Exploring shipping's transition to a circular industry

Findings of an inquiry to understand how circular economy principles can be applied to shipping

Report prepared for the Sustainable Shipping Initiative | JUNE 2021

Table of contents

About the authors

The Sustainable Shipping Initiative (SSI)

The SSI is a multi-stakeholder collective of ambitious and like-minded leaders, driving change through cross-sectoral collaboration to contribute to – and thrive in – a more sustainable maritime industry. Spanning the entire shipping value chain, SSI members are shipowners and charterers; ports; shipyards, marine product, equipment and service providers; banks, ship finance and insurance providers; classification societies; and sustainability non-profits.

Guided by the Roadmap to a sustainable shipping industry, SSI works on a range of issues related to enabling and furthering sustainable shipping, including shipping's decarbonisation, seafarers' labour and human rights, and responsible ship recycling.

www.sustainableshipping.org
www.shiprecyclingtransparency.org

2BHonest

2BHonest is a consultancy firm, driven by the ambition to untangle the complexities surrounding sustainability and circularity. Advisory services are provided along the management cycle, including strategy development, supply chain due diligence, stakeholder engagement and reporting.

2BHonest supports organisations with their circular transformation by conducting research to demystify the concept, developing impactful strategies, making inspiring activation methods and building custom circularity dashboards to measure progress.

www.2bhonest.nl

About this report

Exploring shipping's transition to a circular industry presents the findings of an inquiry commissioned by the Sustainable Shipping Initiative (SSI) and authored by circularity and sustainability consultancy 2BHonest aiming to demystify the concept of the circular economy, which has a key role to play in the shipping industry.

This report builds on previous research around the role of circularity in shipping, including SSI's 2013 Closed Loop Materials Management work, the Circular Shipping Initiative, and other examples both within maritime and in comparable industries such as automotive and aviation.

Prepared based on academic knowledge, industry insights, and a range of stakeholder interviews, this report works to explore how circular economy principles can be applied to shipping, raising awareness and understanding among shipping stakeholders through evidence-based research, and setting out the opportunities and barriers across the vessel lifecycle for the transition to a circular shipping industry.

By focusing on steel as the primary component of a vessel, this report is anchored in today's take-make-waste-recycle model, providing an opportunity to discuss the future of the industry and key levers for change moving forward. Part I outlines the fundamental concepts of the ship lifecycle and the circular economy, proposing a 4R hierarchy that can be applied to shipping. Part II dives into the current state of ship recycling, outlining trends, barriers and opportunities arising in the coming decades. Part III works to connect the dots, taking into account lessons learnt from other sectors undergoing a circularity transition. Part IV discusses the role of different stakeholder groups in enabling and promoting a circular shipping industry. Finally, the conclusion outlines a set of suggested next steps for the industry.

DISCLAIMER: Qualitative and quantitative sources and assumptions made are indicated throughout the report. The report outlines current trends in shipping, which may lead to a variety of scenarios in the coming decades. The report therefore includes forward-looking projections which are subject to risk and uncertainties. The authors undertake no liability and make no representation or warranty for the information and projections given in this report.

Acronyms

BBA	Basel Ban Amendment
BC	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
CLMM	Closed Loop Materials Management
CO_2	Carbon Dioxide
CCI	Circular Cars Initiative
DWT	Deadweight Tonnage
ESG	Environmental, Social, and Governance
EU SRR	European Union Ship Recycling Regulation
FOC	Flags of Convenience
GHG	Greenhouse Gases
GT	Gross Tonnage
HKC	Hong King International Convention for the Safe and Environmentally Sound Recycling of Ships
IHM	Inventory of Hazardous Materials
IMO	International Maritime Organization
LCA	Life Cycle Assessment
LDT	Light Displacement Tonnnage
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
SRTI	Ship Recycling Transparency Initiative
SSI	Sustainable Shipping Initiative
UNCTAD	United Nations Conference on Trade and Development

Executive summary

Driven by a growing world population and concerns about resource scarcity and environmental pressures, industries and policy makers are exploring the switch from a linear to a circular economy, defined by the Ellen MacArthur Foundation as "an economy that is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. As a result, the economy is restorative and regenerative by design" (Ellen MacArthur Foundation, 2021).

While this discussion is advancing quickly in many sectors, and circular economy principles are beginning to appear more commonly in regulation, this topic is still in its infancy for the shipping industry. In exploring the opportunities and barriers to increased circularity, this report points to the following three conclusions:

1

Accelerating trends and patterns in both shipping and ship recycling set the scene for a transition to a circular shipping industry

2

Circular economy principles should be **built into every stage of the ship lifecycle** – from design to construction; to operations and recycling

3

Global regulation and multi-stakeholder collaboration are essential to realise the transition to a circular shipping industry

1

Accelerating trends and patterns in both shipping and ship recycling set the scene for a transition to a circular shipping industry

Global recycling volumes are expected to double by 2028

The past two decades have seen continuous growth in the global fleet in terms of size and number. As these vessels approach end of life, global recycling volumes are expected to grow significantly, doubling by 2028 to 14 million light displacement tonnes (ldt) and near quadrupling by 2033 to 28 million ldt.

For existing ship recycling facilities, this means at least doubling their capacity and potential capabilities to handle larger size ships to meet the increased demand. This rise in demand provides high potential for new entrants. For shipowners (and in particular EU-flagged vessels that must recycle in EU approved facilities), this means challenges in finding facilities that have the actual capacity and capability to ensure that vessels (including post-Panamax size) are recycled in a responsible, timely and economically viable manner. In the current scenario, a sustainable solution for EU SRR-compliant recycling will likely emerge from non-OECD countries, where inherent steel demand with minimal last-mile costs and lower carbon emissions leads to comparable quality recycling with substantially higher steel-scrap prices on offer.

PROJECTION:
ANNUAL SHIP RECYCLING CAPACITY IN LDT (MILLIONS)

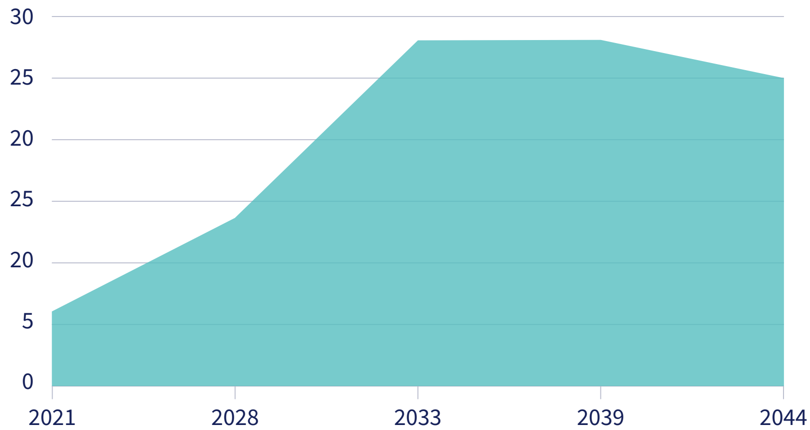


FIGURE 1

Projected need for ship recycling capacity between 2023 and 2044. Extrapolation by 2BHonest based on UNCTAD data (UNCTAD, 2020; Hoffman, 2020)

Furthermore, current decarbonisation efforts see the industry working towards a goal of net zero emissions by 2050, requiring changes to vessel design or retrofitting existing vessels to accommodate new fuels and technologies, thus leading owners and operators to consider the fleet transition plans for the coming decades.

As the industry undergoes this transition period, there is an opportunity at hand to begin raising awareness of, considering, and applying circular economy principles across the ship lifecycle.

2 Circular economy principles should be built into every stage of the ship lifecycle – from design to construction; to operations and recycling

Ships can be designed with resource optimisation in mind to reduce the amount of resources used, allow for greater reuse of components, as well as promote repair, refurbishment and, if needed, replacement of individual modules. Better traceability of materials during the vessel's lifecycle, such as is now required by regulation through the Inventory of Hazardous Materials (IHM), can be a useful tool to enable better reuse, refurbishment and recycling activities.

> **Over 95% of shipping's carbon emissions currently occur during the operating phase as a result of fuel combustion**

Although over 95% of shipping's carbon emissions currently occur during the operating phase as a result of fuel combustion, the industry's decarbonisation is expected to shift this balance, leading to carbon emissions from components, building and recycling taking up a larger share of a vessel's total lifecycle emissions. The figure below illustrates some of the processes that can be implemented across the ship lifecycle, improving circular material flows which would further reduce emissions associated with the ship itself (e.g. those from shipbuilding, recycling, and the production of ship materials and components).

