Contributions of Ship Recycling in Bangladesh:

An Economic Assessment

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Acronyms and Abbreviations

BSBA	Bangladesh Ship Breakers Association
EU	The European Union
GTs	Gross Tons
HKC	The Hong Kong Convention
ILO	The International Labour Organization
IMO	The International Maritime Organization
NOC	No Objection Certificate
LDTs	Light displacement tons
SENSREC	Safe and Environmentally Sound Ship Recycling

Glossary

Ballast	Seawater taken into a vessel's tanks in order to submerge the vessel and maintain its balance.
Basel Convention	A convention on the set of rules to control transboundary movements of hazardous wastes and their disposal.
Beaching	The act of taking advantage of high-tidal conditions to propel a ship onto a beach of a ship breaking yard where breaking takes place.
Cash buyer	The intermediary between scrapped ship sellers and buyers.
Dead weight tonnage	The maximum weight that a ship can safely carry.
Decommission	The decision and process of taking a ship out of service.
Demolition	The process of breaking down or destroying a structure (usually on shore).
Dismantled tonnage	Weight of dismantled parts of a scrap ship measured in tons.
Dismantling	The process of breaking a ship down into various parts; a term preferred by the Basel Convention.
Gas free operation	The process of making ship breaking safe for the workers by removing various flammable and other harmful gases.
Gross Tons (GTs)	The capacity of a vessel measured in units of 100 cubic feet (a measure of volume rather than the weight of the ship).
Hazardous waste	Wastes that are considered threat to human health and environment.
Hong Kong Convention	A convention on a set of rules and regulations for the safe and environmentally sound recycling of ships, adopted in Hong Kong in May 2009.
Hot-rolled band	Flat-rolled coil steel is hot-rolled initially by passing a slab through a multi-stand hot rolling mill.
International Maritime Organization	The U.N. agency responsible for improving maritime safety and preventing pollution from ships**.**
Letter of credit	A letter issued from one bank to another that serves as a guarantee of payment from the buyer to the seller of the good (typically international transactions).

Lifespan of ships	The number of years a ship remains operational before being decommissioned.
Light displacement tons (LDT)	Weight of the ship *without* cargo, fuel, lubricating oil, ballast water, fresh water and feed water, consumable stores, and passengers and crew and their effects on board, but *including* liquids in piping up to working levels. LDT is the most relevant measurement unit in ship recycling.
Material Flow Analysis (MFA)	A methodical valuation of the flows and stocks of materials within a system.
No Objection Certificates (NOC)	A legal certificate issued by an agency that acts as a greenlight to proceed with the intended operation.
Rummage team	A group of experts (formed by the Bangladesh Custom) in charge of checking for bunker oil, hazardous materials, storage and cabin inventory.
Single hull oil tanker	An oil tanker (ship) that has only one outer water-tight layer.
Value-added multiplier	An economic measurement (a number/multiple) that accounts for the direct and the indirect (that is, induced) value-added generated by an industry. Value-added includes wages and salaries, proprietary income, other proprietor income, and indirect business taxes.

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Executive Summary

This report forms part of Work Package 1 of the project 'Safe and Environmentally Sound Ship Recycling in Bangladesh – Phase I', jointly implemented by the International Maritime Organization (IMO) and the Government of the People's Republic of Bangladesh.

This study provides an up-to-date assessment of the overall contributions that the ship recycling industry has made to the economy of Bangladesh. It also discusses the domestic and international regulatory frameworks within which the industry is operating, together with other major factors and developments that have, and will have, shaped the industry and impacted its economic performance.

It is important to note that there are important social, human health and environmental impacts of ship recycling which do not fall within the scope of this economic study and, on their own right, would warrant dedicated study. However, readers interested in the environmental impacts are referred to the companion study of Work Package 1.

In this study, ship recycling is taken to encompass all *economic* activities involved in dismantling and converting imported end-of-life ocean-going vessels−through using labour, land, infrastructure, machinery, and various utilities and consumables−into steel and other recyclable and reusable commodities that are mostly sold in domestic markets.

Bangladesh is one of the leading ship recycling countries in the world.

- On average, the industry recycled over 175 ships totalling about 1.8 million light displacement tonnes (LDTs; the most relevant measurement unit in ship recycling) a year over the past decade to 2015.

- Over this period, the Bangladesh ship recycling industry has accounted for over 25 percent of the total ships scrapped (in LDTs) by the five leading ship breaking nations; the four other being India, China, Pakistan and Turkey.

- In 2015, Bangladesh became the top ship recycling country in the world, surpassing India once again since 2008.

- Despite the structural and cyclical ups and downs in the global shipping and ship recycling markets, the ship recycling industry in Bangladesh has managed a respectable growth, estimated at about 14 percent a year on average since 1980.

- With expanded capacity of breaking yards over the years, Bangladeshi breakers have imported relatively large and diverse range of ships for recycling.

The internationally competitive ship recycling industry of Bangladesh is making valuable contributions to the national economy.

- The industry has sustained its international competition due to a combination of factors including adequate domestic demand for steel scraps and reusable materials and products; proximity to critical infrastructure and a thriving industrial zone with many re-rolling mills and other 'linkage' industries; stable climate and geographical advantage; relatively affordable labour; mature entrepreneurship; and enabling and conducive regulatory environments.

- The industry generated output worth, on average, about Taka 53.3 billion (approximately US$770 million; at 2009-10 constant prices) a year over the past five years to 2015.

- In terms of customs duties, income and other taxes, the industry has paid around Taka 5 billion (or, approximately US$68 million) a year, providing an important source of government annual revenues. Additionally, the industry pays a substantial amount of fees and charges as required under the current regulatory and compliance frameworks.

- Importantly, the industry provides jobs to many thousands of skilled and semi-skilled workers coming from across the country, estimated to be between 25,000 and 40,000 full-time equivalent jobs in 2015.

In addition to these *direct* contributions, the industry is making important *indirect* contributions to the national and local economies by supporting and stimulating a host of economic activities along its supply chain−upstream and downstream, including domestic steel manufacturing, ship building and repairing services.

- Between 80 and 90 percent of all materials recovered from dismantled ships (measured in Metric tonnes) constituted various forms of steel scraps. Typically, between 50 and 60 percent of these recovered steel scraps are used in re-rolling mills in Bangladesh. As such, steel scraps recovered from ship breaking account for over half of the domestically sourced feedstock into total steel manufacturing in Bangladesh.

- Recycled ships are effectively imported feedstock for domestic steel manufacturing. In view of this, the import dependency for feedstock of domestic steel making would not have been reduced substantially by domestic ship recycling. But the substantial value-adding and employment opportunities that the ship recycling industry has been generating since 1980 would have been foregone had there been equivalent direct imports of steel scraps for domestic steel making.

- As such, for every Taka 1,000 of value-added generated by the ship recycling industry, there was an additional Taka 2,000 of value-added generated along the supply chain−upstream and downstream, implying a value-added multiplier of 3. Value-added includes wages and salaries, proprietary income, other proprietor income, and indirect business taxes.

- In addition to steel scraps, ship breaking yards recovers substantial amount of non-ferrous metals (in the form scraps, sheets, nets and bar materials), estimated at 7,500 Metric tonnes in 2015 worth about Taka 1.2 billion (or about US$17 million) at the ‘yard gate’ in 2009-10 constant prices.

- Ship recycling also recovers numerous machines, components and hardware such as pipes, chains, boats, anchors and propellers, the value of which was estimated at Taka 7.6 billion (about US$111 million) at the ‘yard gate’ for the year 2015.

- By ensuring ongoing supply of key feedstock to domestic steel making as well as recovering other reusable or recyclable materials, ship recycling has contributed to the development and growth of many industries in Bangladesh, and thereby playing an important role in broadening and deepening the industrial base of the country.

The substantial domestic demand for steel scraps and the expected ongoing global supply of recyclable ships from the pool of ageing global merchant ships suggest a promising outlook for the ship recycling industry in Bangladesh.

Nonetheless, global shipping and ship recycling markets are volatile by nature. As such, not only the industry will have to deal with market uncertainties, it will also be facing domestic and international regulatory frameworks and standards which are currently being developed or implemented. One of the critical regulatory requirements relates to safe and environmentally sound ship recycling practices under the Hong Kong Convention. Also, the beaching method of recycling that is used in Bangladesh may come under some threat if the controversial EU Regulation gets up.

Last but not least, for evidence-based decision making by the industry stakeholders, it is critical to develop and maintain a credible information base and analytical capacity for the industry, which the authors of this report have found lacking. This report is expected to make a contribution to this end. Nonetheless, it is important that the industry's contributions be duly incorporated in the national accounts and employment statistics generated by the Bangladesh Bureau of Statistics in the future.

1 Introduction

This report forms part of Work Package 1 of the project 'Safe and Environmentally Sound Ship Recycling in Bangladesh – Phase I', jointly implemented by the International Maritime Organization (IMO) and the Government of the People's Republic of Bangladesh. The report documents the 'Economic Impact of the Ship Recycling Industry in Bangladesh' study undertaken under Work Package 1 of the project.

The objective of the study is to provide an up-to-date analysis of the economic impact of the ship recycling industry in Bangladesh. More specifically, the study assesses the industry's:

- direct and indirect economic contributions, measured in terms of steel supply and employment generated;
- economic impacts on other industries; and
- past economic performance as well as the future economic outlook of the industry.

It is important to recognise that there are social, human health and environmental impacts of ship recycling which are not covered by the scope of this economic study but would warrant dedicated study/ies on their own right. Readers interested in the environmental impacts are, however, referred to the companion study of Work Package 1.

In this study, the ship recycling industry is taken to encompass all *economic* activities involved in dismantling and converting imported end-of-life ocean-going vessels−through using labour, land, infrastructure, machinery, and various utilities and consumables−into steel and other recyclable and reusable commodities that are mostly sold in domestic markets. Ship recycling, ship dismantling, ship breaking and ship scrapping all refer to the process of taking an end-of-life vessel apart and, hence, these

terms are used interchangeably throughout this report.[1]

The economic data and analysis on the ship recycling industry of Bangladesh as a whole are either lacking or dated and inadequate. However, the industry's contributions particularly to the domestic steel manufacturing have been well recognised. The significance of Bangladesh, and more broadly of the South Asian countries, in global ship recycling has also been well documented (see, for example, Sarraf et al. 2010; Sujauddin et al. 2015; Mikelis 2013 and 2016). Going forward, the ship recycling industry of Bangladesh will be facing many opportunities as well as challenges. There has been growing awareness across the community and pressure on the industry with regard to improving the safety and environmental soundness in ship recycling. The domestic and international regulatory frameworks and standards are being developed or implemented so as to meet the expectations and needs of various stakeholders in ship recycling. In this context, enhancing the understanding of the Bangladesh ship recycling industry−not only about its contributions but also about its challenges−is essential for sound, evidence-based private decision making, public policy making and for the strategic positioning of the industry to avail future opportunities. This economic study is expected to make a timely contribution in this regard.

This economic study has considered a recent IMO Scoping Study and many earlier studies on relevant issues. Several industry visits and an industry survey were undertaken to collate information and data that have complemented various administrative data and information. A Material Flow Analysis (MFA) framework (Sujauddin et al. 2016) has been utilised to measure and assess the overall contributions of ship recycling in Bangladesh.

[1] Over the years many, and sometimes misleading, terminologies have been used to describe ship recycling. In the beginning, the process was referred to as *decommissioning of ships* or *abandonment of ships* or s*hip disposal* when reusing the ship material was of secondary importance. As the recycling activity has grown and ships were irresolutely broken apart anatomically to separate its organelle, the description got aligned more towards the activity rather than the purpose; and the *obsolete vessel scrapping, ships scrapping, ship dismantling*, *ship breaking* became more accepted terms. Some of these terminologies are, however, preferred by individual stakeholders for example, *ship dismantling* (the Basel Convention)*; breaking* (by the International Labour Organization and Environmental NGOs); *demolition* (by ship brokers); *disposals* (used in shipping statistics)*; scrapping* (by ship owners and ILO/International Maritime Organization/BC Joint Working Group), and *recycling* (by IMO).

2 The Structure, Growth and Performance of the Ship Recycling Industry in Bangladesh

Bangladesh is a leading ship recycling country in the world. Effectively starting off in the 1980s, the Bangladesh ship recycling industry has emerged in course of the past few decades as one of the leading destinations for dismantling and recycling end-of-life sea-going vessels of the world. In 2015, the industry scrapped and recycled 222 ships weighing a total of about 2.4 million light displacement tons[2] (LDTs) (Figure 2.1). Such scale of domestic operation has placed Bangladesh at the top of the recycling countries in 2015 in terms of LDTs of scrapped ships (Figure 2.2). On average, the industry scrapped and recycled over 175 ships totalling about 1.8 million LDTs a year over the past decade to 2015. During this period, the Bangladesh ship recycling industry has accounted for over 25 percent of all ship scrapped done by the five leading ship breaking nations.

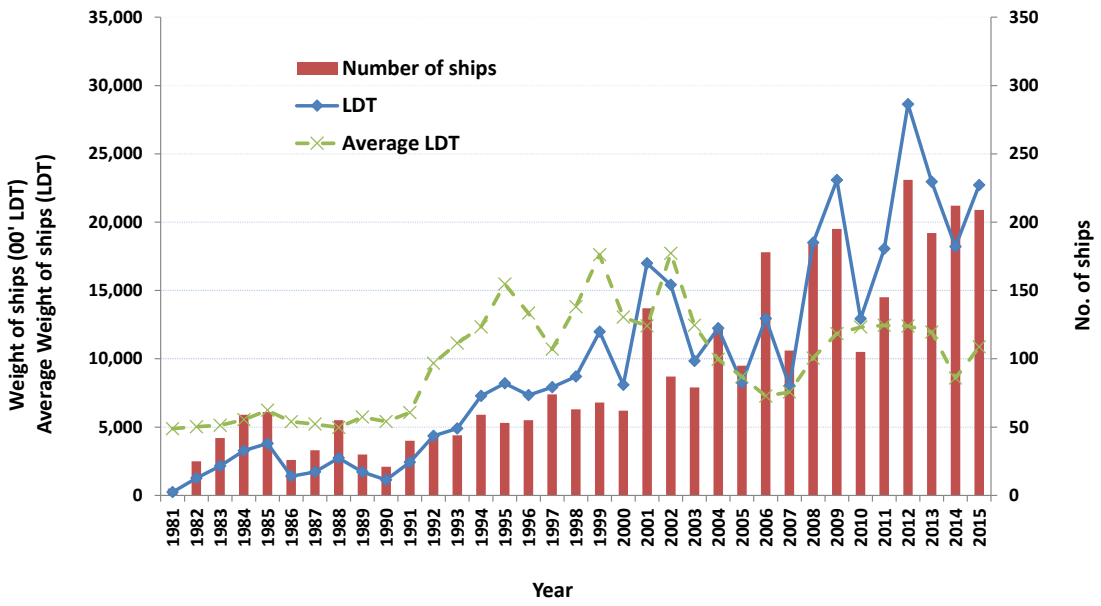

Figure 2.1: Estimated weight ('00 LDT), average weight (LDT), and number of ships recycled in Bangladesh
Source: Data for 1981-2011 are from Sujauddin et al. (2015); from 2011 onward administrative data.

[2] Light displacement tonnage (LDT or lightweight), the most relevant imperial measurement unit in ship recycling, measures ship displacement, in tons, *without* cargo, fuel, lubricating oil, ballast water, fresh water and feed water, consumable stores, and passengers and crew and their effects on board, but *including* liquids in piping up to working levels.

