

Korean Perspectives on Ship Recycling

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Mina

Abstract

Ship recycling activities are mainly taking place in South Asian countries and China. A number of dangerous old ships scrapped in these countries are being sent from developed countries, including Europe. International regulations by the Basel Convention, the ILO and the IMO have been controlling the issues for several years and the EU recently presented a “Proposal on Ship Recycling” and is waiting for its adoption by the European Parliament and the Council of Ministers. The Korean ship recycling industry is poor and small like in other developed countries, but Korea has large shipping and shipbuilding industries. The changing new ship recycling regulations will affect Korean ship industries in many ways, especially large European shipping companies would seem to put pressures on Korean shipbuilