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Policy Brief

Circularity in the Marine Environment and Sustainable Ship Recycling in Pakistan

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Executive Summary

Pakistan's ship recycling industry, predominantly concentrated at Gadani, plays a vital role in the global ship dismantling economy, contributing over 80% of the country's re-rolled steel needs, generating fiscal revenues, and providing employment to thousands in the coastal belt of Balochistan. However, despite its economic benefits, the sector is marred by serious environmental degradation, hazardous labour conditions, regulatory gaps, and outdated dismantling practices.

As the global maritime industry pivots toward circular economy (CE) models, emphasizing waste minimization, resource efficiency, and sustainable material recovery, Pakistan faces both urgent risks and strategic opportunities. International frameworks like the Hong Kong Convention (HKC) and the EU Ship Recycling Regulation (SRR) are tightening environmental and safety standards, creating market access challenges for non-compliant ship recycling hubs.

This policy brief, developed through a multi-stakeholder consultative webinar and supported by a review of global best practices and literature, highlights Pakistan's current shipbreaking challenges and identifies actionable opportunities for reform. It recommends a phased, hybrid modernization strategy that balances high-tech interventions with culturally grounded, low-cost practices to transition Pakistan's ship recycling sector toward a safer, greener, and more competitive future.

Key policy recommendations include:

- ❖ Conduct a comprehensive legislative review to harmonize Pakistan's ship recycling laws with the Hong Kong Convention (HKC) and EU SRR requirements.
- ❖ Require all end-of-life vessels to submit certified IHMs prior to recycling, enforce third-party audits, and establish clear compliance protocols.
- ❖ Introduce concessional loans, tax incentives, and a Green Ship Recycling Fund to finance environmentally sustainable yard upgrades and modern dismantling technologies.
- ❖ Invest in effluent treatment plants, dust suppression systems, mechanized dismantling equipment, and safe waste segregation units across major shipyards, starting with Gadani.
- ❖ Encourage joint investments in green ship recycling hubs and innovation incubators by establishing standardized PPP frameworks with clear risk-sharing and performance benchmarks.
- ❖ Design climate financing facilities and micro-grants supporting women entrepreneurs and marginalized groups in recycling-linked services, with targeted skills development initiatives.
- ❖ Institutionalize marine sector KPIs, establish a Marine Circularity Index, and set up an Inter-Ministerial Circularity Taskforce to coordinate targets, compliance, and reporting.

This policy brief outlines a strategic opportunity for Pakistan to transform its ship recycling sector into a globally compliant, environmentally sound, and socially inclusive industry. Through these reforms and investments, Pakistan can enhance its climate resilience, protect marine ecosystems, and create equitable green jobs while securing long-term economic competitiveness in the global maritime economy.

Introduction and Context

Pakistan's ship recycling industry, primarily concentrated at Gadani, holds a prominent position globally, ranking among the world's largest ship dismantling hubs (ElMenshawey, Ülkü, & Hsuan, 2024). The Gadani yards handle a significant volume of decommissioned vessels, contributing not only to international ship recycling markets but also playing a crucial role in Pakistan's domestic economy by supplying over 30% of the country's re-rolled steel requirements (United Nations Conference on Trade and Development, 2009). Alongside India, Bangladesh, and Turkey, Pakistan accounts for approximately 85% of global ship recycling activities, supporting the global steel industry while generating substantial fiscal revenue, estimated between 5 and 12 billion Pakistani rupees annually for federal and provincial governments (Hameed, 2019). The sector also creates employment opportunities for thousands of workers, especially in the coastal belt of Balochistan, providing essential raw materials for construction, infrastructure, and manufacturing sectors.

Despite these economic contributions, the industry's operations have long been linked to environmental degradation, marine pollution, and occupational health hazards (Khan et al., 2024; Hameed, 2019). Inadequate waste management and hazardous dismantling practices have led to coastal contamination and elevated risks of exposure to harmful substances such as asbestos, heavy metals, and persistent organic pollutants. The reliance on manual dismantling techniques, often with limited protective equipment, further exacerbates worker vulnerability to accidents and long-term health complications. Additionally, unsustainable practices like the widely criticized "beaching" method contribute to severe environmental degradation and hazardous labour conditions. The absence of formalized hazardous material tracking systems and poor regulatory enforcement at dismantling yards have deepened the sector's environmental footprint.

At the global level, the maritime industry is undergoing a pivotal shift towards circular economy (CE) practices, spurred by tightening international regulations such as the Hong Kong Convention (HKC) and the European Union Ship Recycling Regulation (SRR), alongside growing awareness of climate and sustainability imperatives (International Maritime Organization, 2006; 2007). Circular economy frameworks advocate for resource efficiency, pollution minimization, safe dismantling protocols, and sustainable material recovery throughout supply chains (Okumus, Andrews, & Gunbeyaz, 2024). Instead of traditional linear ship dismantling processes, CE models emphasize reusing, repurposing, and recycling ship materials to reduce environmental and social costs while promoting green industrial practices.

For Pakistan, adopting circular economy principles within its ship recycling sector is no longer optional but a strategic necessity. Integrating CE into ship recycling operations would mitigate environmental and human health risks, improve compliance with international environmental agreements, and unlock new economic opportunities via resource efficiency, improved global market access, and enhanced investment flows (ElMenshawey, Ülkü, & Hsuan, 2024). It would support Pakistan's commitments under the Sustainable Development Goals (SDGs) and contribute to national ambitions for a resilient, inclusive, and low-carbon blue economy. Furthermore, modernizing Pakistan's ship recycling sector through CE frameworks could position Gadani as a competitive and compliant hub in an evolving global maritime economy.

