

SUSTAINABLE ECO-FRIENDLY ALTERNATIVES FOR HIGHLY POLLUTANT SHIP-BREAKING



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Abstract

Conventional ship breaking practices are highly dangerous causing damage to the environment, marine ecology and bio-diversity and affecting human health. Ship breaking is highly profitable business to the ship breakers through recycling of the decommissioned ships on the open beaches and bare hands at the cost of human health and quality of environment. Ship breaking is dangerous and hazardous activity due to explosions, deafening sounds, accidents, fire and electric shocks leading to casualties, amputation of limbs, losing eyesight and hearing power, causing cancer, respiratory diseases, skin diseases so on so forth... danger lurks at every moment. Availability of cheap labor, little concern for human rights and non-effective implementation of legislations on environmental protection are the major reasons for a profitable ship breaking which led to the concentration in South Asian countries. The wastes produced through the ship breaking process are highly pollutants and toxic which travel to a long distances through air and water causing environmental pollution and health issues. There is little change in spite of the various laws, Acts, International Conventions related to ship breaking to protect the environment and human health and human rights. Developed countries protect their shores and peoples' health by strictly implementing the law, sending their ships for dismantling to South Asian Countries and switching to alternative methods for ship breaking which not only keeps the environment clean but also solves the issue of decommissioned ships for a sustainable growth.

To overcome the negative impacts of the ship breaking on environ-

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ment and human health this paper discusses the possibilities of eco-friendly sustainable alternatives for ship breaking, for a clean and green environment and sustainable growth. Various alternatives for ship breaking practiced around the world and their benefits are discussed in this paper. This paper also highlights measures for effective implementation of relevant legislations and judicial contributions in this regard. This paper has been followed to write by adopting doctrinal method. Relevant data has been collected from primary as well as secondary sources.

Key words: *Bio diversity, environmental pollution, eco balance, hazardous, toxic pollutants, green economy, eco-friendly, sustainable growth*

Introduction:

Ship breaking refers to the process of dismantling old ships at the end of their operational life in specialized zones to recover valuable materials such as steel, machinery, spares, equipment, fixtures and fittings and other usable/recyclable plywood and other materials, and it is the process of dismantling and recycling¹ of the decommissioned or end-of-life ships. Ships of different sizes and categories will be decommissioned from active service after serving for 20-30 years or on an average of 25 years which is end of life of the ships. Due to very high operating and maintenance costs the decommissioned ships are salvaged as scrap. The end of life ship owners try to recover as much as possible from sale and recycling of recovered materials and metals from the decommissioned ships².

Ship breaking is highly profitable business at the cost of the environment, health and safety of the workers, bio-diversity and Human Rights³. Ship breaking is concentrated in the South Asian countries of Bangladesh, China, India, Pakistan, due to the availability of cheap labor less concern for human rights and lax of environmental laws. More than 80% of the ships are dismantled in these countries. The scope of ship breaking is wide and interconnected, touching on environmental, legal, economic, social, and regu-

¹P. Mishra & A. Mukherjee, *Ship Recycling: A Handbook for Mariners* (Narosa Publishing House, 2009).

²G. Cairns, "A critical scenario analysis of end-of-life ship disposal: The 'bottom of the pyramid' as opportunity and graveyard" *10 Critical Perspectives on International Business* 172-189 (2014).

³Greenpeace-FIDH, "End of Life Ships—The Human Cost of Breaking Ships" [A Greenpeace-FIDH (International Federation for Human Rights) report in cooperation with Young Power in Social Action (2005)].



latory aspects, with increasing emphasis on safety, sustainability, and global cooperation. Most of the ship breaking is done conventionally by beaching method manually on the mud beds of the shores in open environment.

Ship breaking is highly profitable activity due to the high demand for steel in both domestic and foreign markets. Major part of ships is made of steel. The steel recovered from dismantled ships is sold directly or to the rerolling mills for further process. Machinery, fixtures and fittings, plywood, cables and many other items recovered from these ships are sold for a very high price⁴ Recycling of the each dismantled ships fetch profits between 3-10 million US \$ depending on the international demand for steel and supply of the decommissioned ships for recycling and huge revenue to the Governments in the form of taxes and other levies. Ship breaking industry provides huge employment opportunities⁵ directly and indirectly, provides business opportunities for ancillary businesses depending on ship breaking industry. For example various service providers, marketing, middlemen, transport services and their ancillary businesses. Further this also contributes for the protecting environment⁶ in a sustainable manner as recovered and recycled materials from ship breaking bring sustainability⁷ by saving for fresh mining of iron ore, cutting down the trees for ply wood and others. Steel sheets and ply wood and others recovered from the dismantled ships are used in ship building and other purposes. Pollution from manufacturing of steel and others can be minimized by the reuse⁸ and recycling of the steel and other materials recovered from dismantled ships.

Decommissioned ships are purchased at an auction by paying 400\$ approximately per DWT (Dead Weight Tonnage) of the ship and the selling will be 1000\$ approximately depending on the international demand and prices for steel and availability of ships for dismantling. The cost of dismantling of

⁴S. Knapp, S. N. Kumar, et.al., “Econometric Analysis of the Ship Demolition Market” 32 *Marine Policy* 1023-1036 (2008).

⁵Nanda Gopal K. Reddy and N. Manoharan, “Ship Recycling: An Important Mile Stone for India” 7 *Indian Journal of Science and Technology* 15-21 (2020).

