycling industry, given the growth and employment that are accounted for in this sector. However, the IMO initially failed to recognise how the ship breaking industry can pollute the environment and have a negative impact on the district in which it is carried out.

### 2.12.2 The Hong Kong Convention

The HKC convention arose from a number of factors, including mounting concerns about the ship breaking industry's unhealthy practises, a failure to apply the Basel Convention unequivocally to the ship-dismantling industry, interventions from NGOs (particularly Greenpeace and the NGO Ship breaking Platform), and, most importantly, a failure to enforce various guidelines issued by the IMO for this specific activity.

The HKC offers a comprehensive method for ship survey and certification, as well as the approval of ship-recycling facilities. It prohibits states from installing or utilising the hazardous wastes mentioned in the appendix, and it requires them to implement specialised laws to penalise ship-recycling facilities that violate the agreement. Despite the fact that the convention has been signed, it has yet to enter into force.

# CHAPTER – 3

# Ship Breaking Problems

## 3.1 Introduction

Ship breaking is gaining a reputation as a profitable industry in South Asia, particularly in Bangladesh and India, due to its contribution to local business and employment opportunities for a large number of people. Nonetheless, by causing irreversible coastal and marine environmental hazards, the ship dismantling industry is turning into a cemetery for the environment. The type and quantity of waste generated at ship breaking sites differs from that generated on board a ship to be dismantled. This is due to the fact that waste at the site is also affected by the nature of ship breaking activities such as beach scrapping and pier scrapping. Breaking practises generate waste such as paint chips and flakes of rust. Solid, liquid, and gaseous wastes can be generated at a typical ship breaking site. Ship breaking activities pollute the land, sea, and air because of the generation of hazardous and non-hazardous wastes as well as ill-managed dismantling practises. Pollution occurs to some extent in reusable goods shops and re-rolling mills away from the breaking site due to the disposal of broken materials and the removal of paint from steel sheets, respectively.

## 3.2 Common Wastes on Board with their Locations.

| SI No. | Waste Matrix | Location | Equipment / System |
|---|---|---|---|
| 1 | Asbestos | Deck | Stream supplying piping, Exhaust piping, Tank cleaning piping, Deck underlay, Blanket. |
| | | Engine room and machinery spaces | Steam supply piping and hangers, Steam exhaust piping and hangers, Miscellaneous piping outer coverings and hangers, Water pipes and hangers |
| | | Engine room and machinery spaces | Boiler drums, casings and furnace insulation, Heaters, tank, Molded plastic products, Weld shop protectors and burn covers etc |

| | | | |
|---|---|---|---|
| | | Machinery | Brake linings, Electrical cable materials, Arc chutes and in circuit breakers. |
| 2 | Materials and wastes containing, consisting of or contaminated with PCB and its congeners at a concentration level of 50 ppm or more. | Engine room, other machinery spaces and deck areas | Capacitors in light fittings, PCBs in oil residuals, gaskets, couplings, wiring and cable insulation, transformers, Voltage regulators, switches, re-closers, bushings, and electromagnets, adhesives and tapes, Light ballast, any Plasticizer etc. |
| | Hexavalent Chromium Other | Paints (lead chromate) on ship's structure Paints containing pesticides have been used on the hulls of ships to prevent the buildup of sea organisms (e.g., bacteria, protozoa, barnacles, and algae). | |
| 3 | Bilge water | Bilge holding tank, Bilge wells, waste drain | |
| 4 | Ballast water | Ballast tanks, double hull spaces, fore and aft peak, other designated ballast tanks | |
| 5 | Oils, Fuels and Grease: Lubricating Oils Hydraulic Oils | Engine room and other machinery spaces | Main engine, Generator engine, Stern tube and sealing arrangements, propeller and shaft, steering gear etc. |
| | | Engine room and other machinery spaces including deck equipments | Hydraulic controlled systems, valves, solenoid systems etc. |
| 6 | Heavy metals: Mercury and its compounds | Engine room, Hospital, Navigational bridge, W. Deck, Accommodation area | Thermometers, bearing pressure sensors, level switches, fluorescent lamps etc. |

| | | | |
|---|---|---|---|
| 7 | Refrigerants, chemical refrigerants | Engine room and upper deck areas | AC Plant compressor, Refrigeration systems, other small capacity refrigerators |
| 8 | Gases: Carbon dioxide | Engine room, upper deck areas, CO2 rooms protecting certain areas | Total flooding fire extinguishing system for engine and pump rooms F/E systems for Inert Gas system, Emergency generator room, other areas |
| 9 | Other hazardous wastes (e.g. glass wool used as thermal insulating material, cables, , different types of polymers) | | Ceiling panels, lining, partition panels, internal bulkheads, drainage pipe, EEB devices, other hoods and masks |