The relevance of transitioning to circularity is grounded in the sector's historical evolution. The late 1960s marked the first global acknowledgment of the environmental hazards

associated with indiscriminate marine waste disposal (Garmer et al., 2015). The ship dismantling industry initially gained prominence in South Korea and Taiwan in the 1970s before shifting to developing countries, including Pakistan, due to the availability of cheap labor and an expanding market for recycled steel and scrap metal (ElMenshawly, Ülkü, & Hsuan, 2024). However, this geographical shift also transferred the environmental and occupational risks to countries with weaker regulatory frameworks (Deshpande, Tilwankar, & Asolekar, 2012).

As international seaborne trade intensified, surpassing eight billion tons of goods loaded in 2008 alone (United Nations Conference on Trade and Development, 2009), the dismantling of aging ships became an increasingly lucrative yet hazardous industry. Crude oil and petroleum products comprise about 65% of seaborne cargo, with maritime accidents sometimes resulting in catastrophic environmental damage (Talley, Jin, & Powell). Environmental concerns have persisted over harmful substances released during dismantling operations and subsequent waste disposal processes (Demaria, 2010).

Recent studies highlight Gadani's significant contribution to air pollution, with passive air sampling detecting elevated levels of polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and short-chain chlorinated paraffins (SCCPs) near ship-breaking yards (Khan et al., 2024). Molecular diagnostics confirmed that these pollutants predominantly originate from dismantling activities, confirming the urgent need for environmental safeguards.

Policy research has emphasized the importance of integrating environmental considerations into national shipping policies. For instance, Sajid, Ali, & Abubakar (2024) proposed incorporating Strategic Environmental Assessment (SEA) into Pakistan's revised Merchant Marine Policy (2019), identifying key issues such as air and water pollution, invasive species, and noise. Their recommendations advocate sustainable alternatives like low-carbon vessel designs and stricter ballast water regulations to mitigate ecological impacts.

A systematic literature review by ElMenshawly, Ülkü, & Hsuan (2024) further underscores the potential of circular economy principles in enhancing sustainability in the ship recycling industry. The study identifies drivers influencing ship owners' recycling decisions and highlights the pressing need for green ship recycling practices, aligned with the SDGs, through improved regulations, safety standards, and stakeholder awareness.

Nonetheless, significant policy gaps persist. Current international frameworks inadequately address issues such as changes in ownership and flag registration during a vessel's end-of-life phase, complicating the enforcement of recycling responsibilities (IMO, 2006; 2007). The rise of "cash buyers", intermediaries handling up to 80% of end-of-life ship transactions via opaque online platforms and low-regulation jurisdictions has further eroded accountability in the ship recycling chain.¹

This policy brief seeks to inform decision-makers, regulatory authorities, industry stakeholders, and development partners about the urgent need for policy innovation and capacity-building investments to align Pakistan's ship recycling sector with circular economy principles and international sustainability standards.

¹ https://ec.europa.eu/environment/pdf/waste/ships/ship_dismantling_report.pdf

Methodology

This policy brief was developed through a comprehensive, multi-stakeholder consultative process aimed at gathering diverse perspectives, practical insights, and evidence-based recommendations on promoting circularity and sustainable ship recycling within Pakistan's maritime sector.

The primary data collection method involved an online stakeholder engagement session conducted as a webinar titled "Consultative Webinar on Circularity in the Marine Environment and Sustainable Ship Recycling in Pakistan", held on 20th March 2025 via Zoom. The webinar brought together a wide range of participants, including industry leaders, policymakers, environmental experts, academics, regulatory authorities, and representatives from international organizations and the private sector.

The webinar was organized around three thematic sessions, each addressing a critical aspect of sustainable ship recycling and circular economy integration:

1. ***Circularity in Marine and Ship Recycling:*** Focused on material recovery, waste reduction, and pollution control in ship dismantling practices.
2. ***Policy and Regulatory Frameworks:*** Reviewed international conventions and identified policy gaps and regulatory improvement opportunities in Pakistan.
3. ***Financing and Innovations:*** Explored financing options and technological innovations for sustainable ship recycling, emphasizing public-private and international collaboration.

Webinar outcomes were documented, categorized, and synthesized with secondary data from academic literature, policy papers, and global case studies. This mixed-methods approach ensured the brief's technical soundness, contextual relevance, and alignment with both national priorities and international sustainability goals.

Discussion and Analysis

4.1 The Gadani Case for Circularity in Ship Recycling

Gadani, situated along the Balochistan coast about 50 km from Karachi, is Pakistan's primary ship-recycling hub and one of the largest in the world. Gadani spans a 10-kilometer stretch of coastline and remains Pakistan's largest ship recycling facility. The yard currently operates 68 active plots run by 38 economic operators, with an annual capacity to dismantle up to 125 ships of all sizes, including super tankers, and a maximum tonnage capacity of 1,000,000 Light Displacement Tonnes (LDT) (Gadani Ship Breaking Yard data). Gadani directly employs 12,000–15,000 workers, many of them migrants, who are engaged in dismantling a wide variety of vessels. The ship mix is dominated by tankers (44%), followed by bulk carriers (35%), and other vessels such as cargo and fishing ships accounting for 21%. This operational profile reflects both Gadani's capacity and its centrality to Pakistan's steel supply chain, while highlighting the reliance on heavy manual labor in a high-risk environment. The industry plays a crucial economic role, supplying up to 80% of Pakistan's domestic steel demand, generating approximately PKR 5 billion annually in tax revenues, and supporting nearly 125,000+ people through direct and indirect employment.