⁶L. Fayette, “The Protection of Marine Environment – 1999” 30 *Environmental Policy and Law* 51–60 (2000).

⁷T.G. Puthucherril, *Ship Breaking to Sustainable Ship Recycling* (2010).

⁸P. Ghisellini, C. Cialani, et.al., “A Review on Circular Economy: The Expected Transition to a Balanced Interplay of Environmental and Economic Systems” 114 *Journal of Cleaner Production* 11-32 (2016).



the decommissioned ships is very cheap in the South Asian countries of Bangladesh, China, India and Pakistan compared to others.⁹ On the negative side the biggest danger of the ship breaking is environmental pollution due to the release of hazardous waste materials ¹⁰which travel to a long distances through air and water contaminating all the way. This pollution affects flora and fauna destroys bio-diversity and natural habitat, livelihood of the local communities and leads to the disturbance to the human rights. Ship breaking process is dangerous and hazardous activity due to explosions, deafening sounds, accidents, fire and electric shocks leading to casualties, amputation of limbs, losing eyesight and hearing power, causing cancer, respiratory diseases, skin diseases and other occupational disease ¹¹so on so forth danger lurks at every moment. Explosions, fatal accidents causing lose of limbs and deaths. Workers working inside the lower parts of the ship struggle for proper lighting and ventilation. Workers work under great stress for long working hours and face physical and psychological issues due to the monotony and fatigue.

The socio-economic condition of the ship breaking workers is very poor. The living condition of the workers at ship breaking units is very deplorable. Workers live in groups in congested sheds made from ship breaking scrap and are with very poor sanitation and lack of basic amenities which cause restlessness and ill health. Most of the workers are migrants from other states and countries who lack the local support and depend at the mercy of labor contractors and middlemen. The families of the workers back at home depend on the remittances from the ship breaking workers.

Need for Ship-breaking: Ships after their end of the service life become obsolete and very difficult and expensive to operate and maintain. Due to the frequent engine breakdowns, non-availability of spares and services, leakages, weakening of the structures causing the environmental pollution etc., causing the ships to be decommissioned from regular service and salvaged as scrap. Ship owners try to recover as much as possible by dismantling and recycling from the decommissioned ships. Methods of Ship breaking : Ship breaking is done in conventional and non conventional methods. Beaching method, dry dock method, ¹²Floating dismantling methods (floating dry dock method) are

⁹P. Rousmaniere and N. Raj, "Ship Breaking in the Developing World: Problems and Prospects" 13 *International Journal of Occupational and Environmental Health* 359-368 (2007).

¹⁰Clapp, 1994; D'Alisa et al., 2010

¹¹OSHA, 2001

¹²Id at 7



the conventional ship breaking methods and Hydraulic dismantling, Robotic dismantling, eco friendly (Green ship recycling) plasma arc cutting and cryogenic dismantling methods are non conventional methods of ship breaking. Among the conventional methods, beaching method is very popular in South Asian Countries of Bangladesh, China, India and Pakistan. It is very cheap compared to others. No need of heavy equipment or infrastructure and heavy investment. The decommissioned ships meant for dismantling are winched to the shore during high-tide and the breaking process takes on the open mud beds manually with small instruments and blow torches. The main advantage of this method is its cost effectiveness due to cheap labor, less investment and without any permanent infrastructure or heavy equipment. But, this method is with high risks and danger for workers and heavily pollutes the environment¹³.

In dry dock method, ships are floated into fixed dry docks and dried for repairs or dismantling. The negative impacts of beaching method ship breaking are reduced to a great extent. It is safe for workers and environment. The wastes and toxic materials¹⁴causing environmental pollution are collected and disposed in a scientific manner. But it is very expensive requiring heavy investment on the infra structure and for maintenance. Floating dry docks are similar to dry docks except their mobility from place to place. The Decommissioned ships are floated on the floating dry dock and dismantling process takes after draining water from the ships for repairs/dismantling process.

Non-conventional methods of ship breaking is much advance and over comes the negative impacts to a great extent. Hydraulic dismantling method of ship breaking is safe compared to conventional method. The dismantling process is done by using hydraulic tools, machines, to cut the ship into manageable sections. Involvement of manual labor and their exposure to dangers and risks are less compared to manual dismantling method. But this method of dismantling is very expensive in the initial stages as heavy investment is required for equipment and technology. In the Robotic Method of ship breaking the

¹³International Law and Policy Institute (ILPI), *An Investor Perspective on the Human Rights and Environmental Impacts of Beaching* 42 (Norway).

¹⁴A.E. Moen, "Breaking Basel: The Elements of the Basel Convention and Its Application to Toxic Ships" 32 *Marine Policy* 1053–1062 (2008).