**Table: 3.1 Common Wastes on Board with their Locations.**

## 3.3 ENVIRONMENTAL IMPACT

### Water Pollution

Water bodies, particularly the marine environment, are polluted by bilge water, which contains suspended solids, nitrates, phosphate, heavy metals, oil, and grease. Oil spills and heavy metals such as lead, mercury, and Tributyltin (TBT) endanger marine ecosystems, including birds and mammals. Though pollutants are generally diluted during tidal mixing, TBT from antifouling paints remains a threat because it impairs the immune and endocrine systems of organisms even at low concentrations.

### Soil Contamination

Improperly handled heavy metals (lead, cadmium) found in paint chips, asbestos fibres, and PCB-containing elements can become a potential source of soil contamination near ship scrapping activity.

### Air Pollution

Ship paints and coatings are generally flammable and contain toxic compounds like polychlorinated biphenyls (PCBs), heavy metals (like lead, cadmium, chromium, zinc, and copper), and pesticides like TBT. Toxic fumes are released during torch cutting of the ship's body and afterwards when the paints on the ship's surface continue to smoulder. Toxic smoke is formed when non-recyclable rubber pipes and faulty electrical fixtures are burnt in the open

air, which may contain dioxins, furans, and polycyclic aromatic hydrocarbons (PAHs). Air pollution is caused by fine particles created during ship stripping, as well as the discharge of CFCs from the explosion of gases imprisoned in refrigeration systems or other explosive chemicals.

**Noise Pollution**

Ship breaking activities pollute the land, sea, and air because of the generation of hazardous and non-hazardous wastes, as well as ill-managed dismantling practises. Pollution occurs to some extent in reusable goods shops and re-rolling mills away from the breaking site due to the disposal of broken materials and the removal of paint from steel sheets, respectively.

**Solid waste generated at site**

1. Paint chips
2. Chunks and flakes of rust
3. Scales generated during gas cutting of steel
4. Scale generated during re-rolling
5. Concrete slabs used as ballast
6. Ceramic tiles
7. Glass wool and fibrous insulation
8. Asbestos sheets
9. Asbestos (ropes and powder)
10. Fuel Oil (LDO and HSD)
11. Furnace Oil
12. Engine Oil and Lubricants
13. Thermocol
14. Rags and sackings
15. Oily sludge at bottom of fuel tanks cargo hold of tankers and bilge
16. Plastic, fibre glass, linoleum and sunmica

17. Broken ceramic ware, glassware, paper, wood, all sorts of junk

18. Oily sand generated due to clearing oily surfaces before cutting

19. Remnants of cargo

20. Human excrement

**Liquid waste generated**

1. Ballast water 2. Bilge water

**Gaseous waste generated**

1. CO2 from firefighting equipment

2. Ammonia from air conditioning chilling system.

3. Chlorofluro Carbons (CFC) from air conditioning system.

4. Inflammable gases present in pipelines of oil tankers and LPG/LNG carriers.

## 3.4 Industrialization and Environment Issues

Until the late twentieth century, ship breaking took occurred in port towns of industrialised countries. Ship breaking is practically non-existent in wealthy countries right now. The majority of ship breaking currently takes place on developing-country beaches, with the main operations taking place at Alang, India, and Chittagong, Bangladesh. Shipowners prefer to dump obsolete boats in South Asia, where environmental and occupational safety requirements are less stringent. This is due to reduced labour costs and less severe environmental rules controlling the disposal of lead paint and other harmful chemicals Ship destruction is frequently connected with risky practises and pollution. Finally, most ships carry oil sludge, bilge, and ballast water, all of which are environmentally dangerous. As a result, the majority of decommissioned ships destined for scrap contain a cocktail of toxic elements.