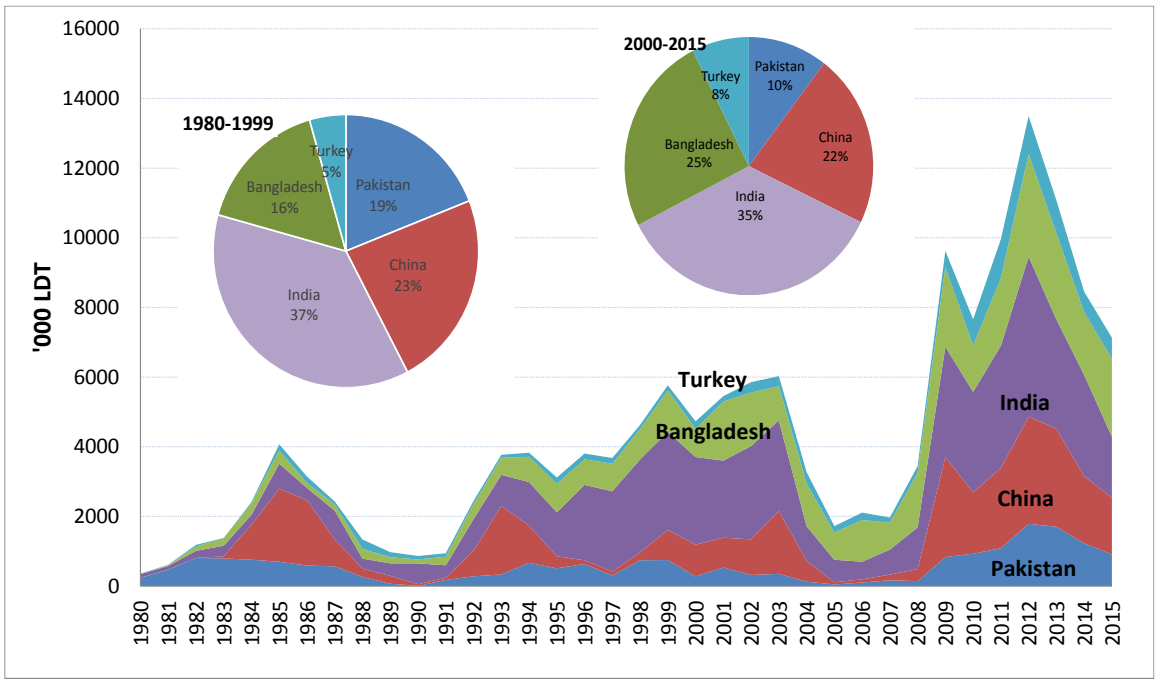

Figure 2.2: Volume ('000 LDT) and share (%) of ship scraps, the five leading ship recycling countries, 1980−2015
Source: Shipbuilders' Association of Japan (2015) and administrative data.
Notes: Gross Tons (GTs) converted into LDTs using the conversion model in Sujauddin et al., 2015)

All ship recycling yards in Bangladesh operate on the 18km long Shitakundu-Bhatiyari coastal strip in the north of Chittagong (Figure 2.3). In 2015, there were 148 registered ship breaking yards of which 68 yards were in operation. The geographical concentration of breaking yards in Bangladesh, a typical feature of ship recycling across the world, has been driven largely by locational advantages, benefits of necessary access to input supplies and enabling services, as well as by proximity to re-rolling and rolling mills for downstream processing of ship steel scraps. The concentration of ship breaking, reworking and recycling yards in a specific location gives rise to economies of scope and scale which enhance industry productivity, and thereby contributing to the ongoing growth and development of the ship recycling industry as well as other industries forward- and backward-linked with the ship recycling industry. It is no surprise that many

of the ship breaking yard owners in Bangladesh also operate re-rolling and rolling mills and/or own oxygen plants, creating a number of vertically integrated conglomerates.

As can be seen from Figure 2.4, the majority of the ship breaking yards in Bangladesh during 2012−2015 were involved in breaking large ships (>30,000 LDT). During this period, the number of yards breaking large ships was on the decline but still continued to be the major source of scraps. In contrast, a small number of ship breaking yards in Bangladesh dismantled small ships under 5,000 LDT.

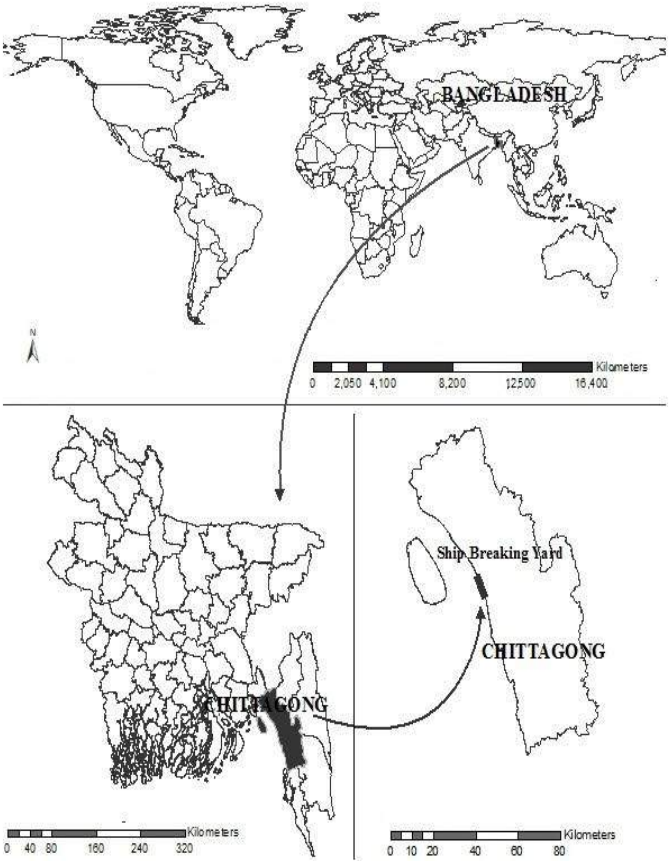

Figure 2.3: Location of ship breaking yards in Chittagong, Bangladesh
Source: Sujauddin et al. (2015)

The scale of operation of individual ship breaking yards in Bangladesh is further illustrated in Figure 2.5. A closer look at the figure reveals that from 2012 to 2014 there was a sharp rise in the number of yards breaking ships of 10,000 LDT and smaller. In

2015, the number of dismantled ships of this size fell but with a significant increase in yards breaking larger ships.

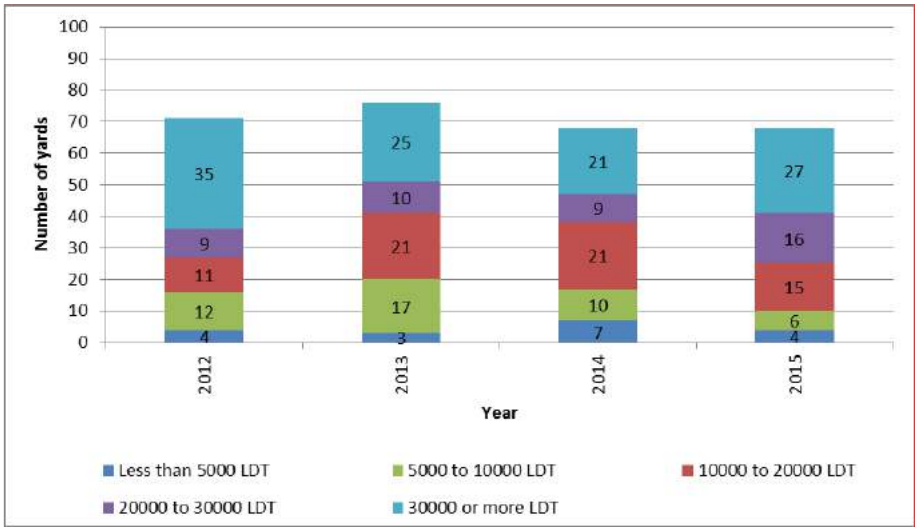

Figure 2.4: Ship breaking yards in Bangladesh by size of dismantled ships, 2012 to 2015

Source: Sujauddin et al. (2015) and administrative data.

The observed recent growth in the scale of operation seems to be a global phenomenon being underpinned by a variety of factors. In particular, globally, the heavier and bigger ships are on offer for recycling in recent times compared with the past as ships built after the 1980s were, in general, bigger and heavier than those built earlier. Commensurately, the ship recycling industry had expanded capacity to dismantle bigger and heavier ships. Also, with experience and time, the domestic ship recyclers have grown in confidence and capacity to dismantle bigger ships.

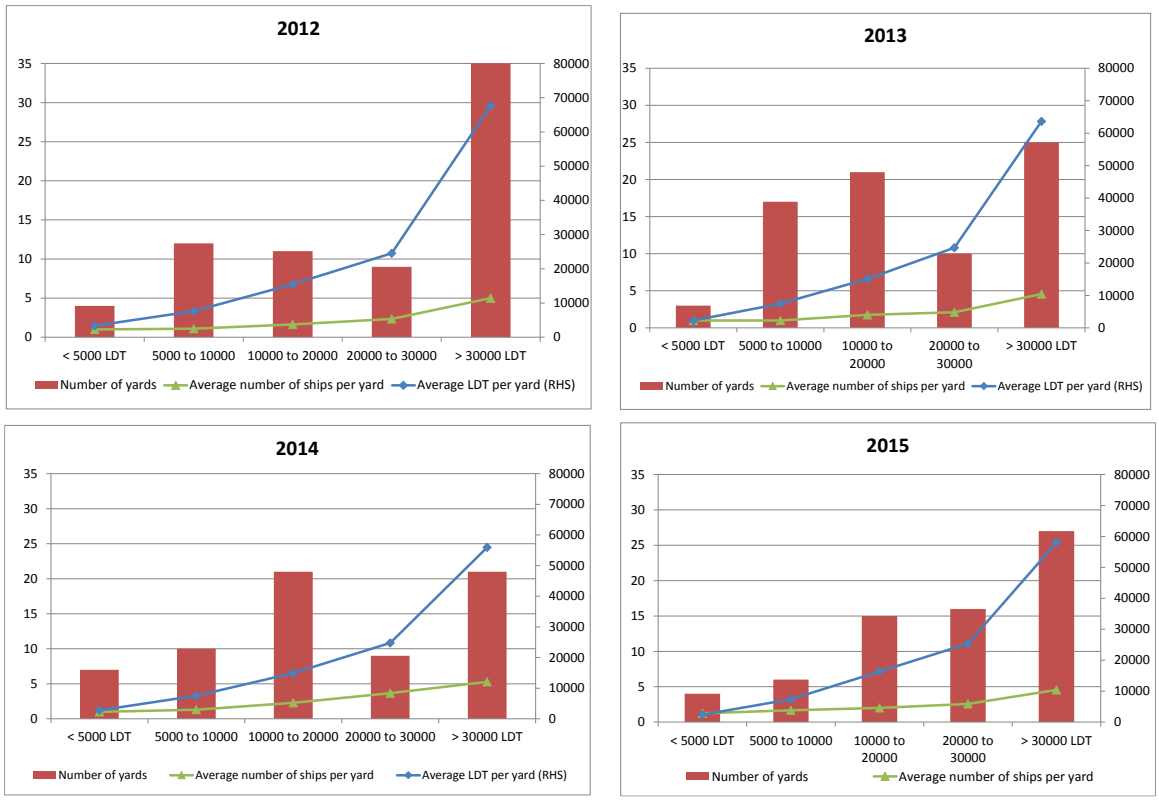

Figure 2.5: Scale of operation of individual ship breaking yards, and average number of ships and average LDT per yard

Source: Sujauddin et al. (2015) and administrative data.

2.1 Drivers of growth and markets for ship breaking and recovered materials in Bangladesh

The ship recycling industry in Bangladesh has come a long way since the 1980s, on average growing in terms of LDT scrapped at a rate of 14 percent a year despite the structural and cyclical ups and downs (Figure 2.1). The emergence, consolidation and the past performance of the Bangladesh ship recycling industry have been influenced by a variety of factors and events over the years, ranging from global and regional market dynamics and regulations to domestic operating environments and markets for steel scraps (Table 2.1).

Demand-side factors

Domestic demand for steel scraps together with wages and other operating costs including those associated with various regulations governing the operating environments of the ship recycling industry, in the main, determine the domestic demand for global end-of-life vessels for recycling (Figure 2.6). Domestic demand for steel scraps from ships is derived from the feedstock demand of re-rolling and rolling mills, which is essentially influenced by prices for steel plate (Mikelis 2013) and imported steel scraps. These, in turn, determine a significant part of revenues from ship recycling. Ship recycling revenues also come from the sale of a variety of other recyclable materials and products (non-ferrous metals, machines and equipment, hardware, fittings and furniture, oils and other consumables) recovered from the ships (Table 2.2).

Whether a yard will enter into the ship recycling market will depend on the potential (expected) revenue relative to the prices expected to be paid for the end-of-life ship(s) plus other estimated costs associated with ship recycling. Wages, costs of various consumables, duties, fees and charges and other compliance costs associated with workplace safety and environmental standards are the key elements of the recycling costs. Historically, these domestic labour and other operating costs in ship recycling relative to those in the competing ship recycling countries have largely determined the international competitiveness of Bangladesh in attracting global supply of end-of-life vessels for recycling.

Table 2.1: Key milestones and events affecting ship breaking in Bangladesh

1964	Chittagong Steel House jettisoned MD Alpine of Greek, a giant cargo ship left beached near the seashore of Fauzdarhat in Chittagong by a violent storm in 1960.
1970−79	Dependecy on scrap steel rose due to lack of iron ore deposits, favouring ship breaking in Bangladesh.
	The C138 Minimum Age convention was adopted and ratified by 155 nations in 1973. Bangladesh, India and the US did not ratify.
	"Al-Abbas", a salvaged Pakistan Navy vessel sunk during liberation war was scrapped in 1974.
1980−89	Bangladesh ship breaking experienced a boom as developed countries like the UK, Spain, Scandinavian countries, Brazil, Taiwan and South Korea getting rid of this industry due to non-compliance with new environmental protection standards.
	Bangladesh became a major ship breaking industry in the world
	"The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Disposal" was adopted in 1989.
1990−99	The ship breaking industry in Bangladesh consolidated substantially due to government's intervention and monitoring of the ship breaking activities.
	"The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Disposal" entered into force in 1992.
	In an effort to strenghthen the protection of developing countries, Parties to the Basel Convention adopted the "Ban Amendment" in 1994, banning the export of hazardous waste from OECD to non-OECD countries. It has not entered into force globally.
	The Bangladesh ship breaking industry had risen to the number two position behind India in terms of volume of scrapped ships in the mid 1990s.
2004	The governing body of Basel Convention requested IMO to come up with a new convention specific to ship recycling, which later led to the adoption of the Hong Kong Convention in May, 2009.
2005	In recognition of the need for international action to address pollution and safety issues relating to ship breaking, the IMO Assembly agreed to deveoping a new legally binding instrument for ship recycling under IMO's auspices.
2008−10	In September 2008, Bangladesh Environmental Lawers Association (BELA) petitioned to Bangladesh High Court to prevent the disposal of ships including hazardous wastes in Chittagong. On 17 May 2009, Bangladesh High Court Order banned ship breaking yards from importing ships without Environmental Clearance Certificate (ECC) from the Department of Environment. Importing and dismantling was stopped for 10 months in 2010 due to lack of safety measures for toxic materials and workers' safety hazards.
	IMO's International Convention for the Safe and Environmentally Sound Recycling of Ships was unanimously adopted in May 2009 by 63 countries

	Implementation of IMO regulations for phasing out of single-hull tankers from 2010 to 2015. The Ship Breaking and Hazardous Waste Management Regulation draft by Ministry of Environment and Forest was introduced in 2010.
2011	Ministry of Environment and Forest produced a Ship Breaking Guideline in January 2011 in order to attain Environmentally Sound Management. Ship breaking was declared a formal industry by the Bangladesh government on 13 February 2011. 'The Ship Breaking and Recycling Rules, 2011' was published by the Ministry of Industries. Ministry of Environment and Forest formulated the rule "Hazardous Waste and Management of Hazardous Waste in Ship Breaking-2011" in May. 142 ship breaking yards applied for Environmental Clearance Certificate (ECC) from the Department of Environment in July 2011, which granted 91 ECCs.
2012	The European Commission presented a proposal for European Union Ship Recycling Regulations (ER) specifically for European flagged ships in order to expedite the ratification of the Hong Kong Convention.
2013	The representatives of South Asian countries raised concerns that by excluding ships and recycling facilities in accordance with ER would negatively affect their national economies and local communities. In December, ER was brought into force.
2014	Phase 1 of the IMO's SENSREC-Bangladesh project launched.
2015	The Bangladesh Ship Recycling Act 2015 was drafted.
2016	Four countries namely Norway, France, Republic of Congo and Belgium have so far ratified the Hong Kong Convention. The Ministry of Industries of Bangladesh, together with the recycling industry, is working with IMO and the secretariat of Basel Convention to build hazardous waste management facilities and develop training courses for ship recycling workers and managers.

Sources: BUET (2012); DOE (2014); Ministry of Industries (2011); Hossain and Islam (2006); Mikelis (2013 and 2016); NGO Shipbreaking Platform (2012); Pastorelli (2014); Sujaudding et. al. (2015); Sarraf (2010).

Supply-side factors

Figure 2.7 lists various factors and mechanisms that influence ship dismantling decision and determine the global supply of ships to recycle. The global supply of the end-of-life ships does not depend only on the age of the ships. All ships are demolished eventually (Kaiser 2008). However, the decision of when to withdraw a ship from active service is

vested completely with the owner of the vessel (Sivaprasad 2011) who may opt for any of the following options (i) continue plying the ship in the hope of improved markets, (ii) laying-up the ship in the hope of a better time, (iii) converting to either alternative trades or modernize (e.g., re-engine), (iv) sell second-hand, and (v) send to dismantle (Knapp et al. 2008). The choice to be made from among these options depends on the interplay of various *economic*, *technical* and *regulatory* factors.