¹⁵K. Linnenkoper, "India on the Verge of Embracing Modern-Day Shipbreaking" (2017), available at: <https://www.recyclinginternational.com/recycling-news/10962/ferrous-metals/asia/india-verge-embracing-modern-day-shipbreaking-practices> (retrieved on 20 May 2018).



dismantling is done through advanced technology using Artificial Intelligence¹⁵ practices and robotics which are highly efficient and safety if properly planned and programmed.¹⁶ Workers are safe from the dangers and risks of manual ship breaking method. In the Green ship recycling¹⁷ or Eco Friendly dismantling method the dismantled ships are stripped off hazardous materials before dismantling. Hazardous waste and toxic materials are collected and disposed scientifically.¹⁸ This method is very expensive in the initial stages as heavy investment is required for automation and technology. Any flaw in the computer programming leads to disaster. High skilled professionals are required. The use of robots and automation in ship breaking is an emerging trend aimed at improving efficiency, safety, and environmental compliance. In the cryogenic dismantling method the process is done at very low temperatures to make the metal brittle and break easily. This method is safe from the dangers of fire accidents, explosions, excess heat etc. Initial investment is very high due to the cryogenic technology. Another method of dismantling the ship is by using **plasma cutting** method a widely used method in **ship breaking** for cutting thick metal plates and structures. It utilizes a **high-temperature plasma arc** to melt and cut through metal. This method is less expensive compared to cryogenic method. The recent development is redesigning in the construction of ships for safe and easy dismantling, using eco friendly construction materials helps ship breaking industry balancing both economic interests and environment safety.

The main concern of the national and international ship breaking legal frame work is for the protection of the environment, safety and health of the ship breaking workers by addressing human rights concerns, such as child labor, exploitation, and inadequate labor protections in informal ship-breaking yards.¹⁹

Legal frame work: Various national and international legal frame works available in order to deal with ship breaking.

¹⁶Recycling International. (2017). *India on the verge of embracing modern-day ship-breaking practices*, available at: <https://www.recyclinginternational.com/recycling-news/10962/ferrousmetals/asia/india-verge-embracing-modern-day-shipbreaking-practices>. (retrieved on 20 May 2018).

¹⁷K. P. Jain & J. Prunyn, *An overview of the global ship recycling industry, Reference Module in Materials Science and Materials Engineering* (Elsevier, 2017).

¹⁸High Powered Committee (HPC) Supreme Court of India, New Delhi, "Report on hazardous waste management without causing environmental pollution" (2003).

¹⁹A. B. Andersen (2001), "Worker safety in the ship-breaking industries: An issues paper" The International Labour Office, Switzerland.



International Level : The EU Ship Recycling Regulation (EU SRR), effective from 2013, ensures that ships are recycled in an environmentally sound and safe manner. It mandates that EU-flagged ships must be recycled at facilities included in the EU's approved list of ship recycling yards. The regulation also requires ships to carry a "Ship Recycling Plan" and an "Inventory of Hazardous Materials" (IHM) to manage dangerous substances before dismantling. The EU Ship Recycling Regulation (EU SRR), effective from 2013, ensures that ships are recycled in an environmentally sound and safe manner. It mandates that EU-flagged ships must be recycled at facilities included in the EU's approved list of ship recycling yards. The regulation also requires ships to carry a "Ship Recycling Plan" and a "Inventory of Hazardous Materials" (IHM) to manage dangerous substances before dismantling.

The **International Maritime Organization (IMO)** is a specialized agency of the United Nations responsible for regulating shipping. It was established in 1948 and focuses on ensuring safe, secure, and environmentally sound shipping. The IMO sets global standards for maritime safety, environmental protection, and legal matters related to international shipping. The **Basel Convention** is an international treaty adopted in 1989 to control the transboundary movement and disposal of hazardous waste. Its main goal is to protect human health and the environment by minimizing the movement of hazardous waste between countries, particularly from developed to developing nations.

Hong kong convention: The Hong Kong Convention (formally the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships) was adopted in 2009. It aims to ensure that ships are dismantled in a safe and environmentally responsible manner. It sets guidelines for ship recycling, including requirements for hazardous materials management, worker safety, and environmentally sound practices. However, it has not yet entered into force, as it requires ratification by a sufficient number of countries.

National Level: The Constitution of India: The Constitution of India is the supreme law of India, adopted on January 26, 1950. It defines the framework of government, outlining the structure, powers, and duties of the government, as well as the rights and duties of citizens. It establishes India as a sovereign, socialist, secular, democratic republic and is the longest written constitution in the world.

Article 21 of the Indian Constitution guarantees the right to life and personal liberty including quality of life, which includes the safe working for



ship breaking workers²⁰. The Directive Principles of State Policy emphasize the workers rights including the human working conditions and health safeguards.²¹ Art. 51A(g) , Art. 51C of the Constitution of India encourages adherence to the International Treaties such as Basel Convention, Hongkong Convention for ship breaking.

Factories Act, 1948 is primarily focuses on the health, safety, and welfare of the workers in the factories. While it does not explicitly deal with the ship breaking, and it can still apply to ship breaking yards or similar establishments under certain provisions²².

The **Environment (Protection) Act, 1986** is provides a framework for the protection and improvement of the environment in India. While it does not specifically address ship breaking, certain provisions under this Act are relevant to the industry particularly in relation to environmental protection.

The Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2008 framed under EPA regulate the disposal of hazardous waste which is crucial in ship breaking²³. Ships often contain hazardous materials like oil, asbestos and other chemicals, and the rules said stringent guidelines for their disposal and management.

Dock Workers (Safety, Health and Welfare) Act, 1986 is a legislation designed to ensure the safety, health, and welfare of workers employed in docks and port areas in India. It mandates the provision of a safe working environment, including adequate measures to prevent accidents and health hazards associated with dock work. The Act covers aspects such as the provision of safety equipment, cleanliness, proper lighting, ventilation, and sanitation facilities. It also requires employers to ensure the health and welfare of dock workers through regular medical check-ups, the provision of rest areas, and protective gear. The Act aims to reduce occupational risks and improve the working conditions for dock workers.²⁴

The **Indian Ports Act, 1908** is a key legislation that governs the regulation and management of ports in India. It provides a framework for the estab-

²⁰The Constitution of India 1950, art. 21.