Marine flora like as kelp, marsh grass, mangroves, and sea grasses are harmed by ship scrapping debris. Plants that grow between the high and low tide lines can have a detrimental influence. Benthic creatures, or bottom-living organisms, play a vital part in the food chain. The world's richest fisheries are intrinsically related to the benthic community, as is commonly understood Because the soil sample from the ship breaking location contains little organic matter, the presence of benthos in the intertidal zone of the ship breaking areas of South Asia

Region is quite low. Due to uncontrolled and unplanned ship breaking activities, the previously pristine intertidal and biodiversity rich coastal environment of Sitakunda, Chittagong, has become a barren wasteland. The environment has been substantially deteriorated, with physical, chemical, and biological qualities lost. A large volume of waste oil and water finds up in our coastal areas. As a result of this process, our land is contaminated, the fisheries is poisoned, and the air is polluted. Shipwrecking pollutes the land and marine environment along the Chittagong coast, from Fauzdarhat to Kumira. With increasing PH, the amount of ammonia dangerous to marine animals in beach soil and saltwater rose. Human and mechanical activity have increased the rate and amount of beach erosion, causing seawater turbidity to rise. The surrounding ship breaking industry in Chittagong, Bangladesh, has wiped off 21 species and endangered 11 more, while 40,000 protected mangrove trees have been threatened with extinction to make room for new ship breaking yards.

| **si.no** | **Ship type** | **Total land fillable waste (kg\LDT)** | **Total incinerable wastes (kg\LDT)** | **Bilge Water(kg\LDT)** | **Cumulative weight of wastes (Kg\LDT)** |
|---|---|---|---|---|---|
| **1** | General Cargo, Bulk Carrier & container Ships | 16.5-20 | 2.7-3 | 2.1-2.4 | 21.3-25.4 |
| **2** | Oil & chemical Tanker | 11-16.6 | 2.5-3.3 | 4.2-4.5 | 17.7-24.4 |
| **3** | Refrigerator ship | 40-152 | 1.7-10 | 13.8-14.8 | 55.5-176.8 |
| **4** | Passenger ship | 17.6-36.6 | 0.8-1.2 | 1.3-1.47 | 19.7-39.2 |

**Table 3.2 Waste factors in kg/LDT for land fillable waste, and bilge water generated from the ship breaking in India.**

Paints and coatings, oil rags, greasy sludge, Thermocol, polyurethane foam (PUF), rubber gasket, polyvinyl chloride (PVC), and plastic are among the total incinerable wastes listed in the table above. Rusted iron scales, ceramics, incinerator ash, shattered glass, and cementing material are some more wastes that can be disposed of in a landfill.

To summarise, the number of ships disassembled in the country and the amount of hazardous waste contained in the dismantled ships define the creation of hazardous trash. Both variables see significant change. The use of low and high estimate waste factors represented the diversity in the quantity of hazardous waste contained in the demolished ships. The environmental stress

caused by ship breaking activity in Alang, India, has resulted in a decrease in biomass, as measured by the abundance and species diversity of both plants and animals. There is essentially no vegetation in the intertidal zone surrounding Alang. The mangroves vanished soon after the ship breaking business took off. The nearby maritime environment is deficient in zooplankton and phytoplankton, as well as fish eggs and larvae. The shoreline east and west of Alang reveals signs of pollutants as well as oil related with the ship breaking process.

The Bay of Bengal is also close to one of the world's largest ship recycling facilities, Chittagong. Metal waste that cannot be resold frequently remains on the shores, washing into the Bay at alarming rates, raising cadmium and copper levels in the water.

| **Type of hazardous waste** | Total(min-max) |
|---|---|
| Landfillable waste (both toxic and inert) | 7’500-10’300 |
| Incinerable waste | 5’400-6’400 |
| Bilge water | 5’600-6’300 |
| **TOTAL** | 18’500-23’000 |

**Table 3.3 : estimated hazardous waste amount generated by Chittagong ship recycling yards and industrial areas (MT)**

The findings demonstrate the variety of hazardous wastes generated in the Chittagong ship recycling industry under current conditions. Asbestos-containing wastes, as well as other land fillable wastes such as rusted iron scales, porcelain, incinerator ash, and so on, are examples of land fillable hazardous wastes. Zinc Concentrations (average 112 μg/g) were higher than the IAEA recommended level of 95 μg/g, and higher than in marine sediment from other parts of the world, the researchers assert. Levels of just 0.1–1 μg/g of zinc in soft water are lethal to all fish species. Mercury levels in contaminated areas were 94 times higher than the acceptable quantity. This is a huge problem since methylmercury is a nervous system toxin that poses a serious risk to human and environmental health. Copper levels were higher than the acceptable range of 33 g/g, which might increase fish mortality. Lead and cadmium levels were roughly 6.5 and 8.5 times higher than the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection.