<table>
<tr><th></th><th>1 DESIGN</th><th>2 SHIPBUILDING</th><th>3 OPERATIONS</th><th>4 DISMANTLING</th></tr>
<tr><td rowspan="2">Reduce</td><td colspan="3">Reducing resource use and prolonging lifetime</td><td rowspan="2"></td></tr>
<tr><td colspan="3">Avoid use of hazardous materials</td></tr>
<tr><td>Reuse</td><td rowspan="3">Design with focus on material reuse, refurbishment and recycling</td><td></td><td colspan="2">Reuse of parts during maintenance and recycling</td></tr>
<tr><td>Refurbish</td><td></td><td colspan="2">Refurbish of parts during maintenance and recycling</td></tr>
<tr><td>Recycle</td><td>Recycling by-products</td><td>Recycling used or damaged parts</td><td>Safe and responsible recycling and waste handling</td></tr>
</table>

FIGURE 2

Circular by design. Developed by 2BHonest based on Honda (2020)

3

Global regulation and multi-stakeholder collaboration are essential to realise the transition to a circular shipping industry

Existing legislative instruments for shipping and ship recycling do not adequately consider a lifecycle perspective and are thus unable to support or promote the transition to a circular economy. However, instruments such as the IHM have clear implications and are only the first steps towards enabling greater circularity whilst simultaneously supporting the safe and environmentally sound recycling of ships. Growing interest in, and understanding of, the potential of circularity across all sectors is also leading to direct references to the circular economy from regulators. For example, the European Union's recent reference to "a circular economy and a respectful attitude to the ocean" in its vision for a sustainable blue economy (European Commission, 2021).

The report identifies four main building blocks to a circular industry: knowledge and awareness, business model innovation, technological advancement, and the need for a global regulatory framework. As with the ongoing decarbonisation challenge, no single stakeholder group can act alone, and there is a need for dialogue and collaboration within and beyond the shipping industry. By learning from comparable sectors such as automotive and working with regulators, financial stakeholders, and industry, major steps can be taken to improved circularity and higher value realisation across the ship lifecycle.

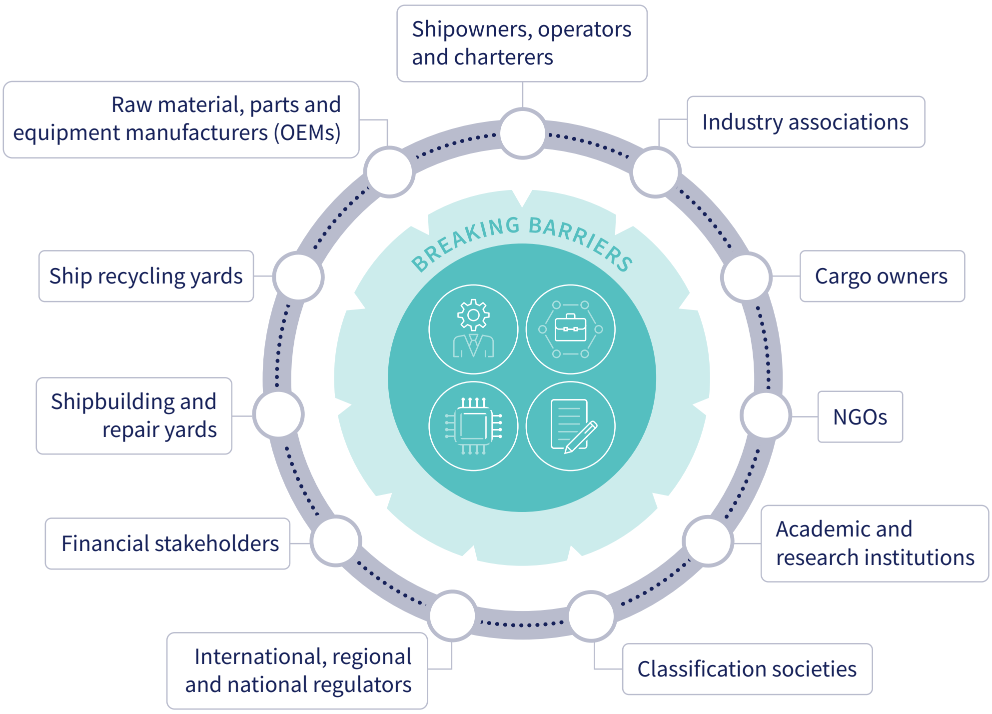


FIGURE 3

Breaking barriers requires collaboration across the shipping industry. Developed by 2BHonest

Towards a sustainable shipping industry

A vessel, over its 20+ year lifespan, will be designed and built, operated, repaired, and eventually dismantled. Each of these activities is likely to take place in a different location, be carried out by a different group of people, under different conditions and potentially under a number of different owners, managers, and charterers.

Understanding and addressing the inter-related nature of the shipping industry is a key lever in the transition to a model which considers all of these activities, and their impact on stakeholders, to be part of one broader lifecycle.

A sustainable shipping industry thus needs to consider its impacts on oceans as well as the communities and people who depend on it. It will need to be transparent and accountable for its actions. It will need to decarbonise, quickly and sustainably. It will require collaboration across and beyond the shipping industry, with regulators, investors, customers, and many others. Circularity has a key role to play in shipping's sustainability journey, and intersects with all vision areas outlined in the Roadmap to a sustainable shipping industry.

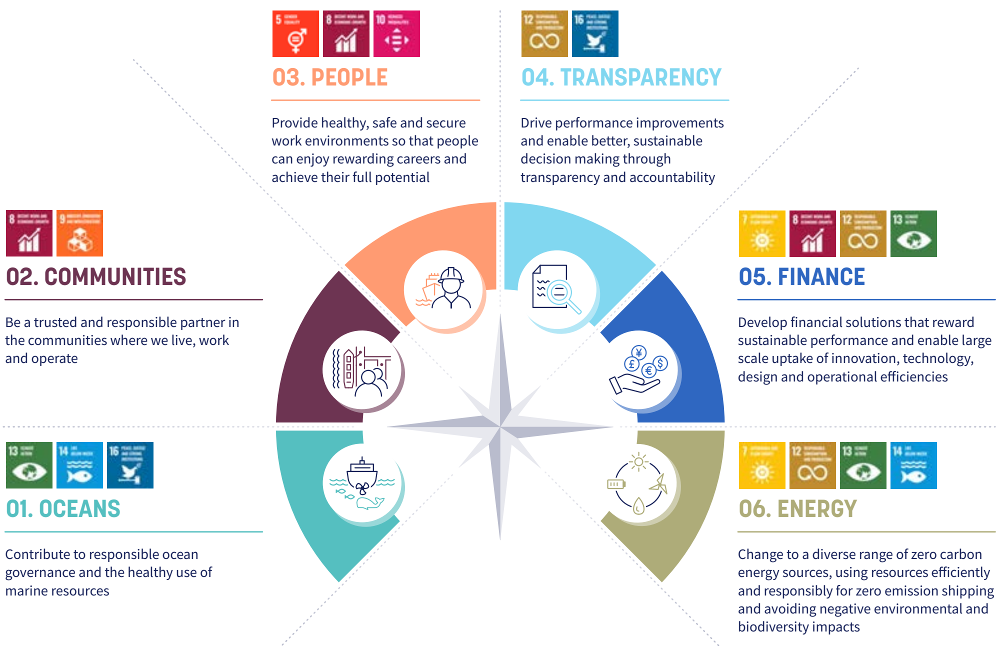


FIGURE 4

Roadmap to a sustainable shipping industry

Part I: Explaining the basics

The shipping industry

Ships[1] must be able to face extreme weather conditions, transport massive cargo and normally operate for over twenty years. A range of requirements need to be met to ensure a ship's strength, flexibility and durability. Steel is able to provide these mechanical properties and meet the demand for a cost-efficient raw material. Steel manufacturing primarily takes place in China, responsible for >50% of the global production in 2020, followed by India, Japan, the USA, Russia and South Korea (World Steel Association, 2020).

Steel is not only the primary material but the primary driver of price for a vessel sold for recycling

This report uses steel, the primary material of a ship (see figure 5), to connect the industry to the circularity concept. Often making up between 75-85% of a vessel, steel is not only the primary material but the primary driver of price for a vessel sold for recycling.

The lifecycle of steel in today's ship follows a linear path ending with it being recycled[2] and materials being refurbished for other sectors. Figure 6 outlines the main stages and related actors across the lifecycle of steel in a ship with steel manufacturers, shipyards, shipowners and ship recycling facilities as important actors. Circular economy principles challenge actors to rethink the entire system and connect the activities to the broader natural and social systems that maintain it.

INPUT TYPE	% (based on MT)
Steel Various grades and types of steel used for, among others, the hull and internal structures	75–85
Machinery and other major parts Including main engine, shaft, anchor, winches, propellers made of various materials	5–10
Other materials Used for other purposes such as cables, painting, insulation and wooden panels	<5
Other parts Any other part used onboard a vessel such as furniture, lifeboats, lamps, ropes, navigation equipment	<5
Hazardous materials To be detailed in an Inventory of Hazardous Materials (IHM) covering PCBs, mercury, asbestos and others	<0.1

FIGURE 5

Composition of a ship. Developed by 2BHonest based on Jain, Pruyn, & Hopman (2017)

[1] The study applies the definition of a ship used by the International Maritime Organisation (IMO): *a vessel of any type whatsoever operating or having operated in the marine environment and includes submersibles, floating craft, floating platforms, self-elevating platforms, Floating Storage Units, and Floating Production Storage and Offloading Units, including a vessel stripped of equipment or being towed* (IMO, 2009). In line with UNCTAD (UNCTAD, 2020) the report distinguishes between oil tankers, bulk carriers, general cargo ships, container ships and other ships.