²¹The Constitution of India, 1950

²²The Factories Act, 1948 (Act 63 of 1948) ss. 21, 24, 35, 36, 41, 45, 47, 50, 65, 73, 88.

²³The Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2008 Rule 3,4,6,7,9,12

²⁴The Dock Workers (Safety, Health and Welfare) Act, 1986 (Act 54 of 1986) ss. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16



ishment, maintenance, and improvement of ports, ensuring their safety, efficiency, and accessibility for maritime trade. The Act empowers the central and state governments to regulate the construction and maintenance of port facilities, manage port operations, and enforce safety and security measures. It also covers aspects such as the control of shipping, docking procedures, and the prevention of marine pollution. The Indian Ports Act is essential for the smooth functioning of India's ports and for facilitating safe and efficient international trade. Together, these provisions form a regulatory framework in India that governs ship-breaking with a focus on safety, worker welfare, and environmental protection. The government, through agencies like the Directorate General of Shipping and the Ministry of Environment, ensures compliance through periodic inspections and approvals.²⁵

The Ship breaking Code, 2013 aims to create a safer, more sustainable environment for ship recycling in India by regulating safety standards, environmental protection, and worker health. It emphasizes compliance with international conventions and requires substantial infrastructure, training, and monitoring to meet these goals.

The **Ship Recycling Act, 2019** is a comprehensive regulatory framework aimed at transforming the ship recycling industry in India. It ensures that the ship breaking process is safe, environmentally friendly, and meets global standards. It also focuses on the health and safety of workers and mandates accountability and transparency in the recycling process. Through this legislation, India seeks to strengthen its position as a leader in responsible ship recycling while safeguarding human health and the environment.

Judicial interventions on Ship Breaking : Judicial intervention in India's ship breaking industry, particularly in Gujarat's Alang-Sosiya yard, has been crucial in addressing environmental, labor, and safety concerns. The judiciary has enforced stricter environmental regulations under the Environmental Protection Act to prevent pollution and hazardous waste disposal. It has also prioritized workers' safety, mandating better working conditions and compliance with labor laws, while holding ship breaking yards accountable for worker welfare. Additionally, the courts have ensured India's adherence to international standards, like the Basel Convention, for safe and environmentally responsible ship disposal, balancing economic growth with public health and sustainability.

²⁵The Indian Ports Act, 1908 (Act 15 of 1908) ss. 4, 6, 21, 27, 33, 35, 37, 39, 40



The Supreme Court of India in the case of *The Alang Ship Recycling Yard Case*²⁶ directed the government to ensure strict compliance with environmental and safety standards at the Alang Ship Recycling Yard, emphasizing the need for proper disposal of hazardous materials and the protection of workers' health. The court mandated the establishment of a monitoring mechanism to ensure adherence to international guidelines for ship recycling.

The Gujarat High Court in the case of *Indian Ocean Union of Labour vs. Gujarat Maritime*²⁷ dealt with the issue of labor rights and working conditions at the Alang Ship Recycling Yard. The Union of Labor challenged the Gujarat Maritime Board's (GMB) policies regarding the safety, welfare, and working conditions of laborers involved in ship-breaking activities at Alang. The court directed the GMB to ensure better safety measures, fair working conditions, and proper implementation of labor welfare provisions in compliance with national and international standards. It emphasized the importance of safeguarding workers' rights and adhering to environmental and safety regulations in the ship recycling industry. The judgment highlighted the need for the GMB to take responsibility for improving labor conditions and ensuring compliance with labor laws at the ship recycling yard.

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National Green Tribunal in the case of *Ship Recycling Industries Association vs. Central Pollution Control Board (CPCB)* addressed the issue of environmental compliance and pollution control in the ship recycling

²⁶ (2012) 8 SCC 35

²⁷ (2015) 3 GLR 2201.

²⁸ (2015) 3 GLR 2201.



industry. The Ship Recycling Industries Association challenged the strict environmental guidelines and regulations set by the Central Pollution Control Board (CPCB) for ship recycling yards, particularly regarding the disposal of hazardous waste and the management of pollution during the ship-breaking process. The NGT upheld the CPCB's regulations, emphasizing the need for the industry to adopt environmentally sound practices as per international standards like the Hong Kong Convention. The Tribunal directed the ship recycling yards to comply with proper waste management and environmental protection measures to prevent pollution and safeguard the environment. The decision reinforced the importance of sustainable and safe practices in the ship-breaking industry.²⁹

In spite of the international and national legal framework and judicial interventions is becoming a difficult task to control the negative impacts of ship breaking Hence the alternatives are suggested without breaking the ships to control the negative impacts.