| Waste stream | Most common practices in the industries surveyed |
|---|---|
| APC dust | Sold to third party |
| Waste oil and grease | Collected and reprocessed/sold to third party |
| Fabric waste | Sold to third party |
| Contaminated packaging | Sold to third party/sent to cement plant or to incinerator |
| Raw Hides Cutting | Sold to third party |
| Contaminated solid waste | Sold to third party/landfilled on own premises/burnt in own incinerator |
| Maintenance Scrap | Sold to third party |
| Bleaching earth | Sold to third party |
| Oily crude tank sediment | Sold to DoE Designated third part/ sold to third party |
| Contaminated plastic waste | Sold to third party |
| Asbestos | DoE instructed to bury in tanks |

**Table: 3.4 most common waste management practices in the industries. Chittagong City Corporation. DoE: Department of Environment.**

## 3.5 The Human cost of Ship Breaking

According to the International Labour Organization, ship breaking is one of the world's most dangerous industries. Workers deconstruct ships by hand the majority of the time, with no safety clothes or equipment. They do it on beaches in 40-degree weather, far from hospitals or emergency rooms in case something goes wrong. The bulk of injuries and deaths are the result of typical mishaps like falling items and fires, as well as exposure to dangerous elements like radiation, mercury, and asbestos. Estimating the number of fatalities is difficult since many shipyard employees are migrants. According to research, the accident rate is two per 1,000 persons. In addition, 16% of employees had asbestos-related disorders. According to the NPSOM Department of Occupational and Environmental Health, 88 percent of employees in the Chittagong yards had some type of unintentional injury, ranging from simple foot injuries to catastrophic mishaps. Workers' understanding of dangers and safety, as well as their use of personal protective equipment (PPE), has historically been inadequate. Yard management may negotiate informal compensation arrangements for workers' families in the case of an injury or fatality. Workers' amenities, such as safe drinking water and latrines, are insufficient. In most yards, health treatment is confined to first aid. Long-term health concerns such as muscular discomfort and skin illness are becoming increasingly relevant. 426 persons perished in South Asian ship breaking yards between 2009 and 2021. In 2021, 18 people were killed in a ship breaking yard.

## 3.6 Sea level rise

Global climate models forecast sea level rise as a result of climate change driven by global warming. A concurrent process of land subsidence, such as that which is now occurring in some areas of Bangladesh, would increase the effects of such sea level rise. In coastal areas, two physical effects of climate change are shoreline regression and building weakening due to erosion. The rising tide level on beaches would also sweep toxins off the buried sand in ship breaking areas, aggravating the impact of existing industrial pollution. Because fish and seafood, in particular, collect and transmit contaminants into human and environmental food chains, metals and persistent pollutants should not be moved from relative immobilisation in soils to the dynamic aquatic ecology of the coastal zone.

## 3.7 A Better Future: Alternatives to Current Ship breaking Practices

Recycling dry-dock stands is now the best alternative to beaching. Workers recycle ships in a safe environment on a steady platform outfitted with hazardous waste management systems and lifting equipment. Because most ships are already built on dry-dock platforms, this strategy merely reuses existing docks. It is a non-invasive approach of dealing with a serious problem.

Another potential answer to ship breaking is to completely redesign boats. A more transformational approach is fraught with pitfalls. Currently, ship transport contributes for 3% of total world greenhouse gas emissions each year. Making ship design more ecologically friendly, as well as greening ship recycling, can contribute to addressing this broader issue.

According to the International Council on Clean Transportation's 2020 report, hydrogen could power 99 percent of cargo ships travelling through the Pacific Ocean. More than half of the boats would only require modest changes to make this shift viable. Hydrogen-powered ships are probably ten years away, but investment in these technologies will profoundly transform the way ships are made and recycled across the world.

Current ship recycling practises are harmful to the environment and to employees in underdeveloped nations who must labour in dangerous conditions. The good news is that there is a choice. Dry-dock shipping yards are a more ecologically friendly and safer alternative to traditional ship breaking practises.