Demand-side drivers

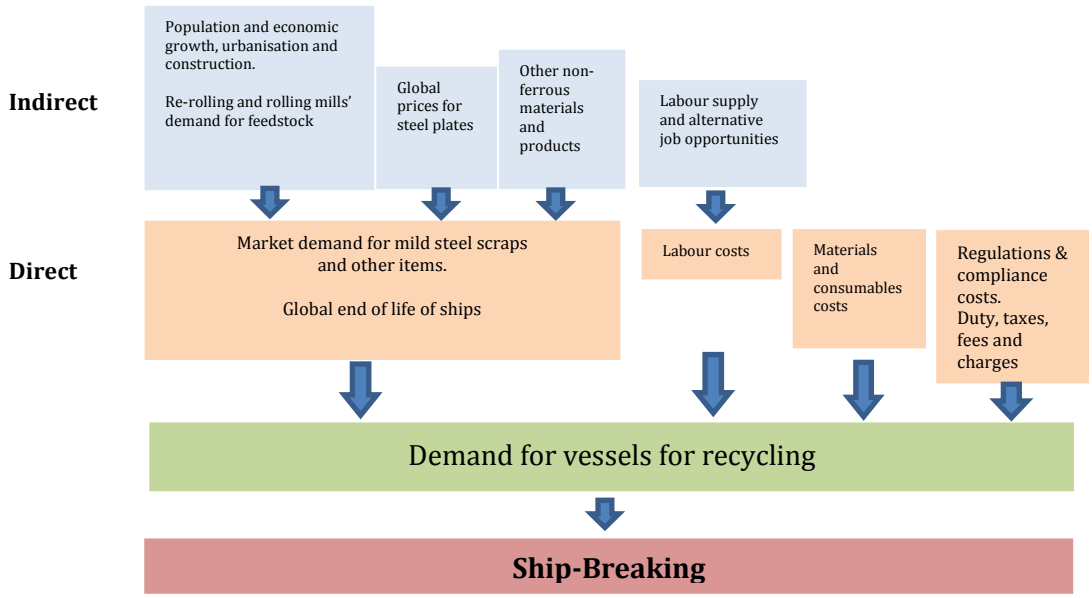

Figure 2.6: Factors affecting the demand for ship-breaking

Ships are quite expensive to build and operate; they undergo lot of wear and tear requiring recurrent and increasing capital investment with ageing, which sometimes make them uneconomical to operate and dismantling of the ships becomes a rational economic choice. Often the 5th special survey of ships, a regulatory requirement at 25 years of their age, calls for heavy repairs which, in many cases, are not worth undertaking especially in a weak freight and shipping market or when the owners are unwilling or incapable to

Table 2.2: Definition and examples of broad commodity categories in ship recycling

Broad category	Definition	Specific material/item
Steel & iron materials	Steel and iron collected as material other than functional equipment	Steel plate, Solid pillar, Bars and shaped steel, Scrap iron, Steel box, Sheet, Chain, Wire and Cast iron
Non-ferrous metals	Non-ferrous metals collected as material other than functional equipment	Scrap, Net, Sheet, Wire, Shaft and Flange of Aluminium, Copper, Brass, Stainless steel, Lead and Zinc
Machines	Machines, electronics, cables and marine equipment including boats and propellers	Main engine, Generator, Motor, Pump, Oil separator, Radiator, Condenser, Refrigerator, Electronics, Wireless equipment, Winches, Cranes, and Cables
Hardware	Pipes, Gate valves, Tanks and other hardware to work with machines	Pipe, Gate valves, Nuts & Bolts, Pulley, Filter, Spring, Jacks, Nozzle, Piston, Tanks, Cylinders, Anchor, Hose pipes, Propellers, and Boats
Fittings	Fixtures, Furniture, Non-metal materials, and other items not defined above	Ladder, Door, Basin, Cabin lift, Kitchen equipment, Bottle, Deck meter, Gyrocompass, Plastic, Glass, Paper, Wood & Furniture, Fibre, Bricks, and Cement
Oils	Various fuel and other oils	Furnace oil, Diesel oil, Lubricant oil, Gear oil, Compressor oil, and Sludge oil (Dirty oil)
Other consumables	Consumables other than oils	Paints, Chemicals, Foods, Medicine, Gas cylinder (LPG, Oxygen, CO_2)

Source: Sujauddin et al. (2016)

commit additional capital for repair and maintenance. Also, the increasing insurance premium with the age of ships that raises operating costs for aged ships and makes using them less profitable. In the past, slowdown in the global economy had cut down the shipping business and had facilitated the growth of the ship breaking industry. In addition, a fall in the international shipping freight rates intensifies demolition and, conversely, a rise decelerates demolition (as well as raising demand for new vessels *i.e.*

ship building increases). In addition, when scrap prices increase in the international market, owners decide in favour of dismantling. On the other hand, since the larger vessels need longer time to build and are kept in business for longer time, it is difficult to adjust their fleet size by changing the number of vessels in the short run. Consequently, in an active marine transportation market with soaring charter rates, even the most superannuated vessels continue serving the fleet and the supply of vessels to ship breaking industry decreases. In reverse, when marine transportation market faces a downturn it favours ship dismantling.

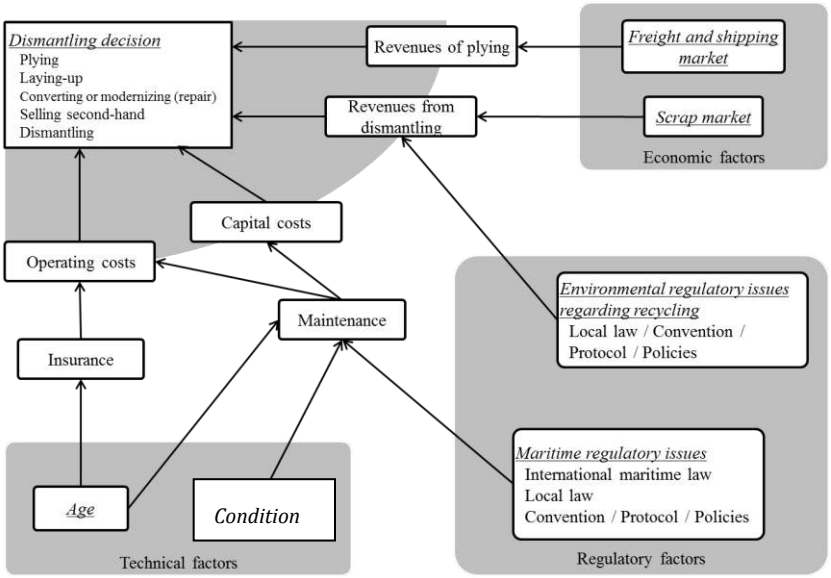

Figure 2.7: Drivers of the ship dismantling decision and the supply of global vessels for recycling

Source: Sujauddin (2013)

Historically, the global supply of the end-of-life ships has been volatile. The strong influence of fluctuating marine transportation market is the key to the volatility in the supply and prices of recyclable vessels. The volatilities are not caused by any single country or any individual stakeholder. Essentially, the marine transportation market is global by nature as is the market of vessels for recycling (Terao, 2008). Ships are usually

designed to ply in designated trade routes and, if commerce shifts away from those routes, the vessels become uneconomical to operate and sent for dismantling (Kaiser 2008).

Among *technical factors,* sometimes larger damages to ship's hull and/or machineries render ships more economical to break than to repair. In the scrap and storage market, old or obsolete vessels and rigs are frequently set aside for possible reuse or sale, cannibalisation, and dismantling. Ships are in some cases, 'laid up' from active service and get converted for an alternative use, depending on the condition and age of the vessel, through 'jumboizing' or reduction. Again, the dismantling decision depends on whether the ships are plying in domestic routes or in international route. For example, while the global average scrapping age for ships is about 20–25 years (Mikelis 2007; Gregson et al. 2010), in protected trades such as the U.S. domestic market, the average scrapping age is about 35 years. On the other hand, ships operating in freshwater such as in the Great Lakes or inland rivers corrode at a much slower rate than ocean going ships where steel gets exposed to a humid, salt-laden environment (Kaiser 2008).

On the *regulatory* side, there are legal or convention/treaty-bound obligations to send ships for dismantling under certain conditions, for example, the ban of single hull oil tanker increased the supply of those tankers to global dismantling market (Graham-Rowe 2004).

2.3 Performance and trends

Ship recycling in Bangladesh, as in other ship recycling countries, has been quite volatile in the past. As can be seen from Figure 2.1, ship breaking in Bangladesh–both in number of ships and in LDT terms–generally expanded from 1990 to 2001. During this period relatively large ships were recycled with the expanded capacity to dismantle these ships. This period was followed by a global supply shortage period from 2003 to 2007 (Figure 2.2), triggered by high freight rates because of increased demand for maritime transportation. Nonetheless, during this global ship breaking recession, Bangladesh

dismantled about 5 million LDTs out of a global total of about 15 million LDTs of ships, and became the global leader (Figure 2.2). The upward trends in global ship breaking resumed in 2007, and the dismantled tonnage in Bangladesh reached 2.3 million LDTs in 2009. Dismantled tonnage in Bangladesh fell sharply in 2010 because of a temporary ban on ship dismantling from June until October 2010 in Bangladesh, but it recovered since 2011 reaching an all-time high of estimated 2.9 million LDTs of recycled ships in 2012. In the past three years to 2015, dismantled tonnage in Bangladesh averaged around 2.2 million LDTs from just over 210 recycled ships per annum.

The trends of ship recycling in Bangladesh over the past two decades are clearly showing the country's advance towards becoming a global leader in ship breaking (Figure 2.2). This achievement seems to have resulted from a combination of factors including:

- favourable economics of domestic demand and supply for scrap materials and reusable items that ship breaking supplied;
- proximity to national highways and a thriving industrial zone with many re-rolling mills and other linkage industries;
- stable climate, locational advantage offered by stretched soft sandy-muddy beach, large tidal difference (up to six meters) in water depth, favourable continental shell with appropriate slope conducive to easy beaching of ships−a relatively cheap ship dismantling practice−during two spring tides in each lunar month,
- relatively cheap labour;
- entrepreneurial restructuring;
- improving workplace safety and practices; and
- gradually improving environmental legislation and law enforcement.

Many of these factors made Bangladesh a lucrative destination for ship dismantling.

Size of ships dismantled

Over the years, Bangladeshi breakers seem to have imported relatively large ships for recycling (Sujauddin et al. 2015). They imported fewer number of ships than other major ship breaking countries (except in 2006 and 2015), but these generated relatively more in terms of tonnage. Bangladeshi ship breakers preferred to break ships that yield a large amount of steel. Because Bangladesh has no large steel mills which can smelt iron ores, high-quality steel scraps from ships are in high demand as feedstock to re-rolling mills, which produce reinforced bars for the domestic construction sector. In 2006, the average weight of a scrapped ship was 7,300 LDT (Figure 2.1); 42 percent of ships were less than 5,000 LDT and only 8 percent were greater than 20,000 LDT (Figure 2.8). The worldwide recession in the ship breaking industry (2003–2007) most likely shifted the types of ships available during that period: that is, the ships available for purchase were smaller. The average weight of ships broken rose from 7,558 LDT in 2007 to 12,319 LDT in 2010 (Figure 2.1). From January to August 2011, the average weight of a broken ship was about 12,000 LDT, and 18 percent of ships broken weighed more than 20,000 LDT.

Four observations can be made with regard to the average weight of ships dismantled during 1981 to 2011 in Bangladesh, which may not be remarkably different from what could be observed in other major ship breaking countries: (1) *small ships were dismantled in the 1980s because of a lack of breaking capacity and also because the recycled ships on offer during the period were those built in the 1950s and 1960s which were smaller in size than those built afterwards;* (2) *larger ships were dismantled in the 1990s and early 2000s as the ship recycling industry had commensurately developed the capacity to dismantle them;* (3) *the average weight decreased in 2003–2007 during the worldwide recession in ship breaking as the older small ships were on offer for dismantling; and* (4) *average weight increased from 2008 onwards with the recovery in global ship breaking markets and enhanced confidence of domestic recyclers in breaking bigger and heavier ships*. Noteworthy is that a sharp increment has been observed in importing the larger ships from 2012 onwards by the Bangladeshi ship breakers. The increased number of re-rolling mills (approximately 500) and large rolling mills (about

10) also fuelled the demand for bigger ships during this period, because re-rollable scraps and intermediate product billets can be made in adequate quantity from bigger ships.

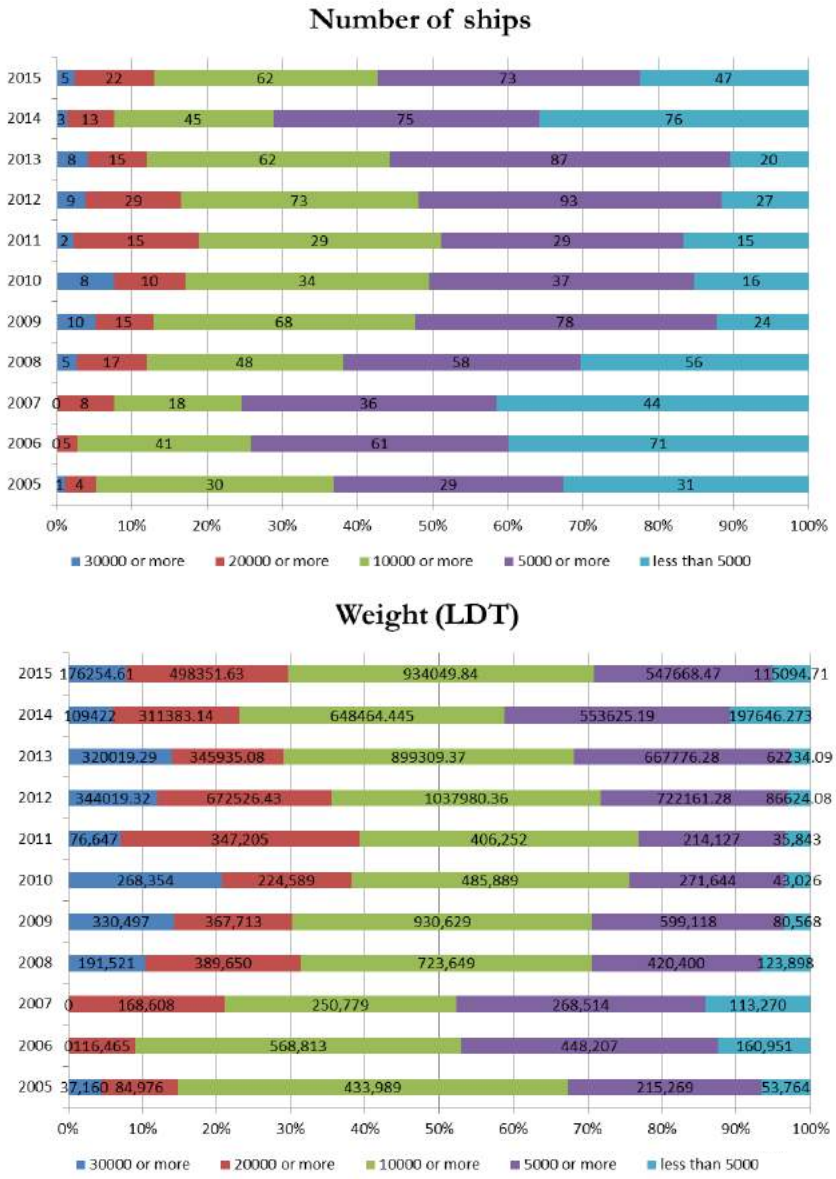

Figure 2.8: Size distributions of the (a) number and (b) weight (LDT) of ships dismantled in Bangladesh

Source: Data for 2005-2011 from Sujauddin et al. (2015), and for 2011 onward from administrative data.

Types of ships dismantled

The types of ships dismantled in Bangladesh diversified with the expanded capacity and experience of local breaking yards as well the global supply of a range of ship types. In 2000, for example, oil tankers accounted for about 57 percent of the total number of ships imported for recycling, followed by dry cargo and bulk carriers. But by 2010, liquefied gas-tankers, chemical carriers, pure car-carriers, and very large crude carriers were also dismantled. In terms of both number and weight, however, oil tankers were the most recycled ship type in Bangladesh in the past. It may be noted that dismantling of tankers has been occurring mostly in Pakistan because of its lesser regulatory requirements particularly regarding *gas free operation* conditions than in India and Bangladesh.