[2] Various terms are used for the activity of ship recycling, including ship breaking, scrapping, and dismantling. This report uses the term ship recycling as defined by the IMO: *the activity to complete or partial dismantling of a ship at a ship recycling facility in order to recover components and materials for reprocessing and re-use, whilst taking care of hazardous and other materials, and includes associated operations such as storage and treatment of components and materials on site, but not their further processing or disposal in separate facilities* (IMO, 2009).

FIGURE 6

The lifecycle of steel in a ship. Developed by 2BHonest

Long before the ship building begins, a ship is designed to meet projected market needs. Compared to other sectors, such as the automotive and aviation industry, the design of a ship is determined by the first shipowner rather than the shipyard. Shipbuilders, primarily in China, South Korea and Japan (which held over 90% of shipbuilding capacity in 2020) (UNCTAD, 2020) will follow the design while meeting regulatory and industry standards, overseen by classification bodies. Standardised models are sometimes available but in practice shipowners often require customisations (both major and minor), resulting in a large variety of types, sizes and configurations. Under current conditions, little attention is paid to circular economy principles, as the dominant design considerations are cost efficiencies in both the building and operating phases, and compliance with minimum standards.

Over 50% of the world fleet is owned by five countries with Greece holding the biggest share

Over 50% of the world fleet is owned by five countries with Greece holding the biggest share followed by Japan, China, Singapore and Hong Kong (UNCTAD, 2020). Behind these figures, complex ownership structures exist. Some shipowners design, own and operate a large number of ships, whilst others operate or lease a small number of second-hand ships. Similarly, some shipowners will own their vessels from cradle to grave, whilst others maintain a young fleet and sell vessels for further trading.

When a ship reaches the end of its useful life, a shipowner may sell it for recycling, in which case the shipowner is paid a price by a ship recycling facility or intermediary, who will recover and sell the steel and other components for recycling, refurbishing and reuse.

Ship recycling facilities are an important source of scrap steel used in other sectors, such as construction and electronics. South Asia (primarily Bangladesh, India, and Pakistan) is the region with the largest global share of recycled tonnage, accounting for over 80% in 2020. The fourth main recycling country is Turkey. These four countries provide the vast majority of global ship recycling capacity (NGO Shipbreaking Platform, 2020). Until 2018, China was also a key ship recycling country. However, a ban on the import of waste by the Chinese government has impacted ship recycling, leaving many ship recycling facilities in China under-utilised or used solely for state-owned ships.

The circular economy

The Ellen MacArthur Foundation conceptualises a circular economy as “an economy that is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. As a result, the economy is restorative and regenerative by design” (Ellen MacArthur Foundation, 2021).

Adopting circular economy principles requires a systemic shift in thinking

Adopting circular economy principles requires a systemic shift in thinking. Instead of optimising individual parts of a system, the system must be acknowledged in its entirety. In practise, this means considering the implications of a decision to other stakeholders and activities within the system, and finding solutions to its problems starting in the design phase.

Material hierarchies, often referred to as R-hierarchies, are developed to operationalise the concept of a circular economy. An example is the traditional 3R model of Reduce / Reuse / Recycle. Recently, more detailed hierarchies have been drafted as individual sectors look to understand how circularity principles can be applied to their activities, reaching as many as 10 levels (Reike, Vermeulen, & Witjes, 2018). This report proposes a 4R model (from the bottom up): Recycle, Refurbish, Reuse, and Reduce, further detailed in figure 7.

Circular

INCREASING CIRCULARITY

REDUCE	**Refuse**	Make a product or component redundant, either by abandoning its function or by fulfilling the same function in a different manner
	Reduce	Consume fewer natural resources and materials during production to achieve the same outcome, therefore increasing resource efficiency
REUSE	**Reuse**	Reuse a discarded product which remains in good condition and fulfils its original function
	Repair	Repair and maintain a defective product so it can perform its original function
	Restore	Restore an old product to bring it up to date
REFURBISH	**Remanufacture**	Use parts of a discarded product in a new product with the same function
	Repurpose	Use a discarded product or its parts in a new product with a different function
RECYCLE	**Recycle**	Process materials to obtain the same (high grade) or lower (low grade) quality
	Recover	Incineration of materials with energy recovery

Linear

FIGURE 7

The 4R Hierarchy from recycling to reducing material use. Developed by 2Bhonest based on Reike, Vermeulen, & Witjes (2018)

Recycling steel from a ship is the lowest step within this hierarchy as it is focused on the processing of materials to obtain a similar or lower quality material

Recycling steel from a ship is the lowest step within this hierarchy as it is focused on the processing of materials to obtain a similar or lower quality material. Moving up, the next two steps in the hierarchy are refurbishment and reuse, which encourage extending the life of individual components, thus reducing environmental impacts. These steps can be 'built' into the vessel at the design stage, ensuring components can be repaired and, if needed, replaced. The highest step of the hierarchy is reduction of material use, which can similarly be 'built in' at the design stage in order to consume fewer resources and materials.

Fundamental change is needed to transform the shipping industry and the material flows within it. Although such a change requires time, a bold vision can help distinguish between the current line of thinking and the radically different view of a circular economy. Incorporating circular economy principles needs to start in the design stage, challenging the designer to include options to refurbish, rethink and reduce vessel parts. This line of thinking is further explored throughout this report.

Part II: The current state of ship recycling

International maritime trade is complex. Major developments in the world economy, merchandise trade, industrial activity and manufacturing supply chains define the demand for the world fleet in terms of volume, size and types of ships. Shipowners constantly review their fleet against their expectations of future market conditions. Guided by developments in the steel market, ship recycling capacity and capability, and regulation, shipowners decide whether to keep or sell a vessel, either for further trading, or for recycling (primarily as scrap steel). This decision-making process is illustrated in figure 8 below.

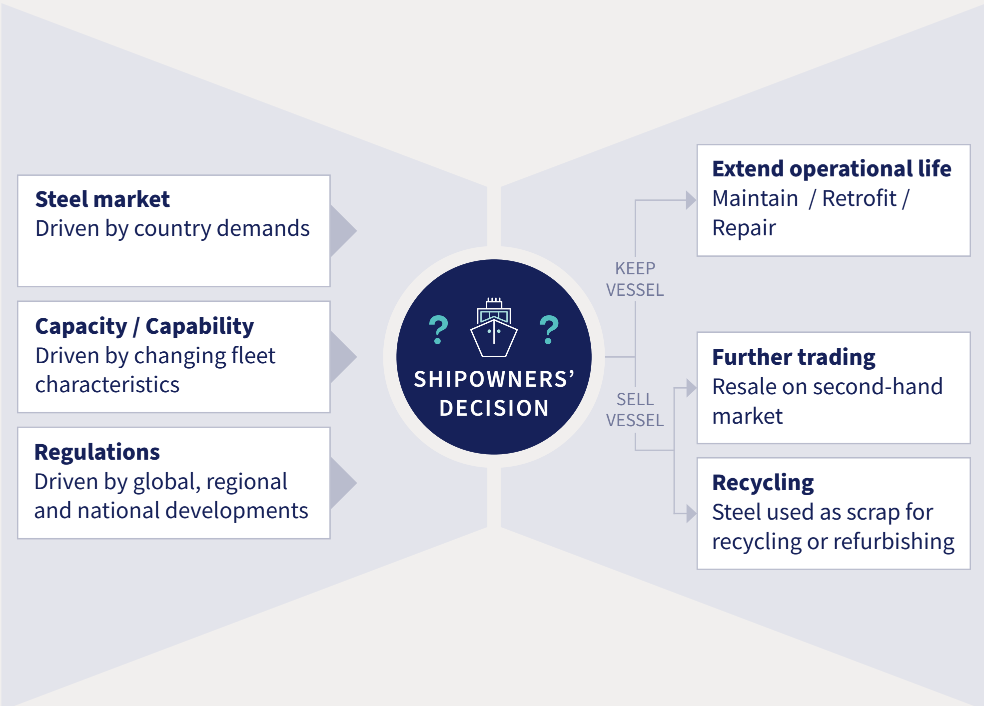


FIGURE 8

Shipowner decision route to recycling. Developed by 2BHonest

Steel is the main driver for the ship recycling market

Bangladesh, India and Pakistan are the leading countries for vessel recycling

Shipowners sell their vessels for recycling, which obtain a price primarily driven by the price of scrap steel. Due to an inherent demand for scrap steel and a robust market for second-hand machinery and equipment, the highest prices are obtained in South Asia (see figure 9). Prices in Turkey, the fourth largest ship recycling market, can be up to 40% lower, and in other parts of the world such as the European Union, UK or USA, prices can be up to 80% lower than South Asia. This makes Bangladesh, India and Pakistan the leading countries for vessel recycling, totalling over 80% of total global ship recycling volumes (NGO Shipbreaking Platform, 2019; 2020).