## 3.8 Design for recycling: a route to green ship recycling

The final stage of a ship's life cycle, recycling, is crucial for the regeneration of the maritime fleet. 96 percent of the ship is recyclable on average. Reusing increasingly scarce goods also reduces the burden placed on natural resources by transportation, improving the industry's environmental sustainability. Ship recycling also assists rising economies such as Bangladesh, China, India, Pakistan, and Turkey, which account for 97 percent of the world's ship recycling capacity. On the other hand, current recycling techniques may have negative social and environmental implications. Ships transport hazardous materials such as asbestos and heavy metals, which many ship recycling centres are unable to manage, posing worker health and safety problems as well as environmental damage. After raising awareness of ship recycling problems in the early 1990s, the International Maritime Organization approved the Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships in 2009. The EU has published a Ship Recycling Regulation with the purpose of limiting the harmful consequences of recycling ships flagged by Member States. The basic assumption is that ship designers should make recycling as safe, efficient, and ecologically friendly as possible. This would not only eliminate the use of materials like asbestos, (polychlorinated biphenyls), heavy metals, and lubricants that might damage employees and the local environment during disassembly, but it would also minimise risk throughout the ship's life cycle, minimising dangers to builders and crew members. Standardization of all parts and equipment on every ship to make it easier to detect end-of-life ship components for potential reuse, remanufacturing, or recycling. Another strategy for easing disassembly would be to utilise properly designed lifts. Supports for managing dismantled structural pieces to avoid accidents caused by falling components the main goals, for example, might be included into design rules via IMO codes. To cover these additional costs, the ship owner must shoulder the expense of compiling hazardous material inventory, in accordance with the 'polluter pays' concept. Costs for alternative replacement materials and design changes are also calculated to determine the most cost-effective options.

# CHAPTER - 4

# SUMMARY & CONCLUSION

## 4.1 Findings & Suggestions

Competition from neighbouring ship breaking yards in Bangladesh and Pakistan is being cited for India's poor performance. Bangladesh's competition is now more severe than Pakistan's. Bangladesh has overtaken both India and Pakistan. Bangladeshis bid more per LDT than India during the bidding procedure. India also face competition from Pakistan, which has lately gone silent owing to economic instability.

Ship recyclers in India spend more money while dismantling a ship because they must follow tougher environmental regulations. In comparison to India, Pakistan and Bangladesh have more flexibility, allowing them to pay higher rates for ships. Second, India's steel industry produces steel from ingots and billets. As a result, the steel plates from the ships are mostly sold as scrap. On the other hand, in Pakistan and Bangladesh are able to directly manufacture TMT bars from the steel sourced from the ships.

For several years, Bangladesh has increased infrastructure spending. Metro Rail, elevated expressways, and numerous more significant power plants and infrastructural projects are in the works. Furthermore, the housing sector has begun to recover from a recession. As a result, the country's need for rods has soared. Iron consumption has also risen in a variety of sectors. The ship breaking business is critical to satisfying the need for rods in these industries. Re-rollable scrap accounts for 70% of a ship's total light displacement tonnage. These are subsequently transformed into construction-grade bars and rods.

The ship type, year of construction, and, to a lesser extent, ship size are all major elements that determine the ship's trash content. Except for 2013 and 2014, when a much larger number of ships were recycled internationally, the overall number of ships recycled has been quite steady over the years. For the global financial crisis, which will affect all industries, but for the ship breaking industries, it is a boom. From 2015 to 2021, there will be a constant flow of ship breaking around the world. In the years 2016 and 2021, Bangladesh was the top ship scrapping location with 301 and 254 ships scrapped respectively. In 2017, 2018, and 2020, India was the leading location for ship scrapping. One of the main reasons for the decrease in the Chinese ship scrapping industry is the strict policies implemented by the Chinese government. One of the main reasons is increased competition. There is a global decline in ship breaking activity

in 2019 due to the COVID-19 restriction. The number of ships recycled in India has been decreasing each year. The annual LDT in India is decreasing. One of the main reasons for this is the increasing competition in the field of ship breaking. The development of ship recycling yards in countries like Bangladesh and Pakistan is also one of the major reasons for the decline in LDT in India. The total number of ships scrapped in India is similar to that of Bangladesh, but ship size is an important factor in determining the LDT. As a result, we can conclude that India scraps fewer smaller vessels than Bangladesh. Around 60 to 65 percent of the ships scrapped in India are bulk carriers and general cargo, with refrigerated cargo vessels accounting for the remaining 15 to 20 percent. The rest are oil tankers, passenger ships, and cruise ships. With China's recent decision to stop importing end-of-life ships, India, Bangladesh, and Pakistan, the major players in the ship-breaking industry, will benefit the most.