Lifespan or vintage of ships dismantled

As for the lifespan or vintage of ships dismantled, a considerable number were older than 30 years (Figure 2.9), which has long been thought to be the expected lifespan of most ships. The global age profile of dismantled ships (Figure 2.9a) was somewhat different from that in Bangladesh (Figure 2.9b). One potential explanation for the observed shorter

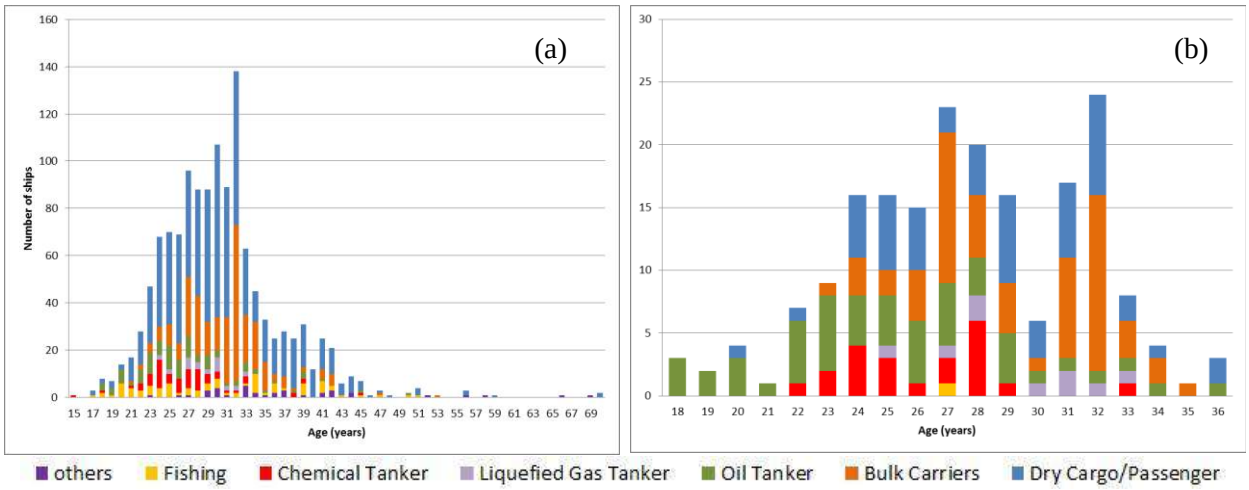

Figure 2.9: Age distributions of major ships dismantled in 2009 in (a) the world and (b) Bangladesh

Source: Sujauddin et al. (2015)

average lifespan of the dismantled ships in Bangladesh than elsewhere could be that Bangladesh's ship recycling industry, being a main feeder to the local steel industry, focused more on the bigger ships with higher steel content, such as cargo and oil tankers. Smaller ships often have longer lifespans (Mikelis 2007).

2.4 Changing ship recycling practices in Bangladesh

In recognition of the socio-political imperatives and changing policy environments (discussed in Chapter 3), the Bangladesh ship recycling industry has undertaken various measures and made significant investments particularly since 2010 in, for example, introducing and expanding mechanisation at the yards to replace manual handling, improving yard infrastructure, waste management infrastructure and practices with regard to labour force training and equipment.

Going forward, there are considerable opportunities for the Bangladesh ship recycling industry to maintain its global position but the industry will have to overcome some of the challenges particularly relating to workplace safety and environmental management. Some of the issues that are likely to affect the future structure, growth and performance of the Bangladesh ship recycling industry are explored in Chapter 5 of this report.

3 The Policy Environment Facing the Bangladesh Ship Recycling Industry

In assessing the implications for ship recycling activities in Bangladesh of domestic and international rules, regulations and obligations, it is instructive to understand various technical steps, policy procedures, and compliance and transaction costs involved in domestic ship breaking in Bangladesh.

3.1 Beaching and breaking of ships in Bangladesh

A summary of ship dismantling and recycling activities−the technical flow from offshore to the breaking yard, to millers, dealers and recyclers to end users−is presented in Figure 3.1. Obviously, the ship recycling process starts with the purchase of ships. As per the global practice, ship recyclers in Bangladesh purchase ships through a mediator called *cash buyer*. Globally, about 95 percent of all ships sold for recycling are sold through cash buyers who have country specific knowledge and expertise (Hunter 2012). Ship owners usually collect and sell most of the valuable consumables such as coating materials and oils (especially lubricating oil) before the ships reach their final port for their sale to ship breakers who then bring these ships to the Chittagong port mostly by the previous owners' operator(s). Also, selling of ships occur when consumables are not collected by the previous ship owners before selling the ship to ship breakers. Once a ship reaches Bangladesh, ballast water is disposed at outer anchorage near Chittagong port. As detailed later, securing various certificates (such as No Objection Certificates or NOCs) and reports from relevant agencies, the breaker applies for Beaching Permission from the Ministry of Industries. Once granted, a specially-skilled captain is assigned for beaching the ship at the designated breaking yard in shallow water during high tide and in the presence of a representative(s) of the breaker on board. With a Cutting Permission from the Ministry of Industries, the physical ship dismantling process commences.

Figure 3.1 Technical sequences in ship dismantling, material recovering and segregation at a yard

Source: Sujauddin (2013).

The adoption of relatively inexpensive *tidal beaching method* (Fig 3.2) is one of the major factors that underpinned the past growth of the internationally competitive ship breaking industry in Bangladesh (and also in India and Pakistan), taking advantage of the natural coastline for bringing ships ashore. There are other breaking techniques (namely, *non-tidal beaching* also known as landing method, *alongside*, and, extremely rarely, *graving dock* or *drydock*) practiced elsewhere in the world, depending on geo-physical attributes, suitability of pre-existing infrastructures or regulatory requirements. Tidal beaching is done simply by driving ships on full power towards beach during high tide for dismantling during low tide; and subsequent cuttings and selections are carried out on the dry shore land. As discussed later in this chapter, the beaching method is being threatened to be banned by the EU Regulation although permitted under the Hong Kong Convention.

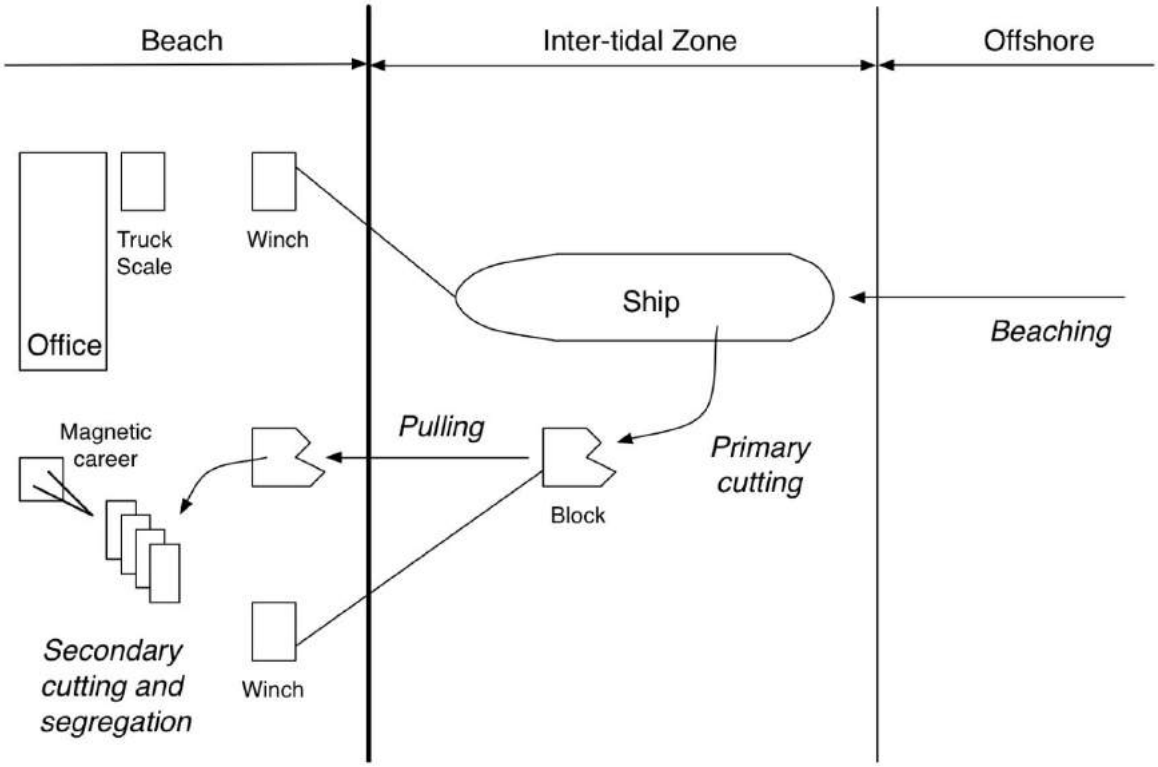

Figure 3.2 The beaching method used in Bangladesh
Source: Adapted from MLIT (2008) by using insights and observations made at various ship breaking yards during site visits.

Equipment and machines used in breaking and recycling procedures include natural gas cutters, oxygen cutters, winches, magnet handling carriers, pumps, and truck scales (Table 3.1 and Figure 3.3). The physical breaking process starts with securing a safe-for-man-entry and safe-for-hot-work status−otherwise known as *gas free operation,* when each hatch is opened to inspect potential presence of gas; holes are made and sea/fresh water is injected to ensure all chambers are gas free. Diesel oil, furnace oil, lubricating oil and sludge oil are collected into separate drums by hand pumps before removing

Table 3.1 Equipment and tools used in ship breaking

Name	**Description and use**
Gas cutter	To dismantle and cut a ship and its materials by hand. Fuelled by oxygen and natural gas.
Auto cutter	To dismantle and cut a ship and its materials straight and automatically.
Winch and rope	To transfer materials including steel blocks from inter tidal zone to land. There are often two to three winches at a yard.
Wagon	To transfer small items collected from ships by being pulled by a winch. Made of steel collected from a ship.
Magnetic handling carrier	Heavy machine to transfer iron and steel items by magnet.
Hand pump	To pump up oils. Hand pump is used to avoid explosion and burning.
Water pump	To pump up non-oil liquids.
Grinder	To grind surfaces of pipes.
Blower	To remove gas
Truck scale	To weight items being sold. Truck with loading items was weighted, then weight of items was calculated by subtracting weight of trucks themselves.
Wrench, Driver, Hammer, Shovel and others	Various purposes

Source: Sujauddin (2013)

(a) Gas cutter

(b) Auto cutter

(c) Winch

(d) Wagon

(e) Magnetic Carrier

(f) Truck scale

Figure 3.3 Equipment and tools used in ship breaking yards

Source: Sujauddin (2013).

consumables and hazardous wastes such as asbestos. As reported during interviews with ship breakers, trained workers are assigned for hazardous wastes removal process. Most consumables such as chemical substances and coating materials are resold as they are.

Then, all equipment, devices and non-ferrous parts and fittings such as electronic appliances, device parts, electric cables and pipes, as well as copper, brass, stainless and aluminium, and furniture are collected and sold to recyclers and traders by auction (Figure 3.1). At the last stage of ship dismantling, steel scraps and plates are cut and collected using gas and automatic cutters. At this stage, the cabins and the ship hull are cut into steel blocks and thrown into the muddy beach which are pulled ashore to the yard by mechanical winches during low tide for subsequent cutting into suitable shapes before selling and transportation.

3.2 National ship recycling policy, rules and regulations

To operate, a ship breaking yard must have a government issued Environmental Clearance Certificate (ECC) that is subject to renewal each year with satisfactory results from the air, water and sound tests conducted quarterly every year. The associated costs for a yard owner are given in Table 3.2. These costs are in addition to the Environmental Clearance Certificate required for each ship dismantled in the yard (discussed later).

Table 3.2 Environmental Clearance Certification (ECC) fees and charges

Description	**Amount** (Taka)
Government fees for ECC (first year)	66,000
Government fees for ECC renewal /year	10,000
Government fees for yard clearance certificate (air, water & sound tests, four times a year) /year	56,000
Other costs /yard*	50,000

Notes: *Includes indirect, time, transportation costs to get the clearance

Ship breaking in Bangladesh is to comply with the Ship Breaking and Recycling Rules 2011 (Bangladesh Government 2011), administered by the Ministry of Industries, which issues No Objection Certificates (NOCs) for importing ships as well as Inspection,

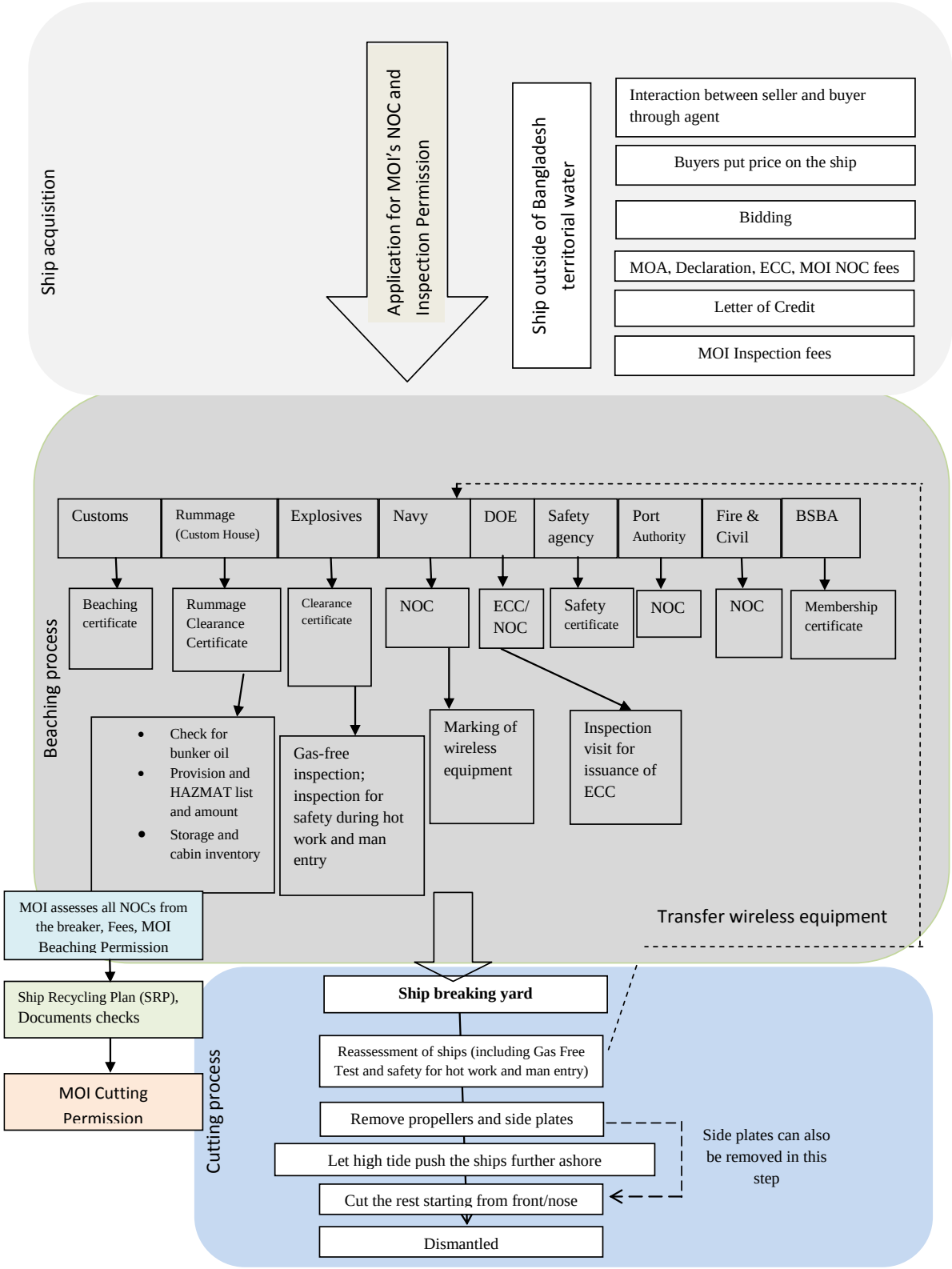

Figure 3.4 Process flow for no-objection certificates issue and permissions by government agencies

Beaching and Cutting Permissions. Once a ship breaker decides to buy a ship for breaking, the breaker should lodge an application with the Ministry of Industries to obtain an NOC before opening a Letter of Credit to import the ship (Figure 3.4). The Ministry issues the NOC after evaluating and examining a valid ECC for the yard, the Memorandum of Agreement on the specific ship purchase, ship's details and the inventory of on-board hazardous materials. For various stages of the Ministry of Industries' approval process, ship breakers are to obtain various clearance certificates and inspection reports from a range of other agencies (Figure 3.4). This clearance and inspection process is currently coordinated through a Committee for the inspection of ships as per the "Hazardous Waste and Management of Hazardous Waste in Ship Breaking 2011" rule (Department of Environment 2015). The Committee is convened by the Director, Department of Environment, and formed with seven other members and technical experts from relevant agencies and academia; namely, Bangladesh Navy, Department of Explosives, Customs, Fire Service and Civil Defense, Marine Academy, and the University of Chittagong. This current arrangement is due to be reviewed and may undergo changes in the future.

As the ship arrives at the outer anchorage, the breaker should obtain the Beaching Permission from the Ministry of Industries on payment of applicable fees. For Beaching Permission, the breaker has to obtain an ECC for the ship from the Department of Environment, Custom duty liability assessment and the Rummage Clearance Certificate from the Chittagong Customs House, and a safety certificate from a designated Safety Agency, 'gas free' certificate from the Department of Explosives, along with a Trade Body's valid membership certificate. With the Beaching Permission, the breaker employs a team consisting of a qualified Captain, Deck Officer and an engineer to beach the ship. Often the breaker employs a Beaching Master who has available to him some crew members of the seller. After beaching, the breaker must remove the navigation and other sensitive equipment marked by Bangladesh Navy during their inspection at outer anchorage. The Captain has to give a post-beaching report on the unused fuel and the design of the ship to the breaker who then has to submit it to the Department of Environment. Next, the breaker obtains a Cutting Permission from the Ministry of

Industries by submitting a range of necessary clearance certificates and inspection reports together with the Ship Recycling Plan for every ship to be recycled. Finally, when the breaking is completed, the breaker needs to submit a Statement of Completion to the Ministry of Industries. During breaking, the breaker should comply with Department of Labour's and COIFE's rules.