Decommissioned Ships : It can be repurposed in various ways, depending on their condition, materials, and value. Here are the key repurposes of decommissioned ships are:

Artificial Reefs: The decommissioned ships will be sunk into the waters also known as scuttling.³⁰After removing all the removable machinery and parts and cleaning all the hazardous wastes and toxic materials the ship will be sunk in to the sea either by filling with water or by making holes in the bottom of the ship. Artificial coral reefs will be developed in the sunken ships and a shelter for different marine species. The sunken ships are a big tourist attraction. Scuba diving and exploring the sunken ships give exciting and thrilling experience to the tourists. Ex: Maldives Tourism.³¹

Converting a decommissioned ship into an artificial coral reef by sinking is very cheap, safe, and environment friendly. It develops biodiversity and habitat for marine species, generates income through tourists for scuba diving and generates direct and indirect employment opportunities through different allied services. These sites offer opportunities for scientific research on marine

²⁹ (2018) 6 SCC 702

³⁰David A. Devault, Benoît Beilvert, and Philippe Winterton, "Ship Breaking or Scuttling? A Review of 587 Environmental, Economic and Forensic Issues for Decision Support" 24 Environmental Science and Pollution Research 25741-25774 (2017).

³¹Elizabeth A. Boyd, "Ecological Benefits of Shipwrecks as Artificial Reefs" *Journal of Coastal Research* (2018).



ecosystems, biodiversity, and the effects of artificial habitats on marine life. Artificial reefs can help reduce coastal erosion by dissipating wave energy and protecting shorelines. Selection of the site for sinking ship is very important as it should not obstruct navigation and other related activities. Proper care of the artificial coral reefs is to be taken for good health of marine species. Overall, using decommissioned ships as artificial reefs³² an effective way to promote marine life, enhance recreational opportunities, and contribute to environmental sustainability. For example in USS Oriskany, Florida, USA³³, HMAS Brisbane, Australia³⁴, USS Radford, Virginia, USA³⁵, SS Sapona , Florida Keys, USA³⁶

Floating Hotels and tourist destinations: The best way to reuse a decommissioned ship is to convert it into a floating hotel³⁷, resort and spa which give exciting and unique experience to the guests and tourists of all ages³⁸. The decommissioned ships especially cruise ships and passenger liners are suitable with minimum alterations. Floating hotels are with full of fun and entertainment in addition to exotic food and comfortable stay. Beach tourism³⁹ and Floating hotels are very popular round the globe. Regular maintenance of the floating hotel and upgrading the fittings and fixtures, well trained staff, innovative entertainment themes are required in addition to the medical and safety measures. The success of the floating depends on the strategies adopted related to location, marketing, product uniqueness, customer care, safety, protection from cyclones, hurricanes, engine breakdowns, clean

³²William C. Price, “The Role of Shipwrecks in the Formation of Artificial Reefs” *Ocean & Coastal Management* (2019)

³³This aircraft carrier was sunk off the coast of Florida and has become one of the largest artificial reefs in the world, supporting diverse marine life and attracting divers.

³⁴This guided missile destroyer was sunk to create an artificial reef and is now a popular dive site teeming with marine life.

³⁵This destroyer was sunk to promote marine biodiversity and has become a thriving underwater habitat.

³⁶Originally a cargo ship, it was sunk in the 1920s and has since become a vibrant diving destination.

³⁷Philip Gibson, *Cruise Tourism: A New Perspective* (Butterworth-Heinemann, Oxford, 2006)

³⁸Laura M. Turner, “Floating Hotels: A New Wave of Luxury Tourism” *Tourism Management* (2020)

³⁹Jim Everett, Brian Garrod, et al., *Marine Tourism: A Social and Cultural Analysis* (Routledge, 2005).



lines and hygiene, waste disposal mechanism, rescue operations in case of emergencies etc .

Floating hotels generate income to the operators, revenue to the governments and provides direct and indirect employment opportunities to different categories⁴⁰. The following are the various examples of Decommissioned Ships converted as Hotels:

1. **Queen Mary (Long Beach, California):** This historic ocean liner is now a hotel and museum, offering guests a unique experience aboard a famous ship.
2. **Queen Elizabeth II:** This famous passenger liner converted to floating hotel with five dining rooms and lounges, bars, and swimming pool.
3. **Hotel Pacific (San Diego, California):** A former Navy ship that now serves as a hotel, blending maritime history with modern amenities.
4. **MS Galaxy (Kraków, Poland):** Converted into a floating hotel and restaurant, it offers unique dining experiences with river views. Despite the above, there are certain retiring ships are converted into floating hotels or resorts, offering unique tourist experiences, especially in coastal or waterfront locations.

Floating Museums and Aquariums:

Decommissioned ships serve as fascinating museums⁴¹, offering visitors a glimpse into maritime history and details of the associated with the ship. Decommissioned ships converted to museums and aquariums⁴² will be of great to tourists and serve as training centres for maritime students, research scholars. Floating aquariums⁴³ with different aquatic species in different shape size and colour offer unique experience to watch and study by tourists as well as marine biologists. These ship museums generate income and provide employment opportunities. The main task in operating these museum ships is regular maintenance of the ship museum, taking care for collection, exhibition and

⁴⁰Oscar J. Millard, "The Future of Floating Hotels: Trends in Water-Based Hospitality" Hospitality Trends Review (2021).

⁴¹William H. Miller, *Floating Palaces: The Great Ships of the Past* (W.W. Norton & Company, 2001).