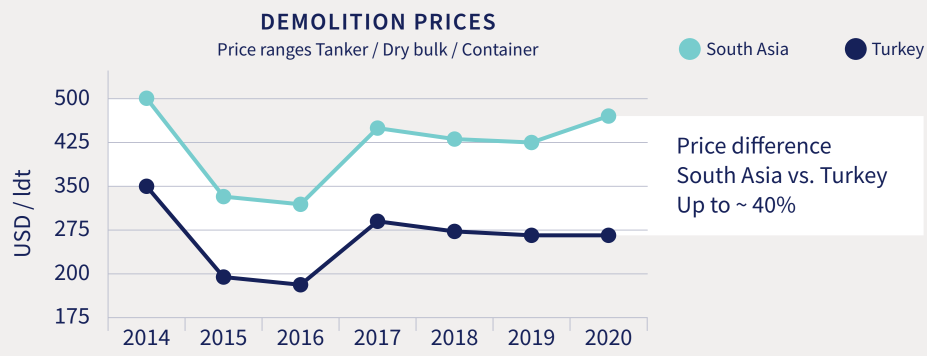


FIGURE 9

Recycling prices in South Asia and Turkey 2014-2020. Developed by 2BHonest based on Mikelis (2020)

Despite often being attributed to lower labour and regulatory compliance costs, the main driver for the price for ship recycling is steel. In South Asia, rerolling mills produce reinforcing bars and other steel products for the construction industry by heating and reshaping plates from recycled ships. The rerolled steel does not reach its melting point and requires lower temperatures compared to making new steel. As the steel used for shipbuilding is certified by classification bodies, steel plates from recycled ships are considered high quality and therefore compete with billets as the raw material for South Asia's rerolling mills. Consequently, South Asia's recyclers have the advantage of commanding better prices for flat re-rollable steel compared to scrap steel destined for melting (Mikelis, 2020).

The methods for recycling of steel in South Asia and Turkey contribute to reduced energy use and CO_2 emissions

Indian ship recycling facilities refurbish and re-roll 70% of steel scrap generated compared to that of Turkish facilities that melt all steel scrap (Mikelis, 2020). The methods for recycling of steel in South Asia and Turkey contribute to reduced energy use and CO_2 emissions. The World Steel Association indicates that on average, 1.9 tonnes of CO_2 are emitted for every tonne of steel produced (World Steel Association, 2019). Melting scrap steel in Turkey, for example, can result in roughly three times fewer emissions depending on electricity source. If steel is not melted but re-rolled, CO_2 emissions could be reduced by up to six times (see figure 10)[3].

POST-RECYCLING					CO_2 EMISSIONS Estimation in tonnes CO2 emitted for producing one tonne of steel
	Recycle	Melting	100%	Crude steel	0.65 (Virgin steel production = 1.9)
	Refurbish		10%	Circle or various size plate (only by cutting)	No data available
	Recycle	Rerolling	60%	TMT bars, angles, plates, channels, rounds	0.23 – 0.31
		Melting	30%	Crude steel	0.68 (Virgin steel production = 1.9)

FIGURE 10

Steel processing after ship recycling in Turkey and India. Developed by 2BHonest based on desktop research and World Steel Association (2019)

[3] These numbers should be used with care, since calculations to compare energy-related CO_2 emissions intensity in the international iron and steel industry requires detailed work. A long and complicated list of explanatory variables needs to be taken into account, such as the age of steel manufacturing facilities, energy mix and penetration of energy-efficient and CO_2 emissions reducing technologies (Hasanbeigi, Arens, Cardenas, Price, & Triolo, 2015).

More insight on the lifecycle can be gained through Life Cycle Assessments (LCAs). An example is a study conducted by Gratsos, Psaraftis, & Zachariadis (2009) which showed that over 95% of lifecycle CO_2 emissions are emitted during the operational stage of a ship's life. The same study showed that steel manufacturing and shipbuilding contribute roughly 3% of lifecycle CO_2 emissions, and the recycling stage only contributes about 1%. However, the shift towards vessels that operate on zero or low emission fuels and technologies will impact these percentages significantly, increasing the need to address and reduce CO_2 emissions at other stages of the lifecycle. An example for achieving these reductions could be through material efficiency principles aiming such as by designing and manufacturing for 100% hull reuse which could provide emission reductions of up to 29% compared to business as usual (Gilbert, Wilson, Walsh, & Hodgson, 2017).

Global fleet growth driving pressure on recycling capacity and capability

World economic development drives maritime trade and the demand for shipping capacity. Amongst others, increased production in emerging economies and technological advancements enabling lower transport costs, has led to more and larger ships being built in recent decades. Total tonnage in ldt has increased 3.5-fold since 1990, and the last decade has seen tonnage grow for all segments except general cargo carriers (UNCTAD, 2020). At the same time, the size of ships has also increased, facilitating global trade in pursuit of cost savings for carriers and consequently decreased maritime transport costs.

Increases in the number and size of ships has resulted in adaptations of port infrastructure and equipment to mitigate peaks in container traffic in ports. However, little attention has been paid to the impact on capacity and capability needs during the recycling phase.

In 2020 United Nations Conference on Trade and Development (UNCTAD) published an extrapolation of the current fleet expectations. The article itself supports the collaboration of UNCTAD with the International Maritime Organization (IMO) and private sector initiatives in the analysis and capacity building to support developing countries in preparing for the required shift in technology and fleet renewal. The underlying data however can also be used to project annual ship recycling capacity. The authors indicate that "if recent scrapping patterns persist, it can be expected that by the end of 2030, 43% of container ships are likely to be scrapped, with just 57% of the currently existing container fleet remaining in service" (Hoffman, 2020).

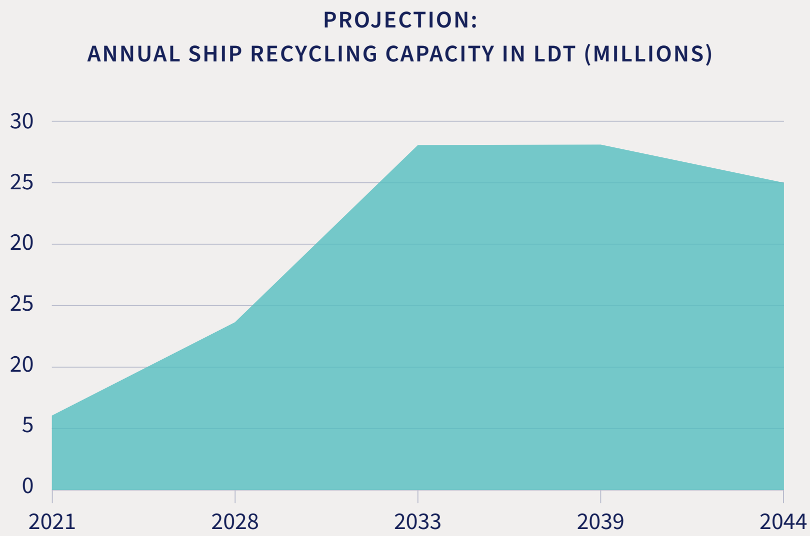
Following increased numbers and size of ships, tonnage due to recycling is projected to nearly quadruple by 2033

Combining global fleet figures with the average age of ships result in the conclusion that the current ship recycling capacity will not be able to process the increasing number of ships to be recycled. Following the increased numbers and size of ships built in the last two decades, tonnage due for ship recycling capacity is projected to double by 2028 and nearly quadruple by 2033 (see figure 11)[4].

[4] This figure provides the outcomes from a statistical extrapolation and is subject to market developments, such as changes to recycling age, which may change the trajectory of this figure in the future. Data from UNCTAD is used as a basis. After conversions to ldt (further detailed in Appendix 1) future expectations based on average and median recycling ages are then formulated to extrapolate the existing tonnage and expected recycling moment.

FIGURE 11

Projected need for ship recycling capacity between 2023 and 2044. Extrapolation by 2BHonest based on UNCTAD data (UNCTAD 2020; Hoffman, 2020)



The capacity challenge is amplified amid concerns about the capability to recycle larger ships. Ships have significantly increased in size in the last decade, with container ships almost doubling in size. A larger ship results in the need for a facility with an infrastructure that is able to process larger assets. The options for shipowners to choose such facilities outside of South Asia is limited due to capability limitations and market conditions (see figure 12). Within the EU list of approved yards in accordance to the EU Ship Recycling Regulation, only 6 of 34 facilities located in the EU and UK can handle Panamax-sized ships.

The capability concern is exacerbated by the fact that some ship recycling facilities located in EU member states are not dedicated to the international market. A report commissioned by shipping association BIMCO in 2020 explains that "EU member state facilities, in general, provide either bespoke local solutions to a niche recycling market, or are focussed on offshore decommissioning. The market provision shows that recycling in EU member states is an unattractive proposition in the overall international marketplace, and that facilities would far prefer to dedicate their energy and search for decent profit margins to either repair yard, newbuilding, and military or offshore recycling projects" (Marprof, 2020).