Table 3.3 Beaching and cutting permission costs*

Description	**Amount** (Taka)
Customs clearance /ship	75,000
Environmental inspection and ECC /ship	80,000
Explosive inspection /ship	40,000
Naval inspection /ship	50,000
Clearing and forwarding cost / LDT	12
Ministry of Industries (MoI) NOC fee /ship	3,000
MoI Inspection fee /ship	40,000
MoI Beaching permission fee /ship	10,000
MoI Cutting permission fee /LDT	4
MoI Safety officer/agency cost /ship	50,000
Other costs including rummage certificate /ship	90,000

Note: * Where applicable, these include costs for boarding, inspection, transportation, survey, report or certificate

Table 3.4 Government taxes and duties

Description	**Amount** (Taka)
Customs duty /LDT	1,500
Value-added tax /LDT	270
Advanced income tax /LDT	800
Land lease costs (high to low water line) /acre^	12,000
Local government taxes /yard#	9,000

Note: ^ also attracts a 15 percent Value-added tax and a 5 percent Urban tax. # includes costs for trade license, CNG permission and Tube-well permission.

The Bangladesh ship breaking and recycling clearance and permission issue system evolved over time mostly in an *ad hoc* manner, responding to specific cases and incidents, until the 2011 Ship Breaking and Recycling Rules were developed. This, in part, is because of the negative image of ship breaking in Bangladesh, particularly portrayed in the media and by the environmentally concerned NGOs, relating to labour

safety issues and lack of understanding and sound practice for environmental impact management. The current approval process and procedures that a ship breaker in Bangladesh has to go through for purchasing, bringing, beaching and breaking a ship alongside maintaining the ship breaking yard are formidable. There are administrative, compliance and transaction costs associated with various certificates and permissions (Table 3.3). For a ship of size 20,000 LDTs, which is close to the average for all the ships dismantled in 2015 (Figure 2.1), the inspection, clearance and permissions costs for a ship breaker could be well over Taka 800,000 (or, US$10,000 at the current exchange rate). In addition, the government collects taxes and duties from ship breakers on the basis of LDTs dismantled (Table 3.4). Again for a ship of size 20,000 LDTs, these taxes and duties could be over Taka 50,000,000 (or, approximately US$700,000 at the current exchange rate). That is, with a purchase price of US$300 per LDT for ships, these taxes and duties could represent about 10 percent of the total price paid for a ship.

Labour safety and hazardous wastes management

During the dismantling process in ship breaking yards in Bangladesh, human casualties are eventuated mainly from explosions and falling of workers from a height during cutting as well as during manual carrying-loading-unloading of heavy loads. In 20 years to 2005, about 400 deaths and 6000 injuries have been documented in ship breaking yards of Bangladesh (YPSA, 2005). Conditions have improved significantly in response to demands from civil society groups, and government's initiatives following the release of Ship Breaking Guidelines and Ship Breaking and Recycling Rules in 2011. Table 3.5 shows likely costs associated with improving workplace health and safety in a ship breaking yard. For a typical yard, these costs may range between Taka 4,000,000 and Taka 9,000,000 (approximately between US$50,000 and US$112,000 at the current exchange rate).

There is widespread scepticism regarding the sound management of hazardous materials such as asbestos, polychlorinated biphenyl (PCB), ozone-depleting substance (ODS) and heavy metals (Sarraf et al. 2010). The management of hazardous wastes in different ship breaking yards has shown signs of improvement in recent years since 2010, as the authors

of this report have observed during sight visits (Figure 3.5). After the Government of Bangladesh's Ship Breaking Guideline came into force in 2011, ship breaking yards in Bangladesh have built hazardous waste storages, oil-waste separators, incinerators, oil storage tanks and rest rooms for workers. In the hazardous waste storages, wastes are supposed to be kept into separate rooms by items such as asbestos, glass wools, coating materials, chemicals, electronic appliances and chemical containers. It is estimated that the likely costs for building hazardous storage facility will be around Taka 6 to 10 lacs (approximately between US$7,500 and US$13,000). The authors' on-sight investigation revealed that these facilities are not fully utilized in some breaking yards. On the other hand, since final disposal sites for these wastes have not yet been built, the wastes are temporary stored for now which has become an issue for ship breaking yard owners. Currently, the ship breaking area is not under the jurisdiction of the Conservancy Department of the Chittagong City Corporation, which deals with waste management issues.

Table 3.5 Potential costs for improving workplace health and safety

Description	**Amount** (Taka)
Healthcare costs (hospital/clinic, doctor, medicine, food etc.) for labour /day	3,000
Personal protective equipment (PPE) and its maintenance /year	200,000
Any drill or training cost /labour	3,500
Corporate social responsibility cost*	500,000 to 5,000,000
ISO certificates (first year)	700,000
ISO certificates renewal/ year	93,600

Notes: * Corporate social responsibility could involve providing staff with food to donation(s) for undertaking social/community activities to developing local roads and drainage facilities; and hence, the associated costs can vary significantly from year to year and from yard to yard.

(a) Storage facility of hazardous wastes and other materials

(b) Asbestos treatment facility

(c) Incinerator and oil/water separator

Figure 3.5 Hazardous wastes management facilities at ship breaking yards

Current state of play

Like in other developing countries, Bangladesh has a number of enforceable legal instruments which could have tackled the environment and labour safety issues of ship breaking by preventing explosions. For example, there exist 'Environmental Conservation Act 1995' and the 'Environmental Conservation Rules of 1997', 'Factory Act for Safety and Health Related Aspects 1965', 'Explosive Act for Gas Fee for Hot Work Conditions 1937' and 'Labour Act 2006' (Ahamed, 2011). Bangladesh Environmental Lawyers' Association's September 2008 petition to Bangladesh High Court to prevent the disposal of ships including hazardous wastes at Chittagong (NGO Shipbreaking Platform, 2012) led to May 2009's High Court order banning ship breaking yards without Environmental Clearance Certificate (ECC) from the Department of Environment from importing ships and asking the government to establish a legal system for the ship breaking sector by October 2011 and requiring the removal of hazardous wastes under specialist's supervision under the guidelines by the government (Ahamed, 2011). This order stopped the import and dismantling of ships for breaking for considerable period in 2010. The order also led the Ministry of Environment and Forest and Ministry of Industries to establish specific regulations for ship breaking and ship breaking yards. Later on as many yards obtained ECC, temporary permissions have been given to import ships and the breaking resumes under a relatively better condition. In 2011, 'Hazardous Waste and Management of Hazardous Waste in Ship Breaking' by Ministry of Environment and Forest (Ministry of Environment and Forest, 2011) and 'The Ship Breaking and Recycling Rules' by Ministry of Industries were released. According to the Draft Bangladesh Ship Recycling Act 2015, the government will maintain Bangladesh Ship Recycling Board (BSRB) within the Ministry of Industries. This board is likely to consist of at least 7 government officials and 3 (non-governmental) officials representing the ship breakers. This board will be in charge of providing oversight for the ship breaking industry, guiding and advising all aspects of ship breaking from approving Ship Recycling Facility Plan to ensuring workplace safety to coordinating the enforcement of labour and environmental laws and environmentally sound ship recycling process. The board will also be responsible for ensuring ship

recyclers' compliance with international conventions and standards. In addition, the aforementioned BSRB will be responsible for auditing and investigating the Hazardous Materials management facilities in every ship breaking yard in order to ensure proper establishment and use of these facilities. The board aims to build mutual collaboration with international organisations, research institutes and universities for exchange of knowledge and expertise. In case of breach of any ship breaking law, the board will be responsible for administering specific penalties and sanctions.

3.3 International ship recycling regulations

As the volume of ship dismantling increased over the years in Bangladesh (as well as globally), international and local NGOs intensified their efforts to raising concerns about the management of hazardous materials and workplace accidents since 1990s. In addition to domestic policy responses (discussed earlier), existing international guidelines and regulations, for example, on transboundary hazardous materials management by the United Nations Environment Programme (Secretariat of the Basel Convention, 2003) and worker safety by the International Labour Organization (ILO, 2004) have been tried; and the new ones, specifically targeted, pragmatic, occupationally safe and environmentally sound ship recycling practices by the International Maritime Organization (IMO, 2009) have been developed. For a variety of reasons−particularly in absence of legally binding enforcement authority, the existing international guidelines and instruments (viz. the Basel Convention; see Box 3.1 for details) seem to have experienced limited effectiveness and efficacies in achieving their stated goals and meeting ship recycling needs. Moreover, ships are not like the household electrical appliances as they have transboundary mobility and majority of materials from a dismantled ship are amenable to recycling or reuse which makes stringent application of producers pay principle practically difficult, if not impossible (Terao, 2008).

Entered into force in 1992, the Basel Convention makes no provisions specifically for ships or for recycling yards let alone recognising the concept of flag States. Nonetheless, ships with hazardous waste materials were brought under the purview of the Basel

Convention. The Basel Convention is fraught with difficulties and has proven to be unenforceable over the years in regulating end-of-life ships. In particular, identification of exporting States for second-hand ships in order to regulate ship dismantling under the pre-existing Basel Convention has proven difficult and unworkable (Maritime Bureau, MLIT, 2008). The Basel Convention's Ban Amendment that proposed complete prohibition on the export of hazardous wastes from developed (OECD) to developing (non-OECD) countries (if applied to ship breaking, for recycling ships in developing countries), is still not in force internationally today. In 1993, however, the European Union (EU) implemented the Basel Convention into European law. Subsequently in 2006, the EU implemented its Waste Shipment Regulation incorporating the Basel Convention's Ban Amendment. Ironically, the European Commission's enforcement of the Waste Shipment Regulation to ship recycling failed miserably, with more than 90 percent of the ships within the scope of the regulation evaded the regulatory requirements in 2011 (Mikelis 2016).

The failure of the Basel Convention in effectively regulating the international ship breaking industry laid the foundation for the development of the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships: the Hong Kong Convention or HKC, for short. The Hong Kong Convention was adopted in May 2009 (see Box 3.2 for more details). Recycling of ocean-going ships and coastal ships of 500 Gross Tons and above will be subjected to the Convention's regulatory requirements. (A Gross Ton is not a measure of weight but of enclosed volume.) The convention limits or prohibits hazardous materials on ships destined to be dismantled and outlines modalities to be followed by ship owners, ship breakers, ship breaking yards and government authorities in respective States for environmentally sound ship breaking in a safe, worker friendly manner. The convention is expected to enter into force in the future. The convention requires the owners of ships flying the flags of the Hong Kong Convention Parties to send their ships for dismantling only to the Hong Kong Convention compliant recycling yards. As such, Bangladeshi ship breaking yards need to improve their management of hazardous materials, labour safety and health issues in order to avail

themselves of future ship recycling opportunities under the emerging international regulatory framework.

Meanwhile, allegedly to speed up the process of the Hong Kong Convention ratification, in 2013 the European Commission adopted ship recycling regulation known as the EU Regulation (see Box 3.3 for more details) that will impose controls on ships and ship recycling facilities mostly consistent with those under the Hong Kong Convention (Mikelis 2016). However, one controversial but critical additional measure of the EU Regulation relates to the banning of beaching technique for ship recycling which may have far-reaching implications for the current practices and the future course of the Bangladesh ship breaking industry.

Box 3.1: The Basel Convention

Designed for strengthening environmental regulations in the industrialised world, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal−which came into force in 1992 and has come to be known as just the Basel Convention−was the *de facto* but notable attempt to regulate the environmental impacts of ship breaking facilities (Carey, 2011). The Basel Convention was crafted with three main objectives:

- To minimize the level of hazards in the waste generated, subsequently creating waste minimizing policy.
- To encourage disposal of waste in the vicinity of its source, essentially to reduce the volume of hazardous waste of developed countries being dumped in developing countries.
- To promote environmentally sound management and disposal of hazardous wastes.

Box 3.1 (contd.)

The Basel Convention defined 'waste' as 'substances or objects which are disposed of or intended to be disposed or are required by law to be disposed of by the provisions of national law' (Secretariat of the Basel Convention, 2003). The Conference of Parties to the Basel Convention resolved that, by this definition of 'waste', a ship may become waste under Article 2 of the convention. Whether or not the waste in a ship, or sometimes the ship itself, is hazardous is decided by the criteria provided in Annex of the Basel Convention. The Basel Convention covers ships that are engaged in international movements and does not apply to ships that are restricted to only national jurisdictions. The controls under the Basel Convention rely on the establishment of a chain of communications between the authorities of the countries involved in the trading of hazardous wastes. Under the convention, before shipping hazardous wastes the authorities of the exporting country are obliged to obtain a 'prior informed consent' from the authorities of the importing country to the effect that the shipment of the hazardous wastes in question can take place on the basis that the wastes will be treated in an environmentally responsible manner.

Limitations of the Basel Convention

- Determining when to define a ship as waste is a big dilemma under the Basel Convention, considering the beaching method requires the vessel to be functional right up to the last minute. Also, vessels destined for dismantling often carry cargo on their last voyage.
- It is also difficult to determine the port for the convention's regulatory enforcement specially when the transboundary movement involves several ports and countries. This makes it hard to apply the principle of country of export for ships under the Basel Convention (Carey 2011).
- The convention does not address at all the risks and challenges of ship breaking and lacks detailed rules for recycling that were needed (Chang 2010).

Not surprisingly, the implementation of the Basel Convention was difficult and inefficient (Mikelis 2016). Early attempts in enforcing the convention were unsuccessful. The European Union implemented the convention into European law but its enforcement in regulating ship recycling was doomed to failure.

Box 3.2: The Hong Kong Convention

Considering the ineffectiveness of the Basel Convention in managing hazardous materials in ship recycling, the UN International Maritime Organization (IMO) took environmental impacts of ship recycling onto its agenda. In fact, concerns around ship recycling were first brought to attention at the 42nd session of the IMO Marine Environment Protection Committee (MEPC) in 1998. The Committee recognised the dominant role IMO ought to play in regulating ship recycling facilities. The role should incorporate technical and legal aspects of the industry such as preparing the ship before recycling begins and collaborating with the UN International Labour Organization and the Basel Convention during the breaking process. In 2009, the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships was unanimously adopted at a diplomatic conference held in Hong Kong (IMO 2009). The conference was attended by delegates from 63 countries. The aim of the Hong Kong Convention is to ensure that the act of ship breaking or recycling does not pose any unnecessary risks to human health or to the environment. Needless to say that the Hong Kong Convention is the first ever targeted and internationally recognised framework that addresses both the environmental impacts and safety aspects of ship breaking (Chang 2010).

Key objectives of the Hong Kong Convention

- To close the identified gaps in Basel Convention while incorporating its objectives.
- To establish a 'cradle to grave' regulation in ship recycling that would comprise every single aspect in the life-cycle of a ship: beginning at the design and construction of a ship up to its final dismantling stage.
- To oblige all 'transboundary', in-scope ships to carry an inventory of hazardous materials.
- To create a comprehensive reporting and certification system of compliance with the Convention.
- To set off jurisdictional cooperation (which was lacking in the Basel Convention) by clearly designating the respective roles of the flag States, port States and recycling States.

Box 3.2 (contd.)

The key elements of the underlying mechanisms of the Hong Kong Convention include (see, for example, Mikelis 2016):

- The ship must have an Inventory of Hazardous Materials that states the locations and quantities of hazardous materials listed in the Annex of the convention.
- Once the Convention comes into force, the ship will be issued an International Certificate on the Inventory of Hazardous Materials.
- Recycling yards of countries who are Parties to the Convention must have a Ship Recycling Facility Plan−valid for five years−that will document systems and processes for workplace safety and sound environmental management.
- Document of Authorisation to conduct Ship Recycling (DASR) will be issued to recycling yards.
- Before beginning the process of ship recycling a Ship Recycling Plan will have to be developed based on its Inventory of Hazardous Materials.
- Before commencing the recycling process, a final survey will be done to provide the ship with an International Ready for Recycling Certificate by its flag State.

In order to come into force, the Hong Kong Convention has to meet the following three conditions (Article 17):

- Fifteen or more States have to ratify the convention: This appears to be the easiest of all conditions because the EU and OECD members are in consensus to sign and bring the convention to force.
- The States that ratify the convention must collectively constitute at least 40 percent of the gross tonnage in the global merchant shipping fleet.
- The combined maximum annual ship recycling volume during the preceding 10 years in the States that ratify the convention, must constitute at least three percent of the gross tonnage of the combined merchant shipping of the same States: It is suggested that ratification by the largest two of the five main ship recycling States (Bangladesh, India, Pakistan, China and Turkey) will be sufficient to meet this condition.

The Convention will enter into force 24 months after the date on which the above conditions are met.

Box 3.2 (contd.)