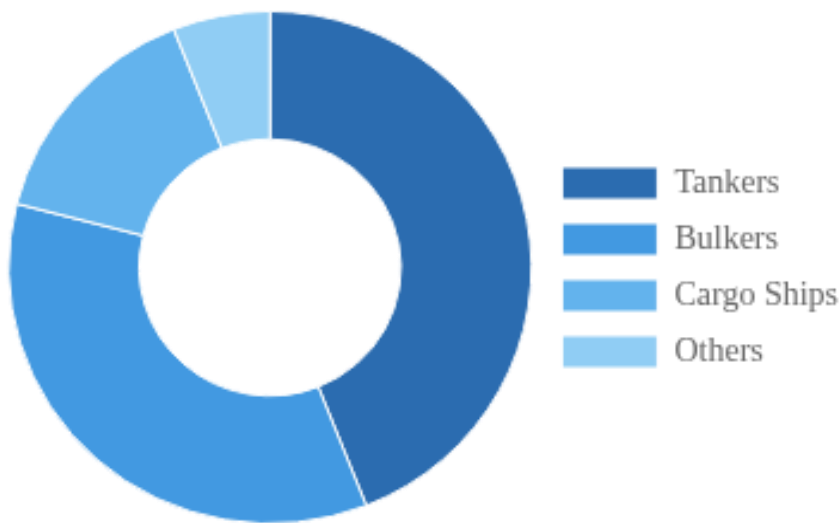


Figure 1: Vessel Types Dismantled at Gadani

Recent Statistics & Data (2023–2024)

Globally, 409 ships were scrapped in 2024, with 80% of total dismantling tonnage concentrated in South Asia, particularly Bangladesh, India, and Pakistan (NGO Shipbreaking Platform, 2024). Gadani maintains an annual dismantling capacity of 125 ships, making it a critical part of this regional hub. The yard plays a major role in Pakistan's economy, contributing around PKR 5 billion (approximately USD 4.7 million) annually in taxes while meeting 80% of the country's domestic steel demand. Material flows from Gadani are substantial, with approximately 400 truckloads of steel transported daily to Karachi, supplying more than 450 re-rolling mills and 650 smelting operations nationwide. The industry directly employs 12,000–15,000 workers and sustains a total workforce of over 125,000 people, with an estimated 850,000 dependents relying on this economic activity. Workers largely come from Khyber Pakhtunkhwa (52%), followed by Punjab (26%) and Balochistan (15%), reflecting Gadani's role as a magnet for migrant labor and a livelihood source across multiple provinces.

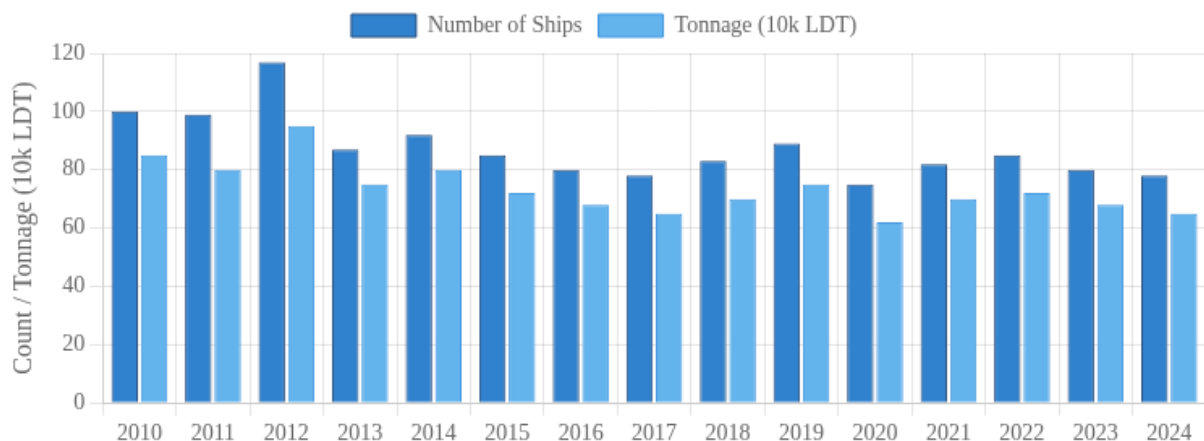


Figure 2: Ships Dismantled at Gadani (2010-2024)

Ship Breaking Practices at Gadani

Despite its scale and economic contribution, ship recycling at Gadani continues to rely on rudimentary practices that pose environmental and social risks. However, the reliance on the beaching method and the absence of effective environmental controls have led to significant risks. The beaching method remains the primary approach, whereby vessels are driven onto tidal flats during high tide and dismantled as the tide recedes. This process provides little to no containment for oils, chemicals, and debris, allowing pollutants to seep into surrounding ecosystems (NGO Shipbreaking Platform, 2024). Dismantling is performed manually with torches, winches, and pulleys, with limited specialized equipment for hazardous material management. Workers, numbering 12,000–15,000, are mostly migrants from Khyber Pakhtunkhwa (52%) and Punjab (25%), earning low daily wages of PKR 366–850 (USD 3.50–8). The lack of protective equipment and formal training compounds occupational risks. Moreover, there is no formal Inventory of Hazardous Materials (IHM), and the management of asbestos, PCBs, and heavy metals remains inadequate. Hazardous wastes are often sold informally or disposed of improperly. Since 2015, there have been 55 documented fatalities, underscoring persistent safety challenges (NGO Shipbreaking Platform, 2024).