FIGURE 12

Ship recycling capability across locations. Developed by 2BHonest

LOCATION	CAPABILITY
South Asia (Bangladesh / India / Pakistan)	All Ships – no limits in size
Turkey	All ships – no limits in size Commercial focus on offshore decommissioning
EU / UK	Mainly smaller ships < Panamax Commercial focus on offshore decommissioning
ROW	Variety in capabilities – some have capability for all ships; others are small yards accommodating local recycling needs. China sole domestic focus

Need for a global regulatory framework

The lack of a global regulatory framework for ship recycling poses difficulties for shipowners

In a compliance-driven global industry, the impact of regulations is significant, and the lack of a global regulatory framework for ship recycling poses difficulties for shipowners. Two legislative instruments have been adopted to directly regulate ship recycling: the IMO Hong Kong Convention for the safe and environmentally sound recycling of ships (HKC), adopted in 2009 but not yet entered into force due to a lack of ratification, and the European Union's Ship Recycling Regulation (EU SRR), adopted in 2013 and entered into force in December 2018. In addition, The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (BC), which came into force in 1992, is linked to ship recycling. In 2019 the Basel Ban Amendment (BBA) was ratified by all EU and OECD member states, restricting the transboundary movement of waste from OECD countries to non-OECD countries.

The impact of these regulations is currently limited. The HKC has a global reach but is not yet in force, preventing global implementation. The EU SRR is in force but has a regional scope, which limits the impact on a global industry like shipping. The BC / BBA has global reach but is subject to legal debates, further detailed in Appendix 2. The potential impact is further restricted by decreasing tonnage covered by an EU flag and the practice of flags of convenience (FOCs)[5].

The EU SRR expects EU flagged ships to use a ship recycling facility listed on the EU list of ship recycling facilities (often referred to as the EU List). These facilities, located in both EU and non-EU countries, must comply with a series of requirements related to environmental protection and workers' safety. The list is reviewed and updated regularly to add or remove facilities. As of April 2021, 43 facilities are included on the list, of which 34 are based in the EU and UK. The remaining facilities are based in Turkey and the USA.

The list does not currently include facilities in South Asia. Several facilities in India have been inspected and three of these have been considered acceptable to EU auditors, pending findings on adequate emergency health care facility with a trauma centre and handling of downstream waste management materials (European Commission, 2021). India is making progress through upgrades to hospitals and improvements compliance and verification processes for handling hazardous materials (The Indian Express, 2021). In addition to these improvements, the entry into force of the Basel Ban Amendment will require the EU to enter into a bilateral agreement with India (and potentially other non-OECD countries) to grant facilities in these countries access to the EU List. The legal challenges around the Basel Ban Amendment and its impact on the accession of non-OECD facilities to the EU List, are further detailed in Appendix 2.

[5] Flags of Convenience (FOCs) refer to the practice of a ship flying the flag of a country other than the country of ownership. The reasons behind FOCs include lower operating costs, better trade conditions or reduced regulations.

REGIONS	COUNTRIES	PROCESSED 2019		PROCESSED 2020	
		Tonnage in ldt (millions)	%	Tonnage in ldt (millions)	%
South Asia	Bangladesh	3.14	50	1.84	34
	India	1.44	23	1.74	33
	Pakistan	0.15	2	0.78	15
Europe & USA	Turkey	0.47	7	0.74	14
	Other EU / UK / USA	<0.10	<1	<0.10	<1
ROW	China and other	1.10	17	0.23	4
Total		**6.30**		**5.35**	

FIGURE 13

Ship recycling tonnage processed 2019-2020. Developed by 2BHonest based on NGO Shipbreaking Platform data (2019, 2020)

Figure 13 shows tonnage recycled globally in 2019 and 2020 by location with South Asia demonstrating continued dominance. Despite the EU SRR entering into force over two years ago, the market share of European yards has not increased as most of them do not have ship recycling as a market priority, main function or primary business (Marprof, 2020). Of the yards on the EU List, approximately only around a quarter of the theoretical capacity is utilised (23% in 2019, 28% in 2020), with 90% of that taking place in Turkey.

The current situation of ship recycling indicates that fundamental changes are needed to achieve a shift to a circular economy. The current regulatory stalemate combined with capacity and capability pressures and a recycling business mainly driven by the prices for recycled steel appear difficult to untangle. Other sectors and industries, however, have faced similar challenges and were able and willing to bring knowledge and awareness together to find solutions. Lessons from their first steps are further described in the next section.

Part III: Connecting the dots

Lessons from other sectors are valuable for our understanding of how circular economy principles can be and have been applied in comparable industries. In this report, learnings from the automotive sector through the Circular Cars Initiative and Honda are discussed.

Learnings from the automotive sector

CIRCULAR CARS INITIATIVE

"Managing the convergence of technologies, business models and policies needed to align the auto industry with a 1.5°C scenario, requires a systems approach founded on transparency and collective action" World Business Council for Sustainable Development (WBCSD, 2021).

The Circular Cars Initiative (CCI) is a public-private partnership between stakeholders in the automotive ecosystem, working to "eliminate or minimise total lifecycle emissions with a special emphasis on manufacturing emissions" (World Economic Forum, 2020) with the goal of aligning the automotive industry with the goals of the Paris Agreement by 2030.

Through its work, the CCI has found that achieving this goal requires "new collaboration models within and beyond the automotive ecosystem" as well as a "fundamental rethinking of today's value chain and its incentives" (World Economic Forum, 2020). To support this transition, the CCI works to create a common language and roadmap, laying the foundations for discourse around circularity in the automotive industry and the contributions that are needed to achieve this, covering economically viable, sustainable solutions across the material, business model and policy arenas.

The links between the CCI's work and the shipping industry are clear, highlighting: the importance of awareness and common understanding of circular economy principles; the potential for circularity to be one tool on the path to a decarbonised, sustainable shipping industry; and the need for multi-stakeholder collaboration to tackle the barriers and technical challenges and develop economically viable and sustainable solutions.

Image source: https://www.weforum.org/projects/the-circular-cars-initiative

HONDA

The work by car manufacturer Honda showcases the systems approach to manufacturing, comparing the automotive industry to a human body: “Just like the human body, industry depends on the existence of both arteries and veins. In this analogy, if Honda’s manufacturing operations are the arteries, then recovering end-of-life products and putting them to effective use again are the veins. As well as supporting Honda’s manufacture of products, Honda Trading is contributing to the formation of a recycling society through businesses that create systems for the unlimited recycling of those products.” (Honda, 2021).

	1 DESIGN	2 SHIPBUILDING	3 OPERATIONS	4 DISMANTLING
Reduce	Reducing resource use and prolonging lifetime			
	Avoid use of hazardous materials			
Reuse			Reuse of parts during maintenance and recycling	
Refurbish	Design with focus on material reuse, refurbishment and recycling		Refurbish of parts during maintenance and recycling	
Recycle		Recycling by-products	Recycling used or damaged parts	Safe and responsible recycling and waste handling

FIGURE 14

Circular by design. Developed by 2BHonest based on Honda (2020)

The importance of the design phase is explained in Honda’s sustainability report. Before a product or service is designed, a pre-assessment is carried out to promote reduce, reuse or recycling. Figure 14 above is an adaptation of Honda’s work, adjusted for this study to the shipping industry. Similar to the automotive industry, a focus on the 4R framework during the design stage can result in vessels that are more resource efficient, and with a focus on later repair, replacement and refurbishment of components to extend the vessel’s operational life.

Early steps towards circularity in shipping

Lessons from automotive are valuable for raising awareness of circular economy across all stages of the ship lifecycle, beginning in the design phase. Despite similarities with the automotive sector, the shipping industry faces its own set of challenges and trends moving ahead. Increased digitalisation and stakeholder demand for transparency and accountability are bringing to bear more tracking and reporting on sustainability activities, targets, and challenges. This, in turn, enables the development of new technologies and innovative solutions to help stakeholders solve these issues. At the same time, the shipping industry has rallied around the need for rapid decarbonisation, notwithstanding its exclusion from the Paris Agreement, and now facing pressure from regulators, investors, customers and other stakeholders to ensure that it contributes to the global sustainability agenda.

Key barriers to circularity that can be applied to shipping can be broken down into four categories: knowledge, business models, technology, and regulation, as outlined in figure 15. Initial efforts to understand the potential of circularity for shipping have already taken place, laying the foundations for further work in this area.

FIGURE 15

Four key barriers towards a circular economy. Developed by 2BHonest based on Kirchherr et al. (2018)

KNOWLEDGE	Lacking awareness and/or willingness to engage with circular economy	**BUSINESS MODEL**	Lacking economic viability of circular economy business models
TECHNOLOGY	Lacking (proven) technologies to implement circular economy	**REGULATION**	Lacking policies to support a circular economy transition

In the Netherlands, the Netherlands Organisation for Applied Scientific Research (TNO) is working to increase awareness of circularity in the maritime sector as a way to reduce shipping's carbon footprint. "Simply put, the research cuts a ship into pieces and then investigates where each component comes from and the implications of this for the carbon footprint. Based on data, improvements can be examined, possibly by comparing the results with different types of ships. The research should eventually lead to a top 10 of measures and a circularity overview of short-cycle materials such as iron and aluminium, hazardous materials such as lead and asbestos and rare materials such as copper and cadmium" (TNO, 2021).