Gaps in the Hong Kong Convention

- The Convention excludes warships, naval auxiliary ships or other ships owned or operated by a Party and used for governmental, non-commercial services from the convention. Also ships weighing less than 500 Gross Tons (GTs) are exempted from the convention. Although nearly half of the ship fleet around the world do not fall under the scope of the Convention, the convention's coverage of ships is quite extensive in terms of gross tonnage.
- The Convention does not enforce the 'polluter pays' principle since it does not impose enough obligations on the ship owners and shifts the burden to the end of the recycling chain (Pastorelli 2014). However, the Convention requires that a ship flying the flag of a Convention Party will have to be recycled in a Convention Party yard. Unless there occurs widespread evation of this requirement, it may allow passing some Convention compliance costs back to ship owners.
- The Convention does not offer a clear mechanism for the process of recycling itself and leaves it to the domestic laws and regulations of each Party. While such flexibility accommodates business and legal imperatives within individual States, this may result in variations in ship recycling methods and practices across Parties.

It is postulated that the enforcement of the Convention will fundamentally change the global ship recycling market. Facilities in the countries who are Parties to the Convention will be able to recycle ships that fly the flag of States that are Parties to the Convention, as well as ships that fly the flags of non-Party States if these ships comply with the requirements of the Convention. On the other hand, non-Party facilities will recycle only non-Convention ships. (Mikelis 2012).

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Importantly for Bangladesh, the Convention does not restrict ground beaching or provide an alternative approach to ship dismantling that would be more environmentally friendly (Chang 2010). The Convention is pragmatic and recognises that putting a ban on beaching would be restrictive since more than 70 percent of the world's ship recycling depends on the beaching method. Nonetheless, the EU is pushing for banning the beaching method (further discussed in Box 3.3).

Box 3.3: European Union Ship Recycling Regulation

The Hong Kong Convention was ratified by only four Parties to the Convention as of June 2016. Meanwhile, in 2012 the European Commission presented a proposal for an EU ship recycling regulation to speed up the process of ratification of the Hong Kong Convention, by applying controls on ships and ship recycling facilities on the basis of the Convention. Known as the European Regulation on Ship Recycling or simply the EU Regulation, it also includes additional measures for European flagged ships (Ormond 2012). In December 2013, the regulation was brought into force by the European Union.

The EU Regulation is consistent with the Hong Kong Convention in many respects (Mikelis 2013). For example, the types and sizes of ships covered under the EU Regulation are the same as that under the Hong Kong Convention. Of course, the former is applicable to the EU flagged ships. The EU Regulation also applies to the non-EU flagged ships which enter the EU ports and requires that these visiting ships must have an inventory of hazardous materials. As such, the EU Regulation is structured in the same way as Hong Kong Convention with regard to controlling certain hazardous materials.

The owners of EU flagged ships will only be able to send their ships for recycling in facilities that are approved and included in the European list. These ships will require a 'Ready for Recycling' certificate. The EU Regulation states that when tankers will arrive at the ship recycling facility, the cargo tanks and pump rooms will have to be ready for certification for safe-for-hot work. By contrast, the Hong Kong Convention requires them to be safe-for-entry or safe-for-hot work but under the conditions of the domestic laws of the Parties to the Convention.

Under the scope of the EU Regulation, recycling facilities are expected to come up with a ship specific ship recycling plan based on the information provided by the ship owner under the guidelines of the Hong Kong Convention. In order to be authorised, recycling facilities will have to comply with the provisions of the Hong Kong Convention along with three important additional conditions as follows:

Box 3.3 (contd.)

- To operate from build structures.
- To indicate the 'control of any leakage' especially in the inter-tidal zones.
- To handle/manage 'wastes and hazardous materials' such that they 'must not come in contact with permeable floors'.

These additional requirements are the outcome of negotiations between the EU Council and the EU Parliament. The last additional requirement in the above list is the most controversial. A strict interpretation of the requitement means that nothing of an end-of-life ship must touch the beach. In fact, the European Commission (that enforces European law) has indicated its intention to interpret this provision as a ban on beaching. This will essentially exclude the South Asian recycling facilities, whose main technique of recycling is beaching. The South Asian countries collectively carry out about two-thirds of the global ship breaking and recycling. It is quite likely that European Commission's outright ban will induce many in-scope European shipowners to change flag and use South Asian breaking facilities. Such realities and workings of market forces could essentially make the EU Regulation on beaching ban rather ineffective if not completely irrelevant for South Asian ship recycling countries.

The EU Regulation cannot expect authorities in countries outside the EU to enforce the EU Regulation and, for this reason, the EU is developing a mechanism of 'European List of Ship Recycling Facilities'. If EU wants to promote 'responsible' ship recycling globally and minimise environmental footprints, it should develop a regulatory framework that does not shut down recycling industries in developing countries. Ideally, it should incentivise developing counties to improve their ship recycling practices and become 'green' without depriving them from future economic prosperity.

Implications of international regulations for ship breaking in Bangladesh

Bangladeshi ship breakers are internationally competitive. However, if and when the Hong Kong Convention comes into force, Bangladeshi ship breakers are likely to face formidable regulatory challenges in bringing ships from outside (Zakariya 2013). In addition, the enforcement of the Convention is likely to bring about changes to global market conditions. The Convention will require that its Parties' facilities should recycle only Convention-compliant ships (both from Parties and non-Parties). If a country does not ratify, it will have to restrict its recycling to only to non-Convention ships−in all probability, a smaller subset of global ships due for dismantling.

It is alleged that ship recycling industries in South Asia are to bear the regulatory burden disproportionately more than the ship owners under the Hong Kong Convention. However, barring any wide-spread 'leakages', the Convention provision that the 'Party ships' will have to be recycled by the 'Party yards' may allow shifting some regulatory burdens from ship recyclers to ship owners.

Importantly, however, the Hong Kong Convention does not ban the beaching method used in Bangladesh for ship recycling. The rationale for this provision of the Convention is that, given global ship recycling needs, a ban would be rather impractical as two thirds of the world's recycling capacity involves the beaching method. Hence, the focus of the Convention is appropriately on finding pragmatic solutions to reduce 'avoidable' risks to human health, safety and the environment. As such, some experts suggest that the Hong Kong Convention has a realistic chance of being ratified, even by the South Asian countries (see, for example, Mikelis 2016) especially Bangladesh which has a higher dependency on beaching due to to its extended uniform inter-tidal flat beach (Shameem 2012).

As of June 2016, four Parties have ratified the Hong Kong Convention. Nonetheless, the Convention is expected to enter into force within the next five to ten years. In the meantime, recycling countries are working towards implementing tighter safety rules in keeping with the requirements of the convention. In Bangladesh, the Ministry of Industries is working with the recycling industry and relevant international authorities to develop hazardous waste management facilities, and training courses for ship recycling

yard managers and workers. Gradually, the concept of ‘responsible recycling’ is gaining currency within the ship breaking industry.

The requirements and mechanism of the EU Regulation are very much similar to those of the Hong Kong Convention. However, details for a potential ban of the beaching method are being considered for the EU Regulation. Although controversial, an outright ban on beaching technique, if implemented, can inflict significant damages onto the Bangladesh ship breaking industry that uses the beaching method for ship breaking. A ban on beaching not only would have devastating impacts on the industry but potentially also the national economy and the local communities. With limited skills and no formal education, workers in the ship recycling yards in Bangladesh tend to earn more than what otherwise they would have earned. Any decrease in ship breaking activity would affect not only these people but also many others currently engaged in many upstream and downsteram activities of the industry supply chain (see Chapter 5). It is indeed possible that ships will switch flags in order to evade the EU Regulation, the extent of this ‘leakages’ will depend on, among other things, the policy and market responses of the key recycling countries particularly in South Asia, as well as any future EU regulatory measures and the associated market dynamics and economic costs of recycling options.

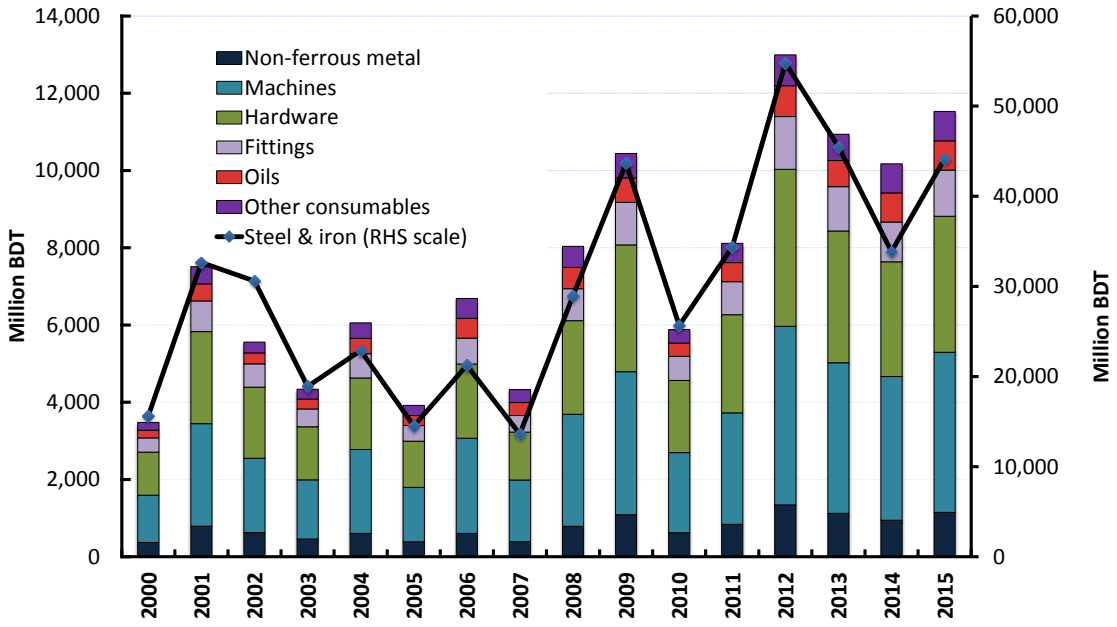
At present, India has successfully secured compliance to the Hong Kong Convention for four of its ship recycling facilities (Mikelis 2016). Another facility has secured document of compliance from RINA, and a further eight yards in Alang are currently working towards securing documents of compliance. The facilities have made considerable investment in infrastructure in order to obtain classNK certification for the Convention. They have also complied with the specific EU Regulation requirements of building concrete floors for the yards, cutting zone and lifting steel blocks with cranes as opposed to dropping them on the beach. So, if the EU Regulation approves certain yards based on its specific criteria, then India would have a huge advantage over Bangladesh in terms of attracting EU flagged ships for recycling. It is possible that the ship owners will be paying a premium for ‘green recycling of ships’, say, in the form of discounts on the market clearing vessel price to the facilities that have acquired the relevant certification.

As such, some Indian facilities with documents of compliance are already benefitting from such voluntary practices, purchasing ships at discounted prices. Depending on the size and scope of this ‘green premium’, it may encourage many ship recyclers in Bangladesh to apply for compliance (Laursen, 2016).

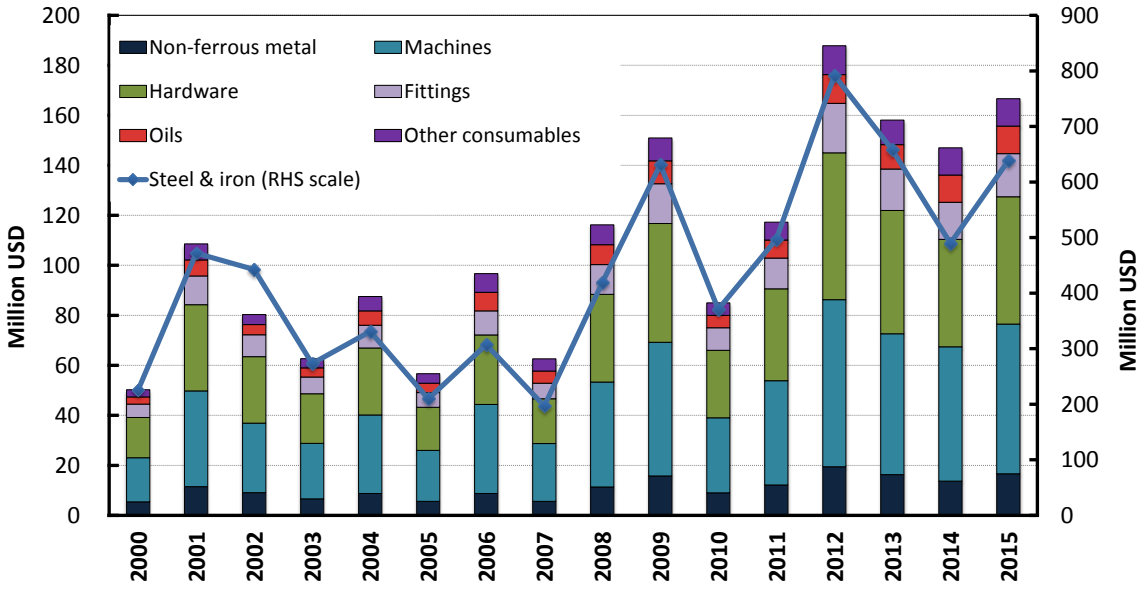
It is expected that the EU Regulation will release its first list of approved facilities in December 2016. It has been suggested that individual verification will be done for each facility and that a candidate will not be disqualified purely on the basis of method of recycling. But whether the EU Regulation approves facilities using beaching or not is yet to be seen (Laursen 2016). This kind of policy uncertainty is unsettling for an industry that has long been making important economic contribution to the local economy.

4 Broader Economic Contributions of the Ship Recycling Industry of Bangladesh

The ship recycling industry makes considerable contributions to the economy of Bangladesh. On average, the industry generated about Taka 53.3 billion (or equivalently US$770 million, at 2009-10 constant prices) worth of output a year over the past five years to 2015 (Figure 4.1). The industry paid customs duties, income taxes and value-added taxes together amounting to over Taka 5 billion (approximately US$68 million) a year, providing the government with an important source of annual revenues (Table 4.1). In addition, the industry pays a substantial amount of fees and charges as required under the current regulatory and compliance frameworks. Table 4.2 shows the annual fees and charges paid to the Ministry of Industries on the basis of ship breaking activities.



(a) In million Taka (at 2009-10 constant prices).



(b) In million US$ (at 2009-10 constant prices).

Figure 4.1: Gross value of production of the Bangladesh Ship Breaking Industry (at 2009-10 constant prices), 2000 to 2015
Source: Authors' estimates.

Table 4.1: Taxes paid by the Bangladesh Ship Breaking Industry (billion Taka*), 2010-11 to 2014-15

Fiscal year	Customs duty	Income tax	Value-added tax
2010-11	1.1 (15)	Not available	Not available
2011-12	2.4 (30)	2.7 (34)	0.02 (0.2)
2012-13	3.3 (41)	2.2 (28)	0.7 (9.2)[@]
2013-14	2.4 (31)	1.6 (21)	0.5 (7.0)[@]
2014-15	3.2 (42)	1.7 (22)	0.6 (7.5)[@]

Source: The National Board of Revenue (personal communication); authors' estimates.
Notes: *Rounded to the nearest number. Figures in parentheses are million US$ equivalents, converted using the yearly exchange rates. [@] Authors' estimates.

Table 4.2: Selected fees and charges paid by the Bangladesh Ship Breaking Industry ('000 Taka), 2011 to 2015

Calendar year	No-Objection Certificate fee	Inspection fee	Beaching fee	Cutting fee	Safety service costs
2011	435 (6.1)	5,800 (81)	1,450 (20)	4,004 (56)	4,350 (61)
2012	699 (8.8)	9,320 (118)	2,330 (29)	11,516 (146)	6,990 (88)
2013	594 (7.4)	7,920 (99)	1,980 (25)	9,317 (117)	5,940 (74)
2014	660 (8.5)	8,800 (113)	2,200 (28)	7,534 (97)	9,533 (123)
2015	666 (8.6)	8,880 (114)	2,220 (29)	9,442 (121)	11,100 (143)

Source: Authors' estimates based on fee and charge rates in Table 3.3.
**Notes: ***Rounded to the nearest number. Figures in parentheses are the '000 US$ equivalents, converted using the yearly exchange rates.

Importantly, the industry provides jobs to many skilled and semi-skilled workers coming from across the country. It is estimated that, in 2015, the industry provided between 25,000 and 40,000 full-time equivalent jobs, ranging from management and administration roles to technical and supporting jobs. The technical and supporting jobs include Supervisors, Foremen, Cutters, Fitters, Wire experts, and their Helpers. A vast majority of them were employed on a temporary or casual basis (about 80 percent in full-time equivalent terms).

The range of employment estimates given above reflects the difficulty in getting a good handle on the industry's actual employment. The Bangladesh Bureau of Statistics does not have credible data on the industry's employment. The employment estimates presented above are based on the industry survey undertaken for this study. Several key ship recyclers were interviewed to collate information and data on their employment detailing as much as possible the type of work (management, administration or technical), the nature of the job (on yard and on ship; Supervisors, Foremen, Cutters, Fitters, Wire experts, and their Helpers) and the tenure of the job (permanent and temporary). The interviewees were highly skilled and expert managers of each ship breaking yard, possessing at least twenty years of experience in the ship breaking industry. During each interview, associates of the ship breaking yards' managers were also engaged in

constructive discussions so as to validate the employment data and information. Using the employment data and other relevant information from the yards surveyed, the 2015 employment for the industry was estimated in full-time equivalent terms, taking into account the annual volume of operations of the industry during 2015.