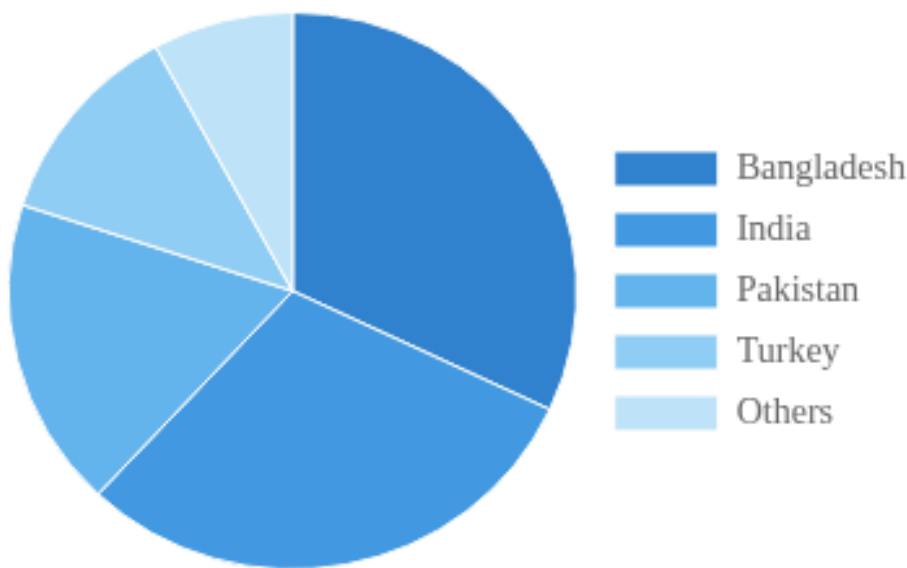


Figure 2: Global Ship Breaking Market Share (2024)

Circular economy principles offer a transformative framework to address these challenges by shifting the sector toward resource retention, waste minimization, and lifecycle-oriented processes (ElMenshaw, Ülkü, & Hsuan, 2024). In practice, this means implementing structured material recovery systems, modular dismantling methods, and responsible hazardous-material extraction protocols approaches shown to enhance both environmental and economic outcomes. Despite these challenges, Gadani holds enormous circular economy potential: it is estimated that 95% of a ship's mass can be recycled if supported by appropriate infrastructure and technology, making it both a challenge and an opportunity in the regional ship recycling landscape (Verma et al., 2020).

Infrastructure modernization is equally critical. Most domestic recycling yards lack mechanized cutting equipment, effluent treatment facilities, and dedicated waste-

segregation zones, impeding the adoption of safe and efficient recycling practices. Targeted investments in yard upgrades and capacity-building initiatives supported by public-private partnerships are necessary to operationalize circular workflows (Okumus, Andrews, & Gunbeyaz, 2024).

One of the most significant insights from the webinar was the potential for integrating traditional, low-tech practices in Pakistan's ship recycling industry, particularly in Gadani. Practices such as manual dismantling, material reuse, and community-led initiatives exemplify how indigenous methods are naturally aligned with circular economy principles. These practices, often perceived as outdated, are rooted in centuries of local knowledge and have proven resilient in the face of environmental and economic challenges. Research by ElMenshawy et al. (2024) reinforces this perspective, highlighting that effective ship recycling does not always require high-tech solutions, especially in regions with limited infrastructure. Instead, a hybrid approach leveraging both traditional techniques and modern sustainability practices can provide a more contextually relevant and cost-effective pathway for Pakistan to transition towards a circular ship recycling model. This approach not only preserves cultural heritage but also enhances the sector's overall sustainability and resource efficiency.

4.2 Environment and Social Challenges

Pakistan's ship recycling industry, centered in Gadani, stands at a critical crossroads. While it remains a key supplier of recycled steel and provides employment to thousands, its reliance on a traditional linear model focused on dismantling vessels for raw material extraction while discarding waste has resulted in widespread environmental degradation, unsafe labour conditions, and entrenched social inequalities (Khan et al., 2024; Hameed, 2019).

1. Pollution and Coastal Degradation

The dismantling of ships through beaching releases multiple pollutants, bilge oil, asbestos fibres, polychlorinated biphenyls (PCBs), heavy metals, and polycyclic aromatic hydrocarbons (PAHs), into the marine and coastal environment (Ali et al., 2016; Kazmi et al., 2024). The beaching method where ships are run aground on tidal flats and dismantled manually remains the dominant practice. This process, conducted without impermeable flooring, formal hazardous-material inventories, or adequate containment systems, leads to direct leakage of oils, fuels, asbestos, heavy metals, and toxic paints into the sea and surrounding soils. The lack of secure waste containment systems exacerbates contamination risks, harming critical ecosystems such as mangrove forests, estuaries, and coastal fisheries (Shipbreaking Platform, n.d.). The environmental burden is equally stark, with over 20,000 tons of hazardous waste released annually into surrounding soils and waters. This environmental degradation diminishes marine biodiversity and reduces fish stocks, impacting coastal livelihoods dependent on small-scale fishing (SDPI, 2022). Consultation discussions confirmed that pollution from dismantling activities continues to undermine local socio-economic resilience, particularly in Balochistan's coastal communities (Consultation Insight, 2025).