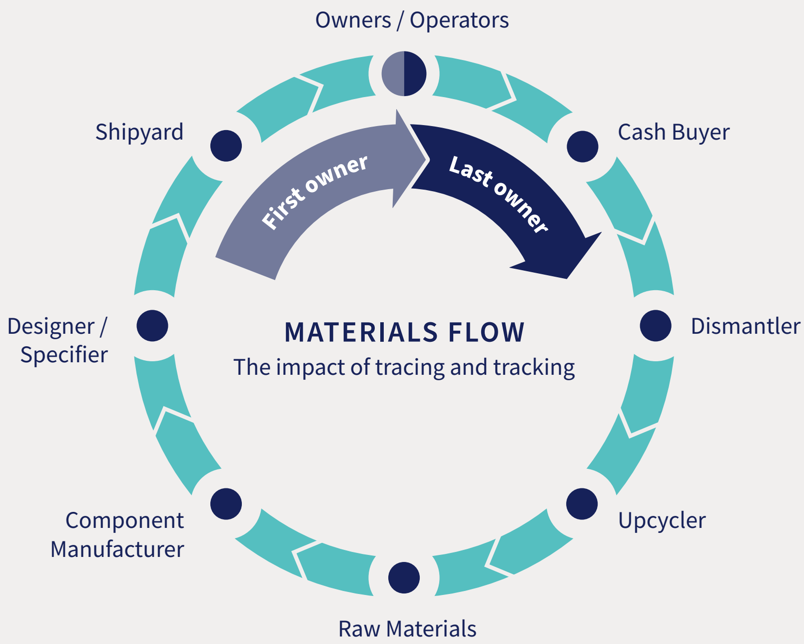
This need to understand and trace ship components was also explored through the Maersk Cradle to Cradle passport, which documented the main materials used to build the company's Triple-E vessels with a view to improve the circularity of materials. The Sustainable Shipping Initiative's (SSI) Closed Loop Materials Management work in 2013 worked with stakeholders across the ship lifecycle to highlight the need for traceability of materials, and found that when buying or selling a ship, a breakdown of materials used, including weight and location, could increase its value. It further found that ship recycling is complicated by "unidentified materials, coatings, adhesives and composites [that] often go unspecified in designs and plans" (Sustainable Shipping Initiative, 2013).

When buying or selling a ship, a breakdown of materials used, including weight and location, could increase its value

The Cradle to Cradle project and other pilots carried out as part of SSI's Closed Loop Materials Management work showed that information cannot be collected in a scalable way without incentives and mechanisms in place to reduce complexities as well as data collection and reporting costs. The data collection framework should also enable easy data updating throughout the vessel's operational life, including after repairs and retrofits in order to create transparency and enable greater circularity.

FIGURE 16

Materials flow for vessels, developed as part of the Sustainable Shipping Initiative's Closed Loop Materials Management work (2013)



The Circular Shipping Initiative report launched in 2018 further explores the potential for circularity to add new value to shipping. It describes the need for circularity as a key driver of business model innovation requiring shipowners to "claim their role and co-develop future circular ecosystems with customers and supply chain partners, as well as digital players" (Circular Shipping Initiative, 2019).

All the work discussed in this section agrees on three key needs: common understanding, multi-stakeholder collaboration, and transparency

The work outlined in this section highlights the first pieces of the puzzle that may enable circularity in the shipping industry. Considerations of the need for increased circularity in shipping, traceability of materials, and business model innovation have been discussed as far back as 2013. However, the landscape faced by the shipping industry today in light of: decarbonisation efforts; the regulatory landscape; the need for increased ship recycling capacity; as well as greater maturity and interest in sustainability discussions, comes together to present a compelling argument for the need to begin incorporating circular economy principles in shipping. All the work discussed in this section agrees on three key needs: common understanding, multi-stakeholder collaboration, and transparency.

Part IV: Steering the industry towards a circular economy

We have established the critical need for collaboration across stakeholder groups both within and beyond shipping in order to steer the industry towards circularity. All stakeholders (see figure 17) have a role to play, from the shipbuilding and ship recycling yards, to Original Equipment Manufacturers (OEMs), regulators, investors, cargo owners and shipowners.

The following section focuses on the role of regulators and financiers as enablers of circularity in shipping. Driven by decarbonisation needs, regulatory and financial actors can link circular economy with opportunities for regulating and investing in environmental, social, and governance (ESG) topics. Reports such as the Ellen MacArthur Foundation's Financing the Circular Economy – Capturing the opportunity reflect the key role of finance in creating momentum towards a circular shipping industry.

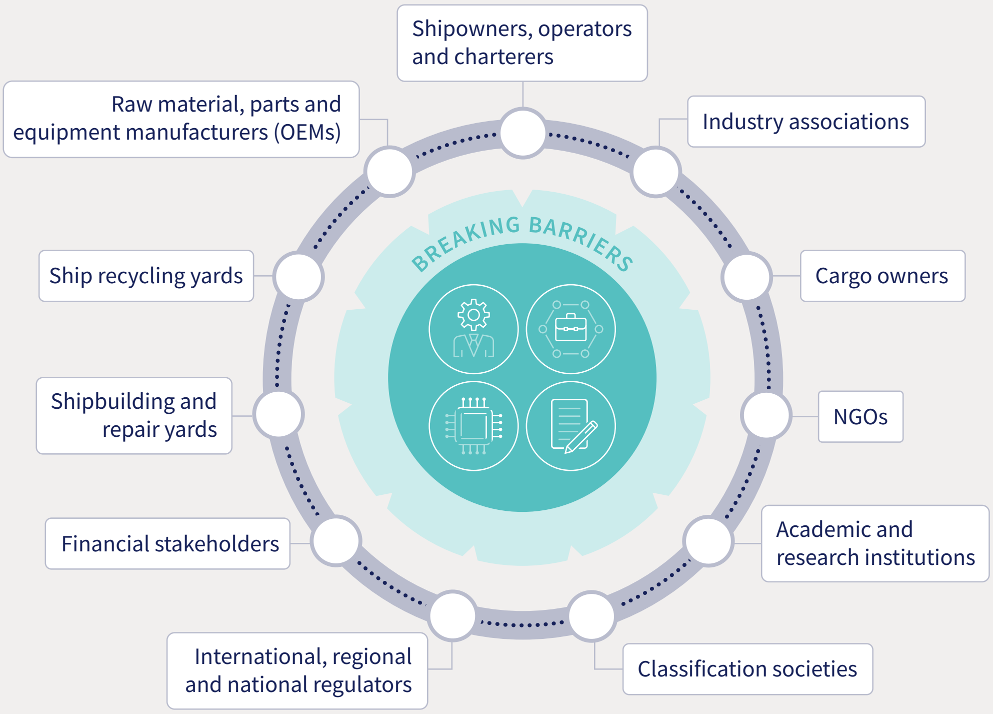


FIGURE 17

Breaking barriers requires collaboration across the shipping industry. Developed by 2BHonest

Regulatory action on the horizon

Current shipping regulation lacks a clear link to the ship lifecycle and the circular economy. Within ship recycling, both the IMO Hong Kong Convention and EU Ship Recycling Regulation focus on safe and environmentally sound recycling of ships but fail to consider design for recycling or the life of materials refurbished or reused after recovery from a ship. As both of these regulations were drafted during a time when circular economy principles were less widely discussed, direct reference to circularity could not be expected. However, they require the development and upkeep of an Inventory of Hazardous Materials (IHM), which keeps track of a number of hazardous substances within the structures and components of a ship and must remain with the ship from its build through to recycling. This marks a significant step in ensuring traceability and accountability across the lifecycle, regardless of how many times a ship may change hands and can be seen as a key first step towards greater circularity and collaboration throughout the lifecycle.

"A circular economy goes beyond the pursuit of waste prevention and waste reduction to inspire technological, organisational and social innovation across and within value chains"

– European Union, 2014

In terms of regulation specifically around the circular economy, major developments are taking place in the EU. In 2014, a scoping assessment of priorities and policy options to support the transition to a circular economy in the EU concluded that "a circular economy goes beyond the pursuit of waste prevention and waste reduction to inspire technological, organisational and social innovation across and within value chains" (European Union, 2014).

The adoption of the new EU Circular Economy Action Plan in 2020 created a stronger basis for legislative and non-legislative measures. One of the main blocks of the EU Green Deal, the Action Plan, is aimed at initiatives along the entire lifecycle of products, taking into consideration product design, and aiming to ensure that resources used are kept in the EU economy for as long as possible (European Commission, 2020).

Another key element within the EU Green Deal is its focus on ensuring that the transition to a climate neutral economy happens in a fair way, leaving no one behind. Through so-called Just Transition Mechanisms, support is provided to the most affected regions to alleviate the socio-economic impact of the transition. The concept of the just transition "encompasses both public policies and business action to deal with the impacts of industry transition away from greenhouse gas emissions for jobs and livelihoods (the transition 'out') and measures to generate the low or zero greenhouse gas emission jobs and livelihoods of a sustainable society (the transition 'in')" (IHRB, 2020). This is a key consideration for shipping in particular, where activities throughout the lifecycle take place in a number of locations around the world and impact related communities, including those of primary seafaring nations, shipbuilding and recycling facilities, port and coastal communities along shipping routes, and others.