According to the industry survey, the casual and temporary workers are engaged through contractors. Usually, each work shift runs for eight hours with about one hour of break. Wages for these workers range from Taka 200 (Winch helper, Cutterman helper, etc.) to Taka 500 (Cutterman, Foreman, etc.) per shift (per day). Workers are required to register/sign in and out each day for work.

In addition to the *direct* contributions in terms of providing employment to thousands of skilled and semi-skilled workers and sizeable revenues to the government coffers, the Bangladesh ship recycling industry makes *indirect* contributions to the national economy by feeding the domestic steel industry and stimulating many other activities along its supply chain−upstream and downstream−as discussed below.

4.1 *Indirect* contributions of ship breaking activities

The ship breaking industry in Bangladesh supports a host of other economic activities including domestic steel manufacturing. A variety of materials and items including steel scraps are likely to be recovered from ship breaking, which meet their potential demands and users along the supply chain. Figure 4.2 presents the schematic flows of various materials and items likely to be recovered from ship breaking.

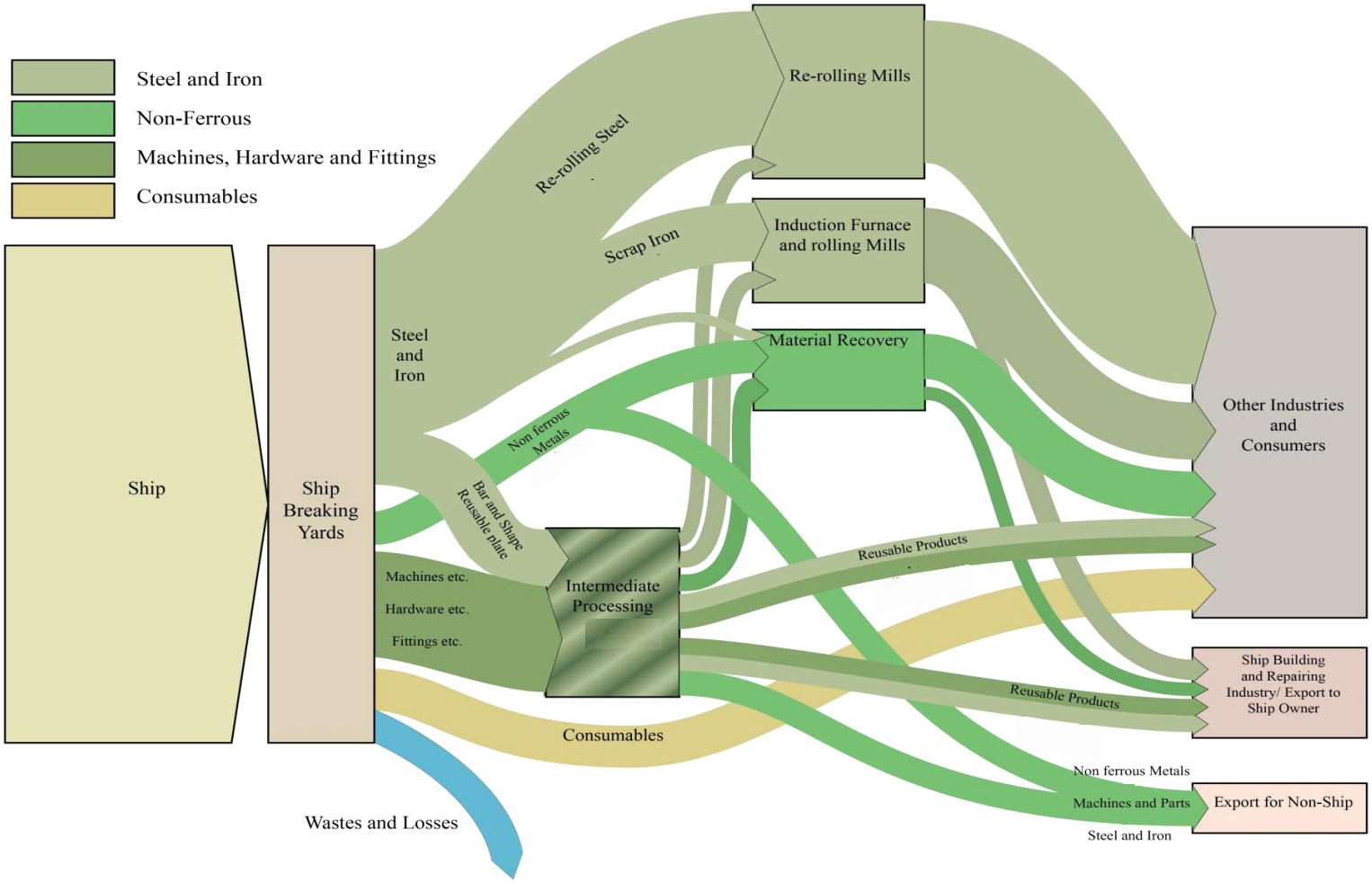


Figure 4.2: Schematic flows of materials and items likely to be recovered from ship breaking and their potential usages and destinations

Source: Sujauddin (2016)

Table 4.3: Materials and items likely to be recovered from ship breaking and their potential usages and destinations

Broad category	Specific material/item	Potential use/destination
Steel & iron materials	Steel plate, Solid pillar, Bars and shaped steel, Scrap iron, Steel box, Sheet, Chain, Wire and Cast iron	Re-rolling mills, Rolling plants, Reuse
Non-ferrous metals	Scrap, Net, Sheet, Wire, Shaft and Flange of Aluminium, Copper, Brass, Stainless steel, Lead and Zinc	Reuse in Ship building, and Ship and Non-ship repairing industry; Domestic material recycle, Exports
Machines	Main engine, Generator, Motor, Pump, Oil separator, Radiator, Condenser, Refrigerator, Electronics, Wireless equipment, Winches, Cranes, and Cables	Reuse in Ship building, and Ship and Non-ship repairing industry; Recycle through domestic dismantling operators, Re-rolling mills, Rolling plants; Exports
Hardware	Pipe, Gate valve, Nuts & Bolts, Pulley, Filter, Spring, Jacks, Nozzle, Piston, Tanks, Cylinders, Anchor, Hose pipes, Propellers, and Boats	Reuse in Ship building, and Ship and Non-ship repairing industry; Recycle as fuel, Re-rolling mills, Rolling plants
Fittings	Ladder, Door, Basin, Cabin lift, Kitchen equipment, Bottle, Deck meter, Gyrocompass, Plastic, Glass, Paper, Wood & Furniture, Fibre, Bricks, and Cement	Reuse in Ship building, and Ship and Non-ship repairing industry; Recycle as fuel, Re-rolling mills, and Rolling plants
Oils	Furnace oil, Diesel oil, Lubricant oil, Gear oil, Compressor oil, and Sludge oil (Dirty oil)	Various domestic uses including in Ship building and repairing industry
Other consumables	Paints, Chemicals, Foods, Medicine, Gas cylinder (LPG, Oxygen, CO_2)	Various domestic uses including in Ship building and Repairing industry

As can be seen from Figure 4.2 and its corresponding Table 4.3, a considerable number of activities in Bangladesh including steel manufacturing, ship building and repairing

services depend, to varying extents, on the supplies of key feedstock, recyclable or reusable parts or items recovered from ship breaking. With ongoing supply of key feedstock and other reusable or recyclable materials, ship breaking has contributed to the development and growth of many industries in Bangladesh, which add considerable value to the economy of Bangladesh.

Contribution to domestic steel manufacturing

Using the methodology for material flow analysis by Sujauddin et al. (2016), the flows for various materials recovered from ship breaking in Bangladesh were estimated in terms of weight (tonnes) and are shown in Figure 4.3 for the broad commodity categories listed in Table 4.3.

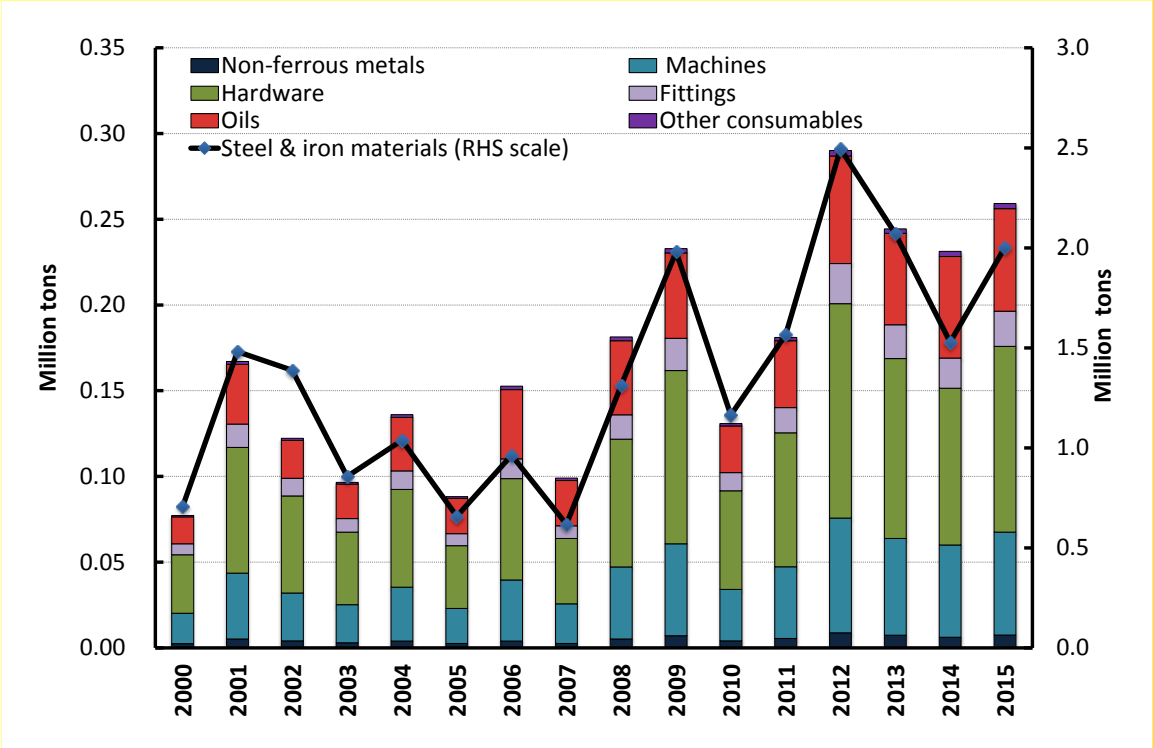


Figure 4.3: Recovered materials from ship breaking yards in Bangladesh, 2000 to 2015
Source: Authors' estimates based on the methodology in Sujauddin (2016).
Notes: For the unit of weight measurement, Metric tonne (MT) is used at a ship breaking yard's sales point whereas light displacement tonne (LDT) is used throughout its ship purchase processes.

Critical among the supplies from ship breaking are various steel scraps (the broad category 'Steel & iron materials' in Figure 4.3 and Table 4.3), which constituted between 80 and 90 percent of the total tonnage (Metric tonnes) of all materials recovered from dismantled ships in a year (Figure 4.3). Figure 4.4 shows the annual volumes (in Metric tonnes) of various types of steel scraps recovered from ship breaking. As can be seen, typically between 50 and 60 percent of the recovered steel scraps from ship breaking was used in re-rolling plants within Bangladesh.

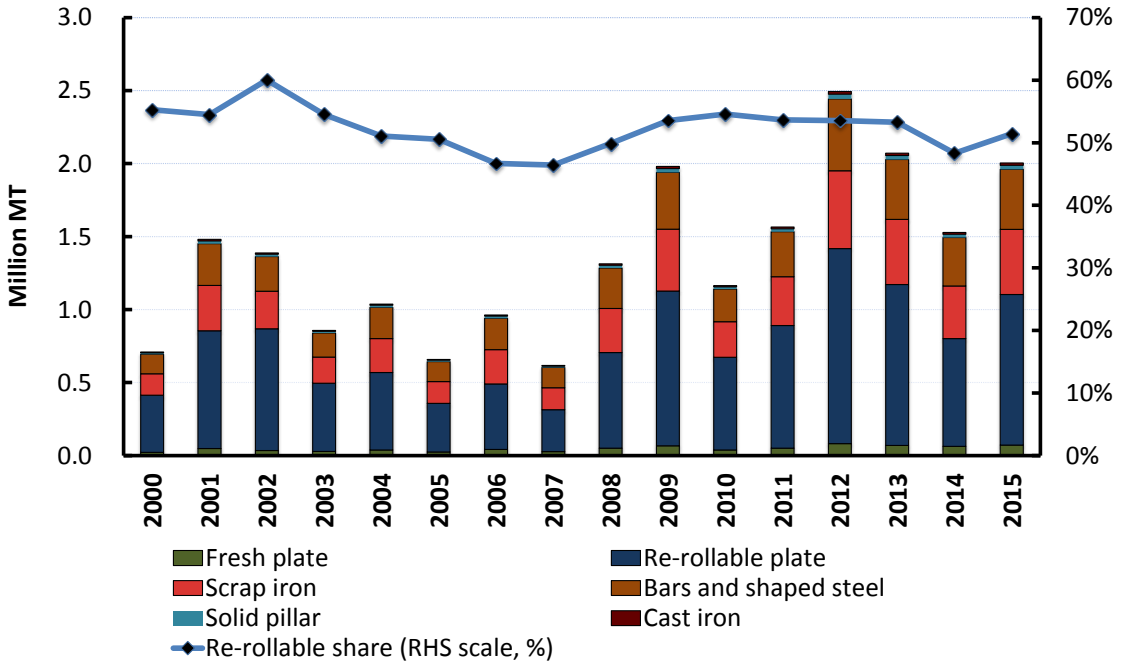


Figure 4.4: Types of steel scraps recovered from ship breaking yards in Bangladesh, 2000 to 2015
Source: Authors' estimates based on the methodology in Sujauddin et al. (2016).

To elucidate the significance of ship breaking in domestic steel production and use, the material flows analysis for steel in Bangladesh was undertaken for this study. Figure 4.5 shows the schematic material flows for steel and Figure 4.6 presents the estimated flows for Bangladesh in various years (see Sujauddin 2016 for details on the estimation

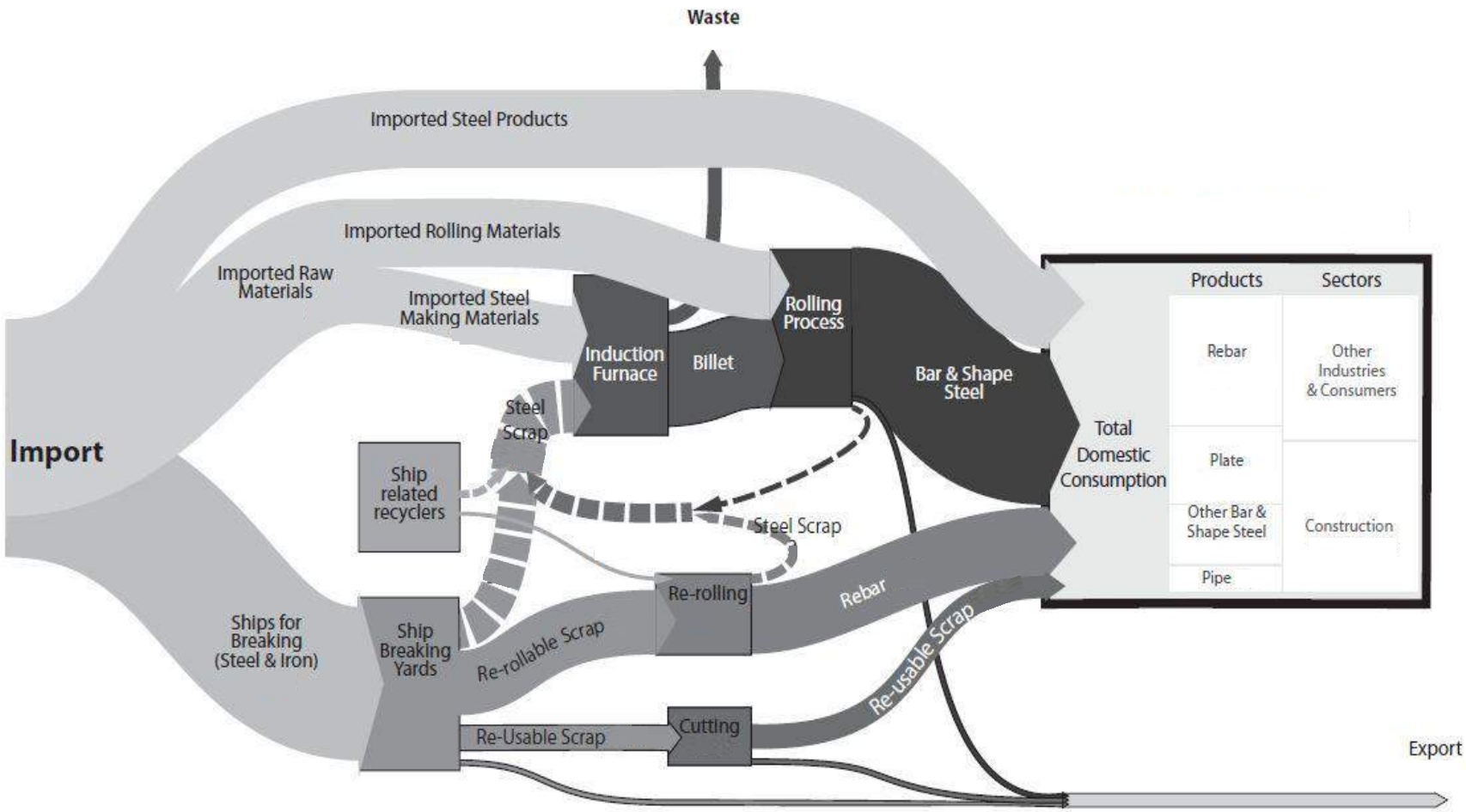


Figure 4.5: Schematic material flows for steel in Bangladesh (Adopted from Sujauddin et al. 2016)

methodology used). As can be seen from Figure 4.6, the import dependency of steel used in Bangladesh has been declining over the years, with about a third of final steel products in recent years depended on direct imports in one form or other. Of the remaining two thirds of steel used in Bangladesh−which depended on domestic production based on domestically sourced feedstock, steel scraps recovered from ship breaking accounted for 50 percent and more. The annual share of steel scraps from ship breaking fell below 50 percent of the steel production based on domestically sourced raw materials for 2005 and 2007.