2. Occupational Hazards and Labor Rights Violations

Shipbreaking yards in Gadani are characterized by hazardous working conditions. Workers are frequently exposed to toxic materials without personal protective equipment, face risks during manual dismantling, and the constant threat of fires and explosions (SDPI, 2022; Hossain et al., 2015). A lack of formal emergency response systems further magnifies the

danger. Studies have documented elevated concentrations of mercury, PCBs, and PAHs in Gadani's marine sediments, seafood, and even air samples around the yard (Kakar et al., 2021; Khan et al., 2024). These pollutants persist in the environment, bio accumulate in food chains, and pose chronic health risks to workers and coastal populations alike. For example, asbestos exposure causes respiratory diseases, while heavy metals contribute to neurological and reproductive disorders patterns that mirror global evidence on marine pollution impacts (Verma et al., 2020). The devastating explosion in 2016, which claimed dozens of lives, remains a stark reminder of systemic safety failures (SDPI, 2022).

Consultation insights emphasized that most workers lack formal contracts, health insurance, or accident compensation frameworks (Consultation Insight, 2025), creating a climate of insecurity and rights violations that discourages workforce development.

3. Social Vulnerability & Community-level Impact

Social vulnerabilities are entrenched within the shipbreaking workforce, which is composed predominantly of internal migrants from marginalized regions. Workers often live in temporary settlements lacking basic amenities such as potable water, sanitation, electricity, and education access (SDPI, 2022; Shipbreaking Platform, n.d.). The consultation revealed that the absence of decent housing, public services, and community health infrastructure deepens social exclusion (Consultation Insight, 2025). Notably, gender inclusion remains critically low, with women virtually absent from formal or informal ship recycling activities, representing a missed opportunity for inclusive green job creation (Consultation Insight, 2025).

4. Environmental Non-compliance & Outdated Practices

The continued use of beaching practices starkly contrasts with modern, environmentally sound ship recycling methods such as dry-docking or landing-based dismantling (Ali et al., 2016). Beaching on open shores prevents containment of hazardous waste, limits monitoring of discharges, and results in cumulative contamination of coastal environments (Kazmi et al., 2024). Consultation discussions noted that Pakistan's shipbreaking yards currently lack the infrastructure necessary for compliance with international standards like the Hong Kong Convention (HKC) and the EU Ship Recycling Regulation (SRR) (Consultation Insight, 2025).

4.3 Policy, Regulatory and Enforcement Gaps

For several years, the Basel Convention has been used to control the cross-border movement and disposal of hazardous wastes. The export of hazardous waste from OECD countries (State listed in Annex VII of the Basel Ban Amendment) to non-OECD countries (developing) is prohibited under the Basel Ban Amendment.⁵ Thus, the export of ships for dismantling can be interpreted as the cross-border movement of waste. However, global application of the Basel Convention to ships is uneven. The principles of "producer liability" and "the polluter pays" are well established in law, but their application in the maritime industry is inconsistent and appears to be beyond the control of flag States (Alter, 2000, Alter, 1997, Bleeker, 2009, Falkenberg, 2010, Moen, 2008, UNEP, 1995, Yujico, 2014).

The international agreement commonly referred to as the "Hong Kong Convention" is currently under negotiation, based on a draft developed by the International Maritime Organization (IMO) under the United Nations framework. Recognizing that the dismantling of end-of-life ships is a necessary activity requiring regulation, both ship owners and maritime authorities have supported this initiative. Given the urgent need to expand global

ship recycling capacity, the IMO, the international shipping community, and maritime regulators are prioritizing the enhancement of existing ship recycling facilities, particularly in Asia namely in India, China, Bangladesh, and Pakistan as a practical strategy. Additionally, to address the global backlog of ships ready for dismantling, efforts are being made to encourage and assist several ship repair yards and even some shipbuilding yards to engage in ship breaking and recycling activities worldwide.

Despite partial progress towards ratification of international agreements, Pakistan's domestic regulatory framework remains fragmented. However, the domestic application of these frameworks is constrained by weak regulatory mechanisms, as national institutions lack unified legislation to govern ship dismantling comprehensively (SDPI, 2022). Consultation participants highlighted critical institutional weaknesses, including a shortage of trained environmental inspectors, lack of real-time yard monitoring systems, insufficient hazardous material auditing, and absence of clear financial penalties for non-compliance. Without a fully functional regulatory and institutional system, Pakistan's ability to meet global compliance standards and access green ship recycling markets remains compromised. Responsibilities are split between federal maritime authorities and provincial environmental agencies, with no central body to enforce compliance or coordinate hazardous material controls.

This regulatory fragmentation was echoed in stakeholder consultations, which identified critical enforcement gaps, including a shortage of trained environmental inspectors, absence of real-time yard-level monitoring, and inadequate oversight of hazardous material flows. Compounding these challenges is the lack of an integrated system to identify, segregate, store, and dispose of hazardous waste on board dismantled vessels. Despite international best practices emphasizing inventory management such as the Inventory of Hazardous Materials under the HKC Pakistan's yards continue to rely on informal, undocumented disposal methods, heightening environmental and human health risks while impeding access to international certification schemes (SDPI, 2022). Without clear regulatory mandates, institutional coordination, and hazardous waste tracking mechanisms, the sector remains vulnerable to reputational, ecological, and market access risks.

4.4 Innovations and opportunities

As the global ship recycling industry faces increasing pressure to align with international sustainability standards, Pakistan's shipbreaking sector is presented with a unique opportunity to modernize and improve its environmental, social, and economic performance. The transition to green ship recycling is not only essential for reducing ecological impacts but also for enhancing Pakistan's competitiveness in the global market. By embracing innovative technologies, digital tools, financing mechanisms, and upgrading infrastructure, Pakistan can strengthen its regulatory compliance, increase material recovery rates, and create a safer working environment. The following innovations and opportunities highlight key areas where intervention can drive transformation in the sector.