The environmental stress caused by ship breaking activity in India and Bangladesh has resulted in a decrease in biomass, as measured by the abundance and species diversity of both plants and animals. The intertidal zone has almost no vegetation. The mangroves disappeared shortly after the ship breaking industry boomed. The local marine environment has very low levels of zooplankton and phytoplankton, as well as a scarcity of fish eggs and larvae. Within 100 kilometres east and west, the coastline shows traces of pollutants as well as oil associated with the ship breaking process.

Hazards must be considered throughout the design process in order to adequately handle the negative implications of ship recycling. Design for recycling, a concept that entails addressing recycling difficulties at the design stage, has previously been used effectively in the vehicle sector. It might include finding risks, such as hazardous paints, or inefficiencies, such as oil tanks that must be physically cleaned before they can be recycled, in the context of ships.

Dry-dock stand recycling is now the greatest option to beaching. Workers recycle ships securely on a sturdy platform equipped with hazardous waste management systems and hoisting equipment. Because most ships are already built on dry-dock platforms, this strategy merely gives existing docks a new role. It is a non-invasive method of addressing a major issue.

Standardization of all ship parts and equipment to make it easier to identify end-of-life ship components for reuse, remanufacturing, or recycling. Another strategy for easing disassembly would be to utilise properly designed lifts.

## Suggestions

- Governments with limited financial and technical resources should seek assistance from international organisations to develop the necessary guidelines and operational standards for enhancing ship scrapping safety procedures.
- The administrations of the top ship breaking nations should express their concern at suitable international forums so that they may begin investigating the issue and finding acceptable remedies.
- Administrations should establish channels of communication with all impacted sectors and solicit input from them. Assistance should be offered to the industry by beginning to create required preparations for improving safety in advance, rather than waiting for the implementation of new international legislation.
- It may not be profitable, but measures on a more in-depth approach must be done by the main shipbreakers to develop well-planned ship scrapping facilities that also offer trash receiving and handling capabilities. These facilities will industrialise the demolition process, hence improving safety and working conditions in general.
- Many yards need to be updated to reduce pollution and improve security.
- In order to preserve the health of coastal waters, shipbreakers must avoid spilling petroleum products and hazardous pollutants and rigorously adhere to government regulations.
- Immediate attention is required for recycling yard improvement. Periodic monitoring of coastal ecology, including marine biodiversity and metal bioaccumulation in marine species, is required throughout the year.
- The government should guarantee that the ship recycling process stays safe and environmentally sound, and hence the entire operation should be monitored by government environmental professionals.
- Strict penalties should be imposed on ship breaking industrial entities that fail to adopt and enforce labour and environmental rules. The proper application of legislation will only serve as a deterrence mechanism to limit the frequency of deaths and accidents at ship breaking yards. The present actions against industrial units for failing to obey rules and regulations have been ineffective, allowing industrial units to get away with little penalties or fines.
- The government must describe its year-by-year infrastructure development strategy for the ship breaking yard. It must move beyond its existing model of generating merely cash and

become a key institution in supporting and promoting the interests of both employees and ship breaking industrial units.

- International laws against ship breaking should also be attempted. Various environmental groups have repeatedly urged that nations who send their ships for scrapping to India, Pakistan, and Bangladesh guarantee that their ships be de-toxified in the territorial seas of the country to which the ship belongs.
- Any future rule and regulation formation and implementation must be transparent, participative, and democratic in character. Accountability is needed of agencies tasked with enforcing different labour rules.
- The present worker training programme should be enhanced to teach personnel how to manage disasters and implement workplace safety measures. Workers must also be educated on their rights under various labour laws.
- Ship breaking unit owners must guarantee that all workers in their yard have health insurance.
- A system for recording all accidents and deaths in the ship breaking yard must be devised.
- Standard personal protection equipment and safety kits should be given to all ship breaking yard workers.
- The government should develop a system of systematic registration of all workers in ship breaking yards.

## 4.2 Conclusion

The country began to witness an increase in ship breaking activity in 2013 & 2014. Since then, direct and indirect employment has increased in the nation. Hence, an opportunity to re-engineer the various parts is created for this sector. It is essential that a certain level of regulation be in place for the sector to thrive. In the ship breaking sector, it is a major concern that environmental concerns take appropriate measures. The government involvement can create a balance of social and environmental value. Various nations are competing in this sector, such as Bangladesh, which also demonstrates the interest in scrap markets in the region. In underdeveloped countries, the demand for high-quality steel can be moulded much more into many different structures, resulting in a sustainable approach to this industry.

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