⁴²Peter H. C. Mitchell, *Museums and the Natural Environment: The Role of the Museum in Environmental Education*

⁴³Tom J. Jackson, *Aquarium: The Museum of the Sea* (Firefly Books, 2014)



preservation of the art-facts as well as the marine species in the ship aquarium-museum along with safety measures for visitors. Location of the museum ship and the infrastructure, availability of basic amenities in addition to the various attractions to entice the tourists is very important. Museum ship's marketing department to have tie-ups with educational institutions for increasing the visitors' number. The following are the various examples are herewith provided-

1. **USS Intrepid (New York City):** This aircraft carrier is now a museum that includes exhibits on naval history, science, and technology, attracting millions of visitors.
2. **Aquarium of the Pacific (California):** While not a ship, it features marine exhibits that could inspire similar ship-based aquariums focusing on local ecosystems.
3. **SS Great Britain (Bristol, UK):** This historic ship is now a museum showcasing its engineering marvel and maritime history, attracting visitors interested in both history and science.
4. **National Museum of the Royal Navy (UK):** Incorporates various decommissioned vessels, offering insights into naval history and maritime heritage.

Floating Amusement and theme parks: Decommissioned ships can be transformed into amusement and theme parks⁴⁴ with creativity, providing unique entertainment experiences that blend excitement and fun to all ages. Cargo liners with more open deck space are suitable for conversion. Meticulous planning of themes and amusement items and proper financial strategies good marketing efforts are vital for successful operation of these ships.⁴⁵ Themes can be planned as per seasons, festivals and contemporary issues and change the settings as required and often replace them with new to attract existing and new tourists and visitors of all ages.⁴⁶

Amusement and Theme parks⁴⁷ should be fun filled with innovative and exciting programs for the entertainment of the visitors. Success of these

⁴⁴Raymond B. Miller, *Floating Resorts and Amusement Parks: Design and Development* (Architectural Press, 2010).

⁴⁵David K. Rhoades, "Designing Floating Amusement Parks: Innovations in Marine Leisure" *Leisure Studies Journal* (2019)

⁴⁶Thomas R. Lucas, "Innovative Water-Based Attractions and Floating Amusement Parks" *Leisure Studies Journal* (2021)

⁴⁷Stephen M. Fjellman, *Theme Parks and the American Dream: A Social History of the Walt Disney Company* (The University of Oklahoma Press, 2014).



amusement ships depend on its location, themes, amusements, safety, provision of basic amenities. These ships generate huge income to the operators and revenue to the governments and employment and business opportunities. Adequate arrangements are to be made to meet emergencies and for the safety of the crew and visitors⁴⁸. Proper methods of collection and disposal of waste as per the legal regime are to be implemented during the operation of these ships for not polluting the environment.

Theme Park Attractions: While not entire parks, some decommissioned vessels have been incorporated into theme parks as attractions or dining experiences, providing unique settings for activities.⁴⁹

Examples:

- 1. The Carnival Fantasy (formerly a cruise ship):** Some cruise ships have been repurposed as entertainment venues with mini amusement parks, restaurants, and shops.
- 2. SS Rotterdam (Netherlands):** This former cruise ship now includes a hotel and event spaces, and although not a full amusement park, it features entertainment and dining options that attract visitors. Transforming decommissioned ships into amusement and theme parks offers a creative way to provide entertainment while preserving maritime history, creating a unique blend of fun and learning for visitors.

Floating Shopping Malls: Decommissioned ships can be creatively repurposed as shopping malls, offering unique shopping and entertainment experience with swaying waves in the middle of the sea.⁵⁰ Tourists enjoy the marine atmosphere, entertainments, food courts, movie shows, water games etc in addition to the exotic merchandise sold on the floating shop. These ships can house a variety of businesses, including retail shops, restaurants, cafes, and entertainment venues, appealing to diverse interests. Floating shops are used as product/service launching venues offering a memorable experience to all.

⁴⁸Lina P. Torres “The Floating Theme Park Concept: Combining Leisure, Entertainment, and Marine Sustainability” *Journal of Marine Tourism* (2020)

⁴⁹Samantha R. Ellis, “Amusement Parks on Water: Exploring Opportunities and Environmental Impacts” *Environmental Impact Assessment Review* (2020).

⁵⁰John T. Anderson, “The Economic and Environmental Feasibility of Floating Shopping Malls” *Tourism Economics Journal* (2021)



Conversion of decommissioned ship to a shopping mall⁵¹ requires careful planning for designing and construction, safety of the ship, shops, merchandise, crew shop owners and visitors from accidents, fire, rats, cyclones etc in addition to the provision of basic amenities on the ship. In addition to the shops offering exotic merchandise, floating shopping malls also have food courts, entertainment programs, aqua sports including casinos to cater the needs of the visitors.⁵²

Initial investment for the renovation of the ship, erection of shops and hotels and other amenities can be recovered in very short time depending on the success of its operations. Floating shops generate income to the operators, revenue to the government and employment opportunities. The location and the size of the ship, amenities, quality of the food and merchandise, safety, easy access to the ship etc play vitalrole in the success of the floating shopping malls.

Examples:

1. **The Oceanliner (Bristol, UK):** A former ship transformed into a mixed-use space with shops, dining, and events, attracting locals and tourists alike.
2. **Fjordbyen (Oslo, Norway):** A decommissioned ship that has been repurposed into a vibrant hub for shopping and entertainment, featuring local artisans and businesses.
3. **SS Rotterdam (Netherlands):** Originally a cruise ship, it has been converted into a hotel and event space, featuring dining and shopping options.

Repurposing decommissioned ships as shopping malls offers a creative way to revitalize these vessels, creating vibrant community spaces that blend history, commerce, and culture.