1. Green Ship Recycling Technologies

The adoption of advanced cutting technologies such as water-jet cutting and cryogenic cutting can enhance operational safety, improve material recovery rates, and reduce the environmental footprint of ship recycling (Falkenberg, 2010). AI-enabled waste sorting systems can further streamline the recycling process by automating the separation of

valuable metals, reducing human exposure to hazardous substances, and improving efficiency in the recycling yards (Kazmi et al., 2024).

2. Digital Tools and Traceability

The integration of blockchain-based material passports can enable precise tracking of hazardous materials and recyclable content, ensuring compliance with international standards like the Hong Kong Convention (HKC) and European Union Ship Recycling Regulation (SRR). These tools can also enhance transparency, increase efficiency, and help in managing end-of-life ships responsibly (Kazmi et al., 2024). Life-cycle tracking systems will allow for better coordination and monitoring of ship recycling activities, facilitating real-time data collection, compliance verification, and reporting to regulatory bodies (Falkenberg, 2010).

3. Financing Mechanisms

The establishment of climate finance mechanisms, including green bonds and international grants, can provide essential capital for transitioning to greener, safer, and more efficient ship recycling technologies. Public-private partnerships (PPPs) can further help de-risk investments in environmentally friendly infrastructure and facilitate the adoption of sustainable practices within Pakistan's shipbreaking industry (SDPI, 2022). These financial mechanisms are essential for reducing the cost barriers for local yards seeking to modernize and comply with international standards.

4. Infrastructure Upgrades at Shipyards

To ensure compliance with international environmental regulations and enhance sustainability, Pakistan's shipyards need significant infrastructure upgrades. This includes the installation of effluent treatment plants, dust suppression systems, and hazardous waste segregation units to prevent contamination of marine ecosystems and improve worker safety. Modernizing the yard infrastructure will reduce environmental risks, enhance worker conditions, and support the country's entry into the global green ship recycling market (SDPI, 2022; Kazmi et al., 2024).

Policy Recommendations

Building on insights generated through multi-stakeholder dialogue, sectoral analysis, and international benchmarks, this section sets forth strategic policy recommendations to strengthen circularity and sustainability in Pakistan's ship recycling industry. As the maritime sector grapples with environmental pressures, resource inefficiencies, and regulatory demands, it is critical for Pakistan to transition from traditional ship dismantling practices to models that embed environmental stewardship, operational resilience, and material recovery. The recommendations outlined herein are informed by key challenges identified during the consultation process, including regulatory misalignments, infrastructure limitations, financing gaps, and stakeholder coordination needs, providing a structured pathway to drive systemic reform and position Pakistan as a leader in sustainable ship recycling.

1. Regulatory Alignment with International Conventions

Pakistan's ship recycling industry must align with evolving international environmental and labor standards to maintain market access and improve sustainability. Immediate action is needed to conduct a comprehensive legislative review, updating Pakistan's Ship Recycling Regulations and Merchant Shipping Ordinance to meet the requirements of the Hong Kong Convention (HKC) and the EU Ship Recycling Regulation (SRR). Establishing an Inter-Agency Regulatory Harmonization Committee under the Ministry of Maritime Affairs will ensure coordinated and efficient implementation at both federal and provincial levels. A phased statutory amendment plan should be rolled out, incorporating obligations like the Inventory of Hazardous Materials (IHM) and Green Passport protocols. Aligning national regulations will strengthen Pakistan's credibility in the global maritime economy and foster environmentally responsible ship recycling practices.

2. Mandatory Hazardous Material Inventories & Compliance Protocols

Strengthening hazardous material management is essential for safe, transparent, and sustainable ship recycling operations. Pakistan should mandate that all end-of-life vessels submit a certified digital Inventory of Hazardous Materials (IHM) before entering recycling facilities, in compliance with IMO standards. Clear compliance protocols must be established, including submission deadlines, third-party verifications, and penalties for violations. Furthermore, the Port State Control and Pakistan Maritime Security Agency must be equipped with specialized training and digital enforcement tools to verify IHMs and ensure full regulatory compliance. Implementing these measures will protect worker health, safeguard marine ecosystems, and bolster Pakistan's reputation as a responsible ship recycling nation.

3. Financial Incentives for Green Ship Recycling

Transitioning towards environmentally sustainable ship recycling demands strong financial support mechanisms. Pakistan should introduce targeted fiscal incentives such as VAT exemptions and accelerated depreciation benefits for recycling yards adopting compliant and eco-friendly technologies. Additionally, establishing a dedicated Green Ship Recycling Fund, managed through the State Bank of Pakistan, can offer concessional loans and credit guarantees for investments in safer, mechanized dismantling systems. Leveraging blended finance arrangements with the Green Climate Fund and other development partners will further accelerate yard modernization. These financial tools are critical to reducing the investment barrier for green technologies and driving the sector's sustainable transformation.

4. Public-Private Partnerships to Scale Innovation & Compliance

Public-private collaboration is critical to accelerating the modernization of Pakistan's ship recycling industry. Launching a standardized PPP framework will encourage joint investments in pilot green recycling hubs, with clear agreements on risk-sharing, performance benchmarks, and technology transfer. Engaging multilateral development banks like the ADB and World Bank for technical assistance will enhance PPP project structuring and monitoring capacities. Furthermore, establishing an Innovation Consortium uniting recyclers, technology developers, and research institutions will foster the co-development and validation of cutting-edge dismantling technologies. Strengthening collaboration will enable faster adoption of best practices and drive systemic improvements in compliance and efficiency.