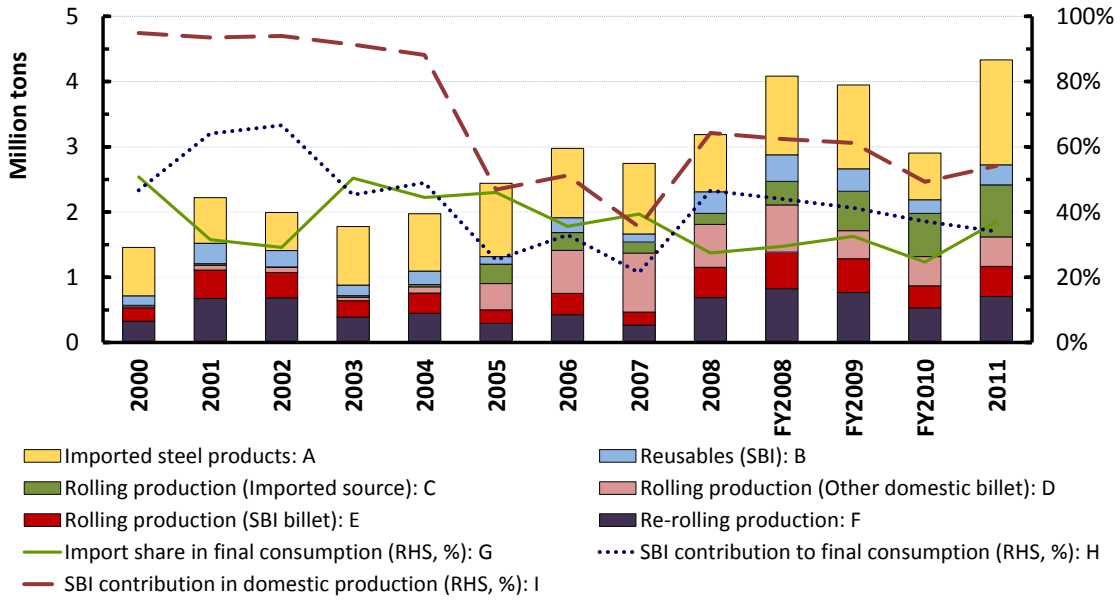


Figure 4.6: Estimated steel & iron supply in Bangladesh, 2000 to 2011
Notes: SBI stands for the ship breaking industry and FY for fiscal year. Estimates for the more recent years could not be made due to the lack of quality, consistent underlying data. Total final consumption: TC = (A+B+C+D+E+F); Total domestic production: TP = (B+C+D+E+F); G = (A÷TC)×100; H = ((B+E+F)÷TC)×100; and
I = ((B+E+F)÷TP)×100.

Contribution to other activities

Estimated annual recovery of non-ferrous materials (as well as ferrous materials) from ship breaking has been presented in Figure 4.3 for various years. For brevity, the

estimates for 2015, for which the latest statistics are available for this study, are discussed below. It may be noted that non-ferrous materials could be collected even when various machines and components are dismantled through intermediate treatments.

Non-ferrous metals

In 2015, about 7,500 Metric tonnes of non-ferrous metals (in the form scraps, sheets, nets and bar materials) were recovered from ship breaking yards in Bangladesh, worth about Taka 1.2 billion (equivalent to about US$17 million; in 2009-10 constant prices). Materials recovered included aluminium, copper, brass, stainless steel, zinc and lead. Among the non-ferrous metals recovered, sheets and bar materials were used domestically in the ship building and repairing industry but mostly in industries other than ship building. The non-ferrous scraps that were not reused were recycled in the country or exported for recycling.

Machines

In 2015, about 60,000 Metric tonnes of machines and components were recovered from ship breaking and sold to recyclers in Bangladesh, worth about Taka 4.1 billion (equivalent to about US$60 million; in 2009-10 constant prices). Some of these machines and components were processed and repaired by the repairing industry, for reuse in different domestic industries including the domestic ship building and cannibalization industry. Those that were considered non-repairable or not to be demanded at yards, were mainly dismantled by domestic dismantling operators for recycling within the country. Through these recycling and reusing processes, additional economic value is generated representing the *indirect* value-added from ship breaking.

Hardware

In 2015, about 108,000 Metric tonnes of hardware such as pipes, gate valves, chains, anchors, boats and propellers and the likes were recovered from ship breaking, worth about Taka 3.5 billion (equivalent to about US$51 million; all in 2009-10 constant

prices). These products were screened by intermediate traders for reuse in domestic ship building and other industries. Those considered by yard owners and intermediate traders to have no demands were recycled in domestic steel and iron industry or exported for recycle. These recycling and reusing processes create further economic value generating the *indirect* value-added from ship breaking.

Fittings

In 2015, about 20,500 Metric tonnes of furniture, fittings and other non-ferrous materials were recovered from ship breaking worth about Taka 1.2 billion (equivalent to about US$17 million; all in 2009-10 constant prices). Through intermediate traders, these fittings were reused in domestic non-ship industries, as well as in ship building. Materials considered by ship break owners and intermediate traders as not having any immediate demands, were recycled in domestic steel and iron industry. Through these recycling and reusing processes, further economic value is generated representing the *indirect* value-added from ship breaking.

Oils and Other consumables

In 2015, about 62,800 Metric tonnes of various consumables were recovered from ship breaking in Bangladesh. Of these, about 59,800 Metric tonnes were oils, worth about Taka 760 million (equivalent to about US$11 million; in 2009-10 constant prices). The remaining 3,000 Metric tonnes were Other consumables such as chemicals, paints, medicine, foods and gas cylinders, worth about Taka 760 million (equivalent to about US$11 million; in 2009-10 constant prices). These recovered consumables were consumed domestically. Those that went through intermediate treatments for recycling included dirty oil. Dirty oil was purified and reproduced as lubricant oil in domestic oil refinery, and then consumed mainly within the country, for example, in ship building and repairing industry and household usages. Through these recycling and reusing processes, additional economic value is generated representing the *indirect* value-added from ship breaking.

Broader impacts of ship recycling

In addition to the flow-on benefits generated by the Bangladesh ship recycling industry down its supply chain (as discussed above), there are many upstream activities that service the industry and generate output and employment through that process. Key among these upstream activities are transport and construction services; electricity and other utilities; oxygen plants; machinery and equipment maintenance and repair services; and banking, insurance and regulatory services. Furthermore, spending by ship recycling workers supports many other economic activities and services including retails, real estate and personal services, not only in the local economy but across the country.

It is estimated that for every Taka 1,000 of value-added generated by the ship breaking industry on the yards, there was an additional value-added of worth about Taka 1,300 generated indirectly through various downstream processing, recycling and reusing activities discussed earlier. Furthermore, various upstream activities mentioned above are likely to generate an additional value-added of Taka 700. That is, the ship breaking industry has a value-added multiplier of 3. Considering that value-added includes wages and salaries, proprietary income, other proprietor income and indirect business taxes, a multiplier of 3 is quite significant.

As for the *indirect* employment (that is, employment in upstream and downstream activities induced) by the ship breaking industry, the key employers are the re-rolling mills and the retailers of various recyclable goods and materials recovered from ships. There are about 500 re-rolling mills across Bangladesh, with about 400 workers per operational mill on average. While majority of the operational mills source their key feedstock (steel scraps) from the Bangladesh ship breaking industry, one may argue that many of these mills could still operate with imported steel scraps had the domestic ship breaking industry ceased operation for any reason. However, more than 5,000 retailers which are currently doing business in materials and goods recovered from ships would mostly cease to operate had the domestic ship industry shut down its operation for any reason. Each retailer is estimated to employ 2 to 5 casual or temporary workers.

It is worth noting that, in order to provide a comprehensive set of estimates and a fuller understanding of all the indirect employment induced by the domestic ship breaking industry, it is necessary to undertake a detailed labour force survey along the supply chain of the industry and develop a detailed input-output model or a value-chain model for the industry, which were beyond the scope of this study.

Also there are many social and human health issues surrounding the direct employment (as well as the indirect employment induced) by the ship breaking industry in Bangladesh. For example, policy makers may be interested to know the impacts of workers' switching between jobs and professions on their livelihood. Furthermore, one sensitive issue relates to the industry's management of industrial incidents and accidents that occur during ship breaking and recycling and which affect human health and lives. To adequately inform policy making on such sensitive social and human health issues would warrant a dedicated detailed study on these issues.

5 Outlook for the Ship Recycling Industry of Bangladesh

Bangladesh provides a rather unique marketplace for ship breaking where almost the entire ship can be recycled and, as discussed in Chapter 4, a vast majority of it can be reused as steel scraps (feedstock) for domestic steel manufacturing while other recovered materials can be reused for ship building, repairing and further processing activities; mostly for domestic consumption and absorption. Through its upstream and downstream linkages, the ship recycling industry has played an important role in promoting and broadening industrialisation in Bangladesh.

The future growth prospect for the industry will depend on a host of factors, on the demand side as well as on the supply side; some are domestic in scope others are international. There are uncertainties around each of the factors. This chapter discusses some of the key factors that are likely to drive the future growth and performance of the industry.

Domestic demand for steel scraps from ship breaking

Future domestic demand for steel scraps is intimately tied to the demand for feedstock of domestic re-rolling and rolling industries. Domestic demand for steel products of these industries is largely driven by infrastructure and construction growth, which in turn is influenced by broader economic growth, population growth and growth in urbanisation. Domestic demand for domestic steel products is also influenced by developments in international iron and steel markets. Some leading indicators seem to suggest that there will be sufficient, ongoing, derived demand for steel scraps from ship breaking in Bangladesh.

Sujauddin et al. (2016) estimated that the per capita steel consumption in Bangladesh was 25kg in 2008. By comparison, in 2008, the per capita steel consumption in the Philippines, Indonesia and India were 39 kg, 38 kg and 45 Kg, respectively. Vietnam, Malaysia and Thailand consumed much more, estimated at about 200 kg per person. It is

expected that the steel consumption in Bangladesh will grow to 50kg per person in 2022 (Steelmint, 2014)

According to Tilton (1990), the use of materials such as iron and steel would increase with the per capita Gross Domestic Product (GDP; a summary measure of goods and services produced within an economy in a year) until the latter reaches a certain level. In other words, the intensity of steel use−the quantity of steel used per unit of GDP (Cleveland and Ruth 1998; Steinberger and Krausmann 2011)− would rise as the economy grows. Sujauddin et al. (2016) estimated that iron and steel consumption per unit of GDP in Japan is very high compared to other less developed economies, whereas that in South Korea and China is increasing. In 2008, the intensity of steel use in Bangladesh was estimated at about 46 grams per US$ worth of GDP, which was close to that of India and Malaysia but much lower than in Taiwan, South Korea and China.

The key economic forecasters such as the International Monetary Fund, the World Bank and the Asian Development Bank, have all projected an economic growth of over 6 percent a year for Bangladesh for the next several years. The recently released 7th Five Year Plan (FY2016−FY2020) has set a target growth rate of 7.4 percent a year for Bangladesh's real GDP over the Plan period. According to the 2013 Economic Census of the Bangladesh Bureau of Statistics, buildings and infrastructure establishments have grown sharply in recent years. The projected and targeted economic growth for the next several years is expected to further boost growth trends in construction activities within Bangladesh, which will generate sustained domestic demand for steel. Bar steel accounted for a significant share (over 70 percent) in total steel consumption in Bangladesh. Furthermore, over 50 percent of the country's raw materials and 37 percent of the demand for finished steel products−the principal raw materials for construction, come from the ship recycling industry (see Figure 4.6; and also Sujauddin et al. 2016). In view of the above, it is reasonable to suggest that steel scraps from ship breaking will have a deep domestic market for many years to come.

Global steel markets and ship breaking

Domestic steel producers and raw materials suppliers are not insulated from the developments and trends in the global iron and steel markets. International prices, production and exports, particularly China's global market dominance and potential supply gluts weigh into the domestic steel markets and, by extension, into ship breaking markets. The global steel market goes through business cycles with frequent and sharp booms and busts. Due to slowing economic growth in most developed economies, the demand for steel is predicted to slow down substantially from its recent peaks. At the moment, steel makers across the world seem to be dealing with an excess supply of between 400 and 700 million tons of lower-grade steel as it continues to drive steel prices down and reduces profit for the steel producers globally.

A large part of this supply glut comes from China's massive steel production which put downward pressure on the price of hot-rolled band (HRB). The downward pressure on the price of HRB is caused by slower economic growth in China, primarily due to very high export volumes of Chinese steel products. These are some of the lowest prices recorded since 2002. In the 1980s, China accounted for only 5 percent of the total world steel production. By comparison, that figure stood at a staggering 50 percent in 2014 (WSA, 2015). The issue continues to be China's excess production of steel. Producers across the globe are unable to compete with China, leading to significant structural changes in the global steel production and trade (Sowar, 2015). How the global steel market unfolds in the future will have important implications for the domestic demand for steel scraps from ship breaking.

On the supply of recyclable ships

The profiles (age, type, size) of global merchant ships, the dynamics in the global freight market, and regulations that govern international shipping and ship recycling all determine the supply of recyclable ships including what, when and where to be recycled.

Each ship currently operational will need to be recycled at some point in time. Currently, there are around 110 thousand ships in the global merchant fleet, of which about 55 percent are of size 500 Gross Tons (GTs) and above. Importantly, about half of the

current global fleet are aged 20 years or older. This would mean that there are many ships in the current global merchant fleet which can potentially end up in a ship recycling yard in the coming decade, subject to favorable economic returns from such a decision by ship owners.

The regulatory measures and standards for international shipping and ship breaking that will influence the future supply of recyclable ships, are being implemented or evolving. The key among these is the Honk Kong Convention, the implications of which are discussed in some detail in Chapter 3 of this report. As already pointed out, the enforcement of the Convention following its ratification and accession, is likely to bring to bear important changes on global ship breaking market. The Convention will require all its Parties' facilities recycle only Convention-compliant ships (both from Parties and non-Parties). Importantly, the Hong Kong Convention does not ban the beaching method used in Bangladesh for ship recycling.

The EU Regulation is another international regulatory framework whose requirements and mechanism are very similar to those of the Hong Kong Convention. Although controversial, details for a potential ban of the beaching method are being considered for the EU Regulation. An outright ban on beaching technique, if effectively implemented at all, can induce changes to the current global ship recycling practices. The nature and extent of these changes will depend on the policy and market responses of the key recycling countries particularly in South Asia, as well as on strategies likely to be adopted by the future suppliers of recyclable ships.

The IMO's International Convention for the Control and Management of Ship's Ballast Water and Sediments (BWM) was adopted in 2004 but is yet to come into force. The aim of this convention is to prevent the spread of harmful marine organisms from one region to another. The convention has formed a set of standards, guidelines, and procedures for the management and control of ship's ballast water and sediment. When the convention comes into force all ships in international traffic will be obligated to manage their ballast

water to a set standard following a ship-specific ballast water management plan. A record book on ballast water will have to be maintained and all ships will have to carry it at all times along with an international ballast water management certificate. Parties to the Convention will be subject to specific requirements for Ballast water management at a substantial additional cost.

On realising ship recycling opportunities

The substantial domestic demand for steel scraps and the expected ongoing global supply of recyclable ships from the pool of ageing global merchant ships suggest a promising outlook for the ship recycling industry in Bangladesh. To what extent the industry's growth prospect can gainfully be realised is not easy to predict. There are uncertainties on the policy and regulatory fronts. There are also formidable market uncertainties that the industry has been, and will be, dealing with. Ship breaking is global in scope. The Bangladesh ship breaking industry has proven to be internationally competitive and made valuable contributions to the domestic economy. To translate future opportunities for the industry into a reality and for evidence-based decision making by the industry stakeholders, it is critically important to develop and maintain a credible information base and analytical capacity for the industry, which the authors of this report have found lacking. This report is expected to make a contribution to this end.

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