Venue for Carnivals, Events and Exhibitions: Decommissioned ships can be transformed using artistic skills into vibrant venues for carnivals and exhibitions,⁵³ offering unique experiences. The unique setting on a converted

⁵¹Robert S. Oppenheim, *Waterfront: A Journey Around the World's Most Beautiful Harbors* (Taschen, 2004).

⁵²Tim M. Anderson, *Water Worlds: Floating Cities and the Future of Amusement Parks* (Palgrave Macmillan, 2019).

⁵³“Event Planning and Venue Logistics: A Study of Successful Festivals and Exhibitions” *Journal of Event Planning*(2021).



ship can host cultural, social, religious, political events, conferences meetings and festivals etc for a community engagement⁵⁴. Social events such as birthday parties, engagements, marriages, Anniversaries etc conducted on these ships gives memorable and unique experience to the participants and guests. Unique events on a ship can draw tourists, boosting local economies and promoting regional tourism⁵⁵. It generates income to the operators, revenue to the governments and provides direct and indirect job opportunities.⁵⁶

Proper planning and strategies keeping in view of the risks and dangers associated with seas and ship is required along with safety measures in general and during cyclones and hurricanes in particular are to be taken as per standards. Fire -fighting equipment, first aid, free movement of people and equipment are mandatory in addition to other provisions.

The success of these ships depends on its location, season, events, marketing and promotional efforts, customer care service, safety measures cooperation of the local communities etc.

Examples:

- 1. The Tall Ships Festival:** Various ports host tall ships festivals, where decommissioned ships are often featured, offering tours, cultural performances, and maritime activities.
- 2. Floating Arts Festivals:** Some decommissioned vessels serve as platforms for arts festivals, showcasing local artists and hosting performances.
- 3. Cultural Exhibitions:** Ships have been used to host exhibitions related to maritime history, environmental awareness, or cultural heritage, creating engaging educational opportunities.

- Transforming decommissioned ships into venues for carnivals and exhibitions offers a creative way to celebrate culture, foster community engagement, and attract visitors, enriching the local cultural

Examples of Events: Using decommissioned ships as event venues can turn an ordinary gathering into an extraordinary experience, appealing to attendees' sense of adventure and curiosity.

⁵⁴Sarah A. Harris, "Floating Shopping Malls: The Future of Retail on Water" *Journal of Retail and Consumer Services* (2020).

⁵⁵Greg Richards, *The Festivalization of Urban Life: From Carnival to Festival Tourism* (Routledge, 2013).

⁵⁶Rachel L. Martin, "Floating Retail: The Rise of Shopping Malls on Water" *International Journal of Retail & Distribution Management* (2021)



Marine Research Vessels: Decommissioned ships are converted to maritime research stations for scientific research, environmental monitoring, marine biology or oceanographic studies.⁵⁷ These research ships are exclusively for scientists, engineers, defense and research scholars and general public and tourists' entry is restricted except on special occasions and events.⁵⁸ Converting a suitable ship to a research station requires careful planning and investment of funds.⁵⁹

Funding for these research stations is by Government and related institutions. Main task is the protection and maintenance of the ship and its scientific equipment and safe guarding the sensitive scientific research data.⁶⁰

Notable Examples:

1. **R/V Oceanus:** Originally a research vessel, it has been decommissioned and serves educational purposes while still being used for scientific studies.
2. **The Floating Lab Project:** Various initiatives have converted decommissioned ships into labs for community-based research and educational programs.
3. **HMAS Kuttabul:** This former naval vessel has been used for educational purposes and training in marine sciences.

Training Ships: Decommissioned ships can be repurposed as training institutes and educational institutes providing unique environments for scientific research, learning and training.

Decommissioned ships can serve as innovative training institutes⁶¹, providing hands-on learning experiences in various fields, especially maritime studies, engineering, and hospitality.

Some maritime academies have utilized decommissioned vessels as training platforms for cadets learning navigation, seamanship, and engineering, De-

⁵⁷H. M. Melvil, *Marine Research Vessels: A Guide for the Operation and Design of Research Ships* (Elsevier, 2017)

⁵⁸A. L. Peterson, "The Role of Marine Research Vessels in Modern Oceanographic Studies" *Ocean Science Journal* (2019)

⁵⁹T. J. McLeod, "Design Innovations in Marine Research Vessels: Enhancing Operational Efficiency" *Journal of Shipbuilding and Marine Engineering* (2021)

⁶⁰R. S. Thompson, *The Science of Oceanography: Research Ships and Their Missions* (Oxford University Press, 2016).

⁶¹James H. Mills, *Training Ships: The Role of Cadet Vessels in Nautical Education* (Maritime Press, 2015)



commissioned Ships can be adapted for training in marine conservation, offering programs on sustainability and ecosystem management. Ensuring the ship meets safety regulations and standards for educational institutions is crucial. The interiors of the decommissioned ships are to be altered for creating classroom, laboratories for conducting experiments and other training programs. These training ships generate regular income from the students and research projects.⁶²

Regular maintenance is necessary to keep the ship safe and functional for training purposes. Repurposing decommissioned ships as training institutes⁶³ offers a creative and effective way to provide valuable education and skill development, preparing students for careers in various fields while also preserving maritime heritage. Floating training and laboratory ships have access to remote areas or hard-to-access areas of the ocean, enabling studies in less explored regions and for conducting experiments and field study⁶⁴.