5. Infrastructure & Capacity Enhancement at Major Yards

Upgrading physical infrastructure and building technical capacity are foundational to achieving safe and sustainable ship recycling practices. Pakistan must prioritize modernizing facilities at Gadani and other key yards, including installing effluent treatment plants, dust suppression systems, and structured material segregation units. Establishing a national Ship Recycling Modernization Fund can support capital investments in advanced dismantling technologies and environmental controls. Parallel efforts should focus on human capital development by partnering with technical universities and vocational training institutes to deliver certified programs on safe ship dismantling, environmental risk management, and digital yard operations. These investments are crucial for ensuring worker safety, environmental protection, and global competitiveness.

6. Gender-Responsive Climate Finance & Job Creation Programs

Promoting inclusivity and gender equality within the ship recycling sector is essential for achieving broader development goals. Pakistan should design and implement dedicated climate finance mechanisms, such as gender-tagged micro grants and blended finance facilities, to support women and marginalized entrepreneurs operating across the recycling value chain. Collaboration with initiatives like UNDP's Policy Challenge Fund can further incubate women-led clean-tech start-ups offering sustainable solutions in ship recycling. Mandating gender quotas and incorporating gender-sensitivity training within occupational health and safety certification programs will ensure that green job opportunities in the sector are equitable and socially transformative.

7. Integration of Marine Circularity into the National Circular Economy Roadmap

Embedding marine circularity within Pakistan's broader national economic and climate policies is vital to achieving long-term sustainability goals. Key performance indicators (KPIs) such as vessel material recovery rates and lifecycle carbon footprints must be incorporated into the forthcoming National Circular Economy Policy. Establishing an Inter-Ministerial Circularity Taskforce will help coordinate ship recycling targets with waste management, climate resilience, and industrial development strategies. Additionally, publishing an annual Marine Circularity Index, overseen by the Ministry of Climate Change, will provide transparency, track progress, and guide evidence-based policy adjustments. Institutionalizing marine circularity will position Pakistan as a regional leader in sustainable maritime practices.

Conclusion and Way Forward

Pakistan's ship recycling sector stands at a pivotal juncture. While its contributions to the national economy, employment generation, and steel production remain significant, the prevailing environmental, social, and regulatory challenges pose serious risks to long-term sustainability and global competitiveness. The environmental consequences of hazardous dismantling practices, coupled with labour rights violations and regulatory gaps, have impeded Pakistan's ability to fully benefit from international green markets and evolving ship recycling standards.

This policy brief has underscored the urgent need for Pakistan to transition from conventional linear shipbreaking methods to a modern, circular economy-based model. By embracing circularity, Pakistan can not only reduce its ecological footprint but also unlock new economic opportunities, improve labour protections, and strengthen its position within the global maritime economy.

The way forward for Pakistan's ship recycling sector requires a coordinated, multi-pronged strategy built around six key priorities. Foremost is the need for comprehensive legal reforms to align national regulations with the Hong Kong Convention (HKC) and the EU Ship Recycling Regulation (SRR), supported by an inter-agency committee to oversee effective implementation and enforcement. This should be complemented by mandatory certified digital Inventories of Hazardous Materials (IHM) for all incoming vessels, backed by third-party verification, strict compliance protocols, and clear penalties for violations. To overcome financial barriers, Pakistan must introduce climate finance mechanisms, concessional loans, green bonds, and public-private partnerships to support infrastructure modernization and the adoption of sustainable dismantling technologies.

Equally important is investing in the physical and human infrastructure of shipyards, including effluent treatment systems, hazardous waste management facilities, and improved worker safety provisions, while partnering with vocational institutions for specialized skills training. Gender-responsive financing schemes and inclusive employment programs should be established to enable women and marginalized groups to benefit from green jobs within the recycling value chain. Finally, integrating marine circularity into Pakistan's National Circular Economy Policy through specific sectoral targets, a Marine Circularity Index, and inter-ministerial coordination mechanisms will ensure that ship recycling aligns with broader climate, environmental, and industrial development goals. Together, these actions offer a realistic and inclusive pathway to transform Pakistan's ship recycling industry into a safer, greener, and globally competitive sector.

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Annexures

Annex 01 – Webinar’s Concept Note & Agenda

"Consultative Webinar on Circularity in the Marine Environment and Sustainable Ship Recycling in Pakistan"

20th March 2025 | 11:00 AM to 1:30 PM | Online via Zoom

Background and Rationale

The marine environment is a critical natural asset, especially for coastal nations like Pakistan, which rely on it for economic activities such as fisheries, shipping, and tourism. However, alongside these economic activities, environmental challenges like marine pollution, overfishing, and unsustainable ship recycling practices pose significant threats to coastal ecosystems and human health.

Ship recycling is a crucial component of the maritime economy. Pakistan, along with India, Bangladesh, and Turkey, handles approximately 85% of the world’s ship recycling activities, contributing significantly to the global steel industry². At the same time, the unsustainable practices often associated with shipbreaking, such as the widely criticized "beaching"

² ElMenshawy, O. M., Ülkü, M. A., & Hsuan, J. (2024). Navigating Green Ship Recycling: A Systematic Review and Implications for Circularity and Sustainable Development. *Sustainability*, 16, 7407.

method, result in environmental degradation and hazardous working conditions for laborers³.

The transition to a circular economy (CE) in the marine and ship recycling industries offers an opportunity to address these challenges. A circular approach emphasizes resource efficiency, minimizing waste, and ensuring that materials are reused, recycled, or repurposed at the end of their life cycles. By adopting sustainable ship recycling practices, the industry can reduce environmental impacts, create new business opportunities, and support Pakistan's broader efforts to promote climate resilience and marine ecosystem protection.

This consultative webinar aims to explore how circular economy principles can be applied to the marine environment and ship recycling in Pakistan. It will bring together key stakeholders, including policymakers, industry leaders, environmental experts, and academics, to discuss strategies for advancing sustainable ship recycling practices and protecting the marine environment.

This webinar, organized by the Sustainable Development Policy Institute (SDPI), in collaboration with National Institute of Maritime Affairs (NIMA) aims to explore how circular economy approaches can drive sustainability and climate resilience in Pakistan's marine environment and ship recycling sectors. By bringing together industry leaders, policymakers, researchers, and environmental professionals, the event will facilitate knowledge-sharing and strategic discussions on advancing circularity, protecting marine ecosystems, and promoting sustainable ship recycling practices.

Workshop Objectives

The webinar will:

- ✓ Discuss how the circular economy can be implemented in Pakistan's ship recycling industry to reduce environmental degradation and enhance resource recovery.
- ✓ Highlight the need for marine environment protection through sustainable management of maritime activities, including reducing marine pollution from shipbreaking and industrial waste.
- ✓ Evaluate how Pakistan can improve regulatory enforcement to ensure compliance with international environmental and labor standards.
- ✓ Encourage collaboration between industry stakeholders, policymakers, and international organizations to foster innovation in green ship recycling techniques and promote investment in sustainable infrastructure.
- ✓ Discuss how the shift towards sustainable ship recycling can create equitable opportunities, including gender-responsive climate finance mechanisms, ensuring women and marginalized communities benefit from climate action and green jobs in ship recycling.

³ Okumus, D., Andrews, E., & Gunbeyaz, S. A. (2024). Developing Circularity Metrics for the Maritime Industry: A Stakeholder Focused Study. *Ocean Engineering*, 312, 119158

Agenda

Time	Session	Speaker(s)
11:00AM-11:10AM	Opening Remarks	Dr Sajid Amin Javed - Deputy Executive Director Research, SDPI
11:10 AM 11:40 AM	Session 1: Circularity in Marine and Ship Recycling - Overview of the circular economy in ship recycling. - Best practices and innovations. - Opportunities in Material Recovery -Environmental Challenges and Pollution Reduction -Barriers to Adoption & Stakeholder Collaboration	1. Dr. Fasiha Safdar , Research Fellow, NIMA <i>"Circularity in Marine Environment: Environmental Challenges and Pollution Reduction"</i> 2. Dr. Aneel Salman - Chair Economic Security, (IPRI) <i>"Overview of The Circular Economy in Ship Recycling Industry"</i> 3. Mr. Jawed Iqbal -CEO, Shoaib Shipping Agencies <i>"Circularity in Ship Recycling Industry: Barriers to Adoption & Stakeholder Collaboration"</i>
11:40 AM – 12:05 PM	Session 2: Policy and Regulatory Frameworks - International conventions (Hong Kong Convention). -European Union Ship Recycling Regulation (SRR) - Policy gaps and opportunities for Pakistan. -Enforcing Compliance & Improving Oversight	1. Cdr. Anees Muhammad Khan – Author of HKC book and Senior Researcher, NIMA <i>"Circularity in Ship Recycling Industry; Policy gaps and opportunities for Pakistan under HKC and EU SRR"</i>
12:05 PM – 12:30 PM	Session: 3 Financing & Innovations in Sustainable Ship Recycling - Climate Finance for Green Ship Recycling - Opportunities for innovation and investment in sustainable ship recycling technologies. -Technological Innovations for Sustainable Ship Dismantling	1. Cdre. Raheel Masood (Retd) -Author of HKC Book and Senior Research, NIMA <i>"Opportunities and Challenges for Innovation and Investment in Sustainable ship recycling technologies for Pakistan"</i>
12:30 PM-12:40PM	Remarks by Chief Guest	Mr. Abdul Sattar Khokhar , Senior Joint Secretary, Ministry of Maritime Affairs, Islamabad

12:40PM-12:45PM	Feedback/Comment from Attendees/Stakeholders	Moderated by Ms. Zainab Naeem-Head of Ecological Sustainability & Circular Economy, SDPI Ms. Fasiha Sadar-Research Fellow, NIMA Industry experts, PSBA, KS&EW, KPT, PQA, PNSC, MMD, Sindh and Baluchistan EPAs
12:45 PM-12:50PM	Closing Remarks	Vice Admiral (Retd) Ahmed Saeed HI(M) -President, NIMA
12:50 PM-1:00PM	Key Policy Take Aways for the National Circular Economy Policy	Ms. Zainab Naeem -Head of Ecological Sustainability & Circular Economy, SDPI

Expected Outcomes

Enhanced understanding of the benefits of circular economy principles in the marine environment and ship recycling sectors.

Actionable policy recommendations for aligning Pakistan's ship recycling industry with international standards and circularity principles.

Identification of potential opportunities for investment in green ship recycling technologies and partnerships with international organizations.

Strategies for ensuring equitable access to climate finance and green jobs for women and marginalized communities in Pakistan's ship recycling industry.