Finally, clear links are being made between the maritime industry and the circular economy in the sustainable blue economy agenda. A European Commission communication in May 2021 outlined its vision for a sustainable blue economy, including "work to mitigate the impacts on oceans and coasts to build a resilient economy model based on innovation, a circular economy and a respectful attitude to the ocean." The communication further refers to incentives for businesses "that use or generate renewable resources, preserve marine ecosystems, reduce pollution and increase resilience to climate change." (European Commission, 2021).

These examples show the direction and growing interest of regulators in discussing and considering circular economy principles as tools to enable and facilitate the global sustainability agenda, and can only be expected to grow in coming years as knowledge and awareness continue to spread.

Finance as a key accelerator

Another major force with the leverage to accelerate the circular economy transition is the financial sector, including lenders, investors, and insurance providers. The United Nations Environmental Programme Finance Initiative (UNEP FI) published a report in 2020 detailing the strategies and actions that financial institutions can take to accelerate financing of the circular economy transition, highlighting how financial institutions can enable the uptake and scaling of innovation and manage related risks and barriers (UNEP FI, 2020).

The report includes recommendations for banks, insurers and investors including raising awareness of the implications of resource efficiency and materials flows among clients, thus using their leverage to increase knowledge around the potential of circularity to add value whilst reducing waste. Other recommendations include measuring circular economy finance on the balance sheet, growing the circular economy footprint of their lending, investment and insurance portfolio, and standardising circular economy metrics.

Interest from financial stakeholders can be beneficial and allow for the establishment of collaborative initiatives where knowledge creation and exchange take place

These recommendations point to increased financial materiality of the circular economy across sectors, emphasising the need for shipping to start considering first steps towards this transition. Interest from financial stakeholders can be beneficial and allow for the establishment of collaborative initiatives where knowledge creation and exchange take place, allowing for learning from other industries as well as innovative sustainable financing models that incentivise circular processes.

By looking at these two stakeholder groups and industry developments related to them, it is clear that discussion around circularity continues to accelerate across sectors. Whilst still early for shipping, these are clear indicators of the issues that key stakeholders (namely regulators and financiers) are working on, and thus an opportunity to take a leading role in their development and implementation for the industry.

Summing up

The shipping industry is still in its early days when it comes to understanding and applying circular economy principles across the ship lifecycle. At the same time, the industry faces a rapidly changing landscape in light of decarbonisation efforts, the growth of the global fleet and need for increased ship recycling capacity, regulatory changes, and the global sustainability transition. When seen together, these circumstances present an opportunity for shipping to demystify and apply circular economy principles throughout the ship lifecycle.

This report has looked at the current situation and existing framework in shipping and identified four main building blocks for a circular shipping industry: technology, regulation, business model innovation, and knowledge.

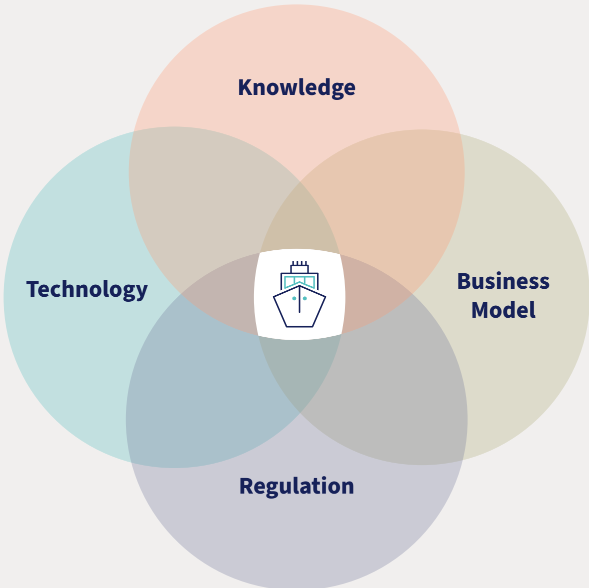


FIGURE 18

Building blocks of a circular shipping industry. Developed by 2BHonest

KNOWLEDGE

Generate awareness, knowledge and willingness to apply the concept of circular economy to shipping

BUSINESS MODEL

Develop business and finance models to support the need for cost-efficient solutions

REGULATION

Connect regulatory forces at all levels to enable a regulatory framework that fits the global nature of the industry while mitigating adverse social and environmental impacts

TECHNOLOGY

Understand how decarbonisation, closed loop infrastructure and value capture along the supply chain can support the transition needed

In the longer term, a systems change towards circular practices across the entire ship lifecycle is needed, starting at the design stage. Learnings from other sectors such as automotive as well as from previous work within the shipping industry, coupled with upcoming pressure from regulators and financial stakeholders for whom circularity is becoming a more material issue, provide the building blocks for shipping to adopt circular economy principles. In the regulatory landscape, ship recycling has shown that without global enforcement impact is limited, and thus standards must be applied globally.

In the short term, the industry needs to address the challenge of increasing global recycling volumes, driven by the continuous growth of the global shipping fleet (in both number and size of vessels). At the same time, it needs to lay the groundwork for further research and collaboration on circularity and create a common language and understanding around how the circular economy can help address shipping's challenges.

Further work required to guide research and collaboration into the potential for a circular shipping industry

Breaking the barriers toward a circular shipping industry (see figure 18) will require steps (big and small) to be taken based on a shared understanding and vision which implements learnings from other industries as well as shipping itself. Further work should focus on the development of a roadmap to guide multi-stakeholder research and collaboration across all stages of the ship lifecycle.

Additional research is needed into the technological, regulatory, and business barriers presented in this report to identify next steps, key stakeholders, as well as potential solutions. Research into the remanufacturing ecosystem, quantification of material flows (including how and where materials and components are reused), and LCAs of key vessel components (including their embodied carbon footprints), are needed to provide evidence-based data around benefits of circularity for shipowners and subsequently OEMs, shipbuilders, and other stakeholders. Collaboration with leading circularity initiatives across sectors can further accelerate these activities and limit any potential duplication of work.

Any further work in this area must consider the complex stakeholder landscape across the ship lifecycle and the role to be played by those stakeholder groups with the most leverage. This report paid particular attention to regulators and financial stakeholders for whom the circular economy is becoming a key consideration and who thus have the leverage to accelerate these changes. However, action towards circular shipping will require buy-in (and in many cases, leadership) from shipowners, ship building, repair, and recycling yards, classification societies, equipment manufacturers, and others.

Transparency and data-driven solutions are critical tools to enable circularity

Alignment with work already ongoing by research institutes can accelerate the development of technological, data-driven solutions and new business cases. Innovations can first be tested in specialised or niche markets where more opportunities for innovation exist, and then applied to markets such as bulk carriers or container ships.

With a mature ship recycling industry, the basic foundations for a circular economy for steel in ships already exists. However, greater transparency and traceability of all materials is a necessity, not only to enable circularity, but to make ship recycling safer and more environmentally friendly. At the same time, material traceability can increase the monetary value of a vessel and improve rates of reuse and recycling.

Technological and regulatory solutions are needed to address the short-term challenges around ship recycling capacity and capabilities

The above steps are all necessary but will not result in short term solutions to tackle the increasing capacity and capability ship recycling needs. The debate around responsible ship recycling is fuelled by concerns of sub-standard safety and environmental practices, the absence of relevant and enforced global and national legislation, lack of attention for social systemic problems and an uneven playing field. As a result, the basis for constructive dialogue and cooperation is limited.

Transparency and collaboration are necessary to rebuild trust among stakeholders, and solutions need to enable and promote responsible ship recycling practices regardless of geography, addressing the challenge of inadequate capacity and capability and enabling recycling in an economically viable manner, while mitigating adverse environmental and social impacts.

Looking ahead, a promising basis for a circular shipping industry can be found. Existing networks can be adjusted to build feedback loops within the ship lifecycle, connecting the dots between shipowners, ship building and recycling yards, steel manufacturers and other stakeholders. New forms of collaborations within these networks need to explore the potential of increasing the value of current material streams and creating shared value. Building knowledge and sharing experiences across sectors and stakeholders are at the centre of incorporating circularity from the design stage as the new standard within the shipping industry.

Appendices

Appendix 1: Ship measurements

Next to GT, the terms dead-weight tons (dwt) and light displacement tonnage (ldt) are often used to measure the size and tonnage of ships.

The following conversion factors are applied to convert dwt to ldt figures from different sources (Ecorys, 2005): Tanker: 0.3 / Bulk carrier: 0.33 / Container / General cargo / RoRo / Reefer: 0.44 / Other types of ships: 0.34.

A conversion from GT to dwt or ldt is not conducted in the report. Ships have significantly increased in size in the last decade as figure 19 shows.