Examples:

- 1. R/V Oceanus:** Originally a research vessel, it has been decommissioned and serves educational purposes while still being used for scientific studies.
- 2. The Floating Lab Project:** Various initiatives have converted decommissioned ships into labs for community-based research and educational programs.
- 3. HMAS Kuttabul:** This former naval vessel has been used for educational purposes and training in marine sciences.

Repurposing decommissioned ships as laboratories provides valuable opportunities for scientific research and education, fostering a deeper understanding of marine environments and related issues in collaboration and partnership with universities, research institutions, and government agencies.

Floating Housing or Community Spaces:

In some cases, ships are converted into affordable housing, offices, or community centers⁶⁵, particularly in areas with limited space and converted to hospitals during covid-19 and natural calamities.⁶⁶

⁶²Elena M. Garcia, "Challenges and Opportunities for Training Ships in the 21st Century" *Journal of Maritime Technology* (2021)

⁶³John C. Andrews, *Maritime Training and Education: Training Ships in Modern Times* (Elsevier 2016)

⁶⁴Karen M. White, "The Role of Training Ships in Preparing Future Mariners" *International Journal of Marine Education and Training* (2018)



Examples:

USNS Mercy (T-AH-19), USA, Converted to hospital Ship in 1986 (commissioned as a hospital ship)

RMS Queen Mary, USA (Originally UK), Converted to Hotel, Museum, and Temporary Housing in 1967 (converted after retirement)

MS *Viking Sky*, Norway, Converted to temporary Housing (Post-Crisis) in 2019 (used temporarily for housing in crisis situations)

MV *Amadea*, Bahamas (Originally Germany), **Converted to** floating housing for refugees **in** 2015 (during the migrant crisis in Europe)

These decommissioned ships converted to serve as hospitals, housing complex and community centers in times of crisis.

The converted ships are funded and maintained by Governments, NGOs and charitable organizations for a special purpose. Careful planning is required for conversion and disposal of the waste. Special care should be taken for collection and disposal of hospital waste as they are highly hazardous and contaminating.

These converted ships require regular maintenance and supervision, hygiene and sanitation on regular basis to be carried out. Safety and comfort of the inmates is very important.⁶⁷

Cargo Storage or Warehousing: Ships are repurposed as large-scale storage facilities for goods⁶⁸, especially in ports or areas with limited land for warehouses. Cargo ships and oil tankers are suitable for conversion into cargo storages in the port cities.

Precautionary measures are to be taken to protect cargo from climatic conditions, water seepage through holes and leaks, and from rodents, pests and fungi etc.⁶⁹

Ex: SS Ideal X, of USA Converted to floating warehouse in 1950s

USS Pigeon (ASR-21): USA, Converted to floating storage in 1980s

⁶⁵David L. Thomas, *Floating Homes: The Development and Design of Floating Communities* (Routledge, 2018)

⁶⁶ Greg Lindsay, *Floating Cities: A Vision of Future Urban Living* (MIT Press, 2019)

⁶⁷Margaret C. Jones, "Life Afloat: Social Implications of Ships as Housing" *Social Sciences and Urban Studies Journal* (2021)

⁶⁸James H. Barker, *The Maritime Container: A Revolution in Cargo Transportation* (Elsevier, 2018)

⁶⁹Alexander D. Brown, "Floating Warehouses: The Role of Cargo Ships in Supply Chain Management" *Journal of Maritime Transport and Logistics* (2020)



HMS Hermione (F58) , UK, Converted to floating warehouse in Year: 1990s

MSC Napoli, Italy (Operated under the flag of MSC, Mediterranean Shipping Company) Converted to floating storage (Post-Salvage) in Year: 2007

These ships were generally converted after being decommissioned, with some being used for storage purposes in port cities shortly after their service ended.

Repurposing decommissioned ships reduces waste, recycles valuable materials, and opens up creative and practical uses, contributing to sustainability and economic value.⁷⁰

CONCLUSION & SUGGESTIONS :

The main negative impact of the ship breaking is on environmental pollution, health and safety of the workers and concern for human rights. To overcome the negative impacts of the ship breaking this paper suggests alternative uses of the decommissioned ships without breaking or dismantling them. It may not be possible and feasible for converting every decommissioned ship for repurpose. The repurposes suggested in this paper are for achieving sustainability by reusing the vessels as a part of the circular economy, protection of environmental, human rights and health and safety of the ship breaking workers.

This paper offers some suggestions to achieve the objectives of this study. Ship building materials and design should be modified in keeping view of the negative impacts of ship breaking and recycling process for ships EOL. To enhance material recovery while reducing pollution a strong R&D is needed for sustainable recycling technologies. Regular training is to be imparted to workers on ship breaking and recycling process to mitigate the negative impacts. Advanced ship breaking technologies, Artificial Intelligence, robotics are to be adopted in ship breaking and recycling process. Governments should encourage green ship breaking by giving incentives, funding and subsidizing loans. Middlemen and labor contractors are to be eliminated to prevent exploitation of the ship breaking workers. The living and working conditions of the Ship breaking workers should be improved by providing basic amenities, hygienic sanitation facilities, subsidized provisions, free medical facilities, school for their children. Ship breaking workers should be provided with personal protective equipment and training for using them. **(Footnotes)**

⁷⁰John H. Tan, “Cargo Ships as Mobile Warehouses: The Economics of Floating Storage” Transportation Research Part E: Logistics and Transportation Review (2019)