SHIP TYPE	AVERAGE SIZE (LDT)			SIZE INCREASE (%)
	Age (years) 10–14	Age (years) 5–9	Age (years) 0–4	
Bulk carrier	23,625	25,660	26,889	↑ 14%
Container ship	19,169	29,062	36,679	↑ 91%
General cargo	2,312	3,303	3,859	↑ 67%
Oil tankers	21,928	23,494	23,494	↑ 13%
Others	3,005	2,226	3,557	↑ 18%

FIGURE 19

Continuous increase of size in ships. Developed by 2BHonest based on Hoffman (2020), converted from dwt to ldt

Appendix 2: A legal perspective on the Basel Ban Amendment

This legal perspective on the Basel Ban Amendment was previously published as a guest piece, authored by A.P. Moller Maersk, in the Ship Recycling Transparency Initiative (SRTI) progress report (launched May 2021)

Two international/regional legislative instruments have been adopted to directly regulate the environmental sound recycling of ships. The IMO's Hong Kong Convention for the safe and environmentally sound recycling of ships (HKC) was adopted in 2009 but has not yet to entered into force due to a lack of ratification. The European Union's Ship Recycling Regulation (EU SRR) was adopted in 2013 and entered into force on the 31st of December 2018.

The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (BC) is a UN international treaty which came into force in 1992. Amendments to the Basel Convention (BCA) entered into force in December 2019. The BC is ratified by all EU and OECD Member States. It restricts the transboundary movement of waste. Initially, assumptions were made by different EU Member States, that the amendments to the BC would effectively bar the EU from allowing ship recycling outside the EU in accordance with its own Regulation. This would mean that the EU could not allow yards from non-EU countries to be adopted on to the approved EU list.

According to article 11(2) of the BC, other treaties – such as HKC and the EU SRR – may take precedence: "provided that such agreements are compatible with the environmentally sound management of hazardous wastes and other wastes as required by this Convention."

This possibility for entering into an agreement under article 11 is thus conditioned by it (the agreement) providing a level of environmental protection at least equivalent to that of BC. It is generally accepted that the EU Regulation meets that same level of protection. This enables EU flagged vessels to be recycled at yards outside the EU.

A legal issue was raised regarding whether a Memorandum of Understanding (MoU) on ship recycling between the EU and India – that would allow for the possibility of Indian yards being included on the EU approved list – could be covered by the scope of art. 11 of the BC as this refers to "agreements".

An interpretation of the word "agreements" in accordance with article 31 of the Vienna Convention on the Law of Treaties (VCLT) establishes that the term "agreements" can encompass non-binding MoUs. This is in line with the already accepted "Article 11-agreements" listed on the Basel Secretariat's webpage which include MoUs.

Regarding the HKC, it is believed that this instrument (also) provides the same level of protection as the BC, wherefore the HKC – once it enters into force – will take precedence over the BC according to art. 11(2) of the Convention. Several stakeholders, including the EU and its Member States, have previously stated this, e.g. in a 2011 report to the Basel Secretariat[6].

Different legal experts, such as the law firm Gorrissen Federspiel, have also stipulated that different legal principles of international law would favour that the HKC will take precedence over the BC[7].

[6] The report, OEWG VII/12: Environmentally sound dismantling of ships, is available via the Basel Convention website

[7] See also p. 79 of the article "Ship recycling regulation under international and EU law" by Alla Pozdnakova, University of Oslo, Law Faculty, Scandinavian Institute of Maritime Law,. MarIus 535 (2019)

References

Circular Shipping Initiative. (2019). *How the Circular Economy could introduce new value to the shipping industry*.

Ecorys. (2005). *The Ship Recycling Fund - Financing environmentally sound scrapping and recycling of sea-going ships*. Retrieved from https://shipbreaking.wordifysites.com/wp-content/uploads/2019/01/ECORYS-survey-on-a-ship-recycling-fund.pdf

Ellen MacArthur Foundation. (2021, March 17). Retrieved from The Circular Economy In Detail: https://www.ellenmacarthurfoundation.org/explore/the-circular-economy-in-detail

European Commission. (2020). *A new Circular Economy Action Plan For a cleaner and more competitive Europe. Brussels*.

European Commission. (2021, May 5). Retrieved from Site inspection reports of yards located in third countries: https://ec.europa.eu/environment/topics/waste-and-recycling/ships/site-inspection-reports_en

European Commission. (2021). *Communication on a new approach for a sustainable blue economy in the EU Transforming the EU's Blue Economy for a Sust*. Brussels: COM(2021) 240 final.

European Union. (2014). *Scoping study to identify potential circular economy actions, priority sectors, material flows & value chains*. Luxembourg: Publications Office of the European Union.

Gilbert, P., Wilson, P., Walsh, C., & Hodgson, P. (2017). The role of material efficiency to reduce CO2 emissions during ship manufacture: A life cycle approach . *Marine Policy, 75 C 227 - 237*.

Gratsos, G., Psaraftis, H., & Zachariadis, P. (2009). *Life cycle cost of maintaining the effectiveness of a ship's structure and environmental impact of ship design parameters: An update*.

Hasanbeigi, A., Arens, M., Cardenas, J., Price, L., & Triolo, R. (2015). *Comparison of Energy-Related Carbon Dioxide Emissions Intensity of the International Iron and Steel Industry: Case Studies from China, Germany, Mexico, and the United States*. Ernest Orlando Lawrence Berkeley National Laboratory.

Hoffman, J. (2020, First quarter). Decarbonizing maritime transport: Estimating fleet renewal trends based on ship scrapping patterns. *UNCTAD Transport and Trade Facilitation Newsletter N°85*.

Honda. (2020). *Sustainability Report 2020*.

Honda. (2021, May 6). Retrieved from https://www.hondatrading.com/en/business/environment_resources/

IHRB. (2020, November). *Just Transitions for All: Business, Human Rights, and Climate Action*. Retrieved from https://www.ihrb.org/other/climate-change/report-just-transitions-for-all

IMO. (2009). H*ong Kong Convention International Convention for the Safe and Environmentally Sound Recycling of Ships*.

Jain, K., Pruyn, J., & Hopman, J. (2017). Quantitative assessment of material composition of end-of-life ships using onboard documentation. *Resources, Conservation and Recycling 107, 1-9*.

Kirchherr, J., Piscicellia, L., Bour, R., Kostense-Smit, K., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the Circular Economy: Evidence From the European Union (EU). *Ecological Econonics 150, 264-272*.

Marprof. (2020). *Report on the European List of Ship Recycling Facilities - Updated Report*.

Mikelis, N. (2020). The Recycling of Ships - 2nd edition. GMS.

Nederland Circulair! (2016). *6 Guidelines to empower financial decision-making in the circular economy*.

NGO Shipbreaking Platform. (2019). *Annual List of Ships Scrapped Worldwide*. Retrieved from Annual list of scrapped ships: https://shipbreakingplatform.org/resources/annual-lists/

NGO Shipbreaking Platform. (2020). *Annual List of Ships Scrapped Worldwide*. Retrieved from Annual lists of scrapped ships: https://shipbreakingplatform.org/resources/annual-lists/

Reike, D., Vermeulen, W., & Witjes, S. (2018). The circular economy: New or Refurbished as CE 3.0? — Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options. *Resources, Conservation & Recycling 135, 246 - 264*.

TNO. (2021, April 25). Retrieved from https://www.tno.nl/en/focus-areas/buildings-infrastructure-maritime/roadmaps/maritime-offshore/green-performance-of-ships/circular-shipping/

UNCTAD. (2020). *Review of Maritime Transport*. New York: United Nations.

UNEP Finance Initiative. (2020). *Financing Circularity: Demystifying Finance for Circular Economies*.

WBCSD. (2021, May 6). Retrieved from https://www.wbcsd.org/Programs/Cities-and-Mobility/Transforming-Urban-Mobility/Mobility-Decarbonization/Circular-Cars-Initiative

World Economic Forum. (2020). *Forging Ahead: A materials roadmap for the zero-carbon car*.

World Economic Forum. (2020). *The Road Ahead: A policy research agenda for automotive circularity*.

World Steel Association. (2019). *Steel's contribution to a low carbon future - Position Paper*.

World Steel Association. (2020). *2020 - World Steel in Figures*.

Photo Credits

The China Navigation Company
iStockphoto.com
World Economic Forum

Lead Authors

Pieter van t'Hoff & Didi Hoezen, 2BHonest

Contributions from

Elizabeth Petit González & Andrew Stephens, SSI Secretariat
Editorial Committee: Prashant Widge, A.P. Moller Maersk; Scott Jones, Oldendorff Carriers; Oriana Brine, SSI Trustee

Thank you to the industry stakeholders who provided inputs

E info@sustainableshipping.org
W sustainableshipping.org
@SustShipping

About the Sustainable Shipping Initiative

The Sustainable Shipping Initiative (SSI) is a multi-stakeholder collective of ambitious and like-minded leaders, driving change through cross-sectoral collaboration to contribute to – and thrive in – a more sustainable maritime industry. Spanning the entire shipping value chain, SSI members are shipowners and charterers; shipyards, marine product, equipment and service providers; banks, ship finance and insurance providers; classification societies; and sustainability non-profits.

SSI
Sustainable Shipping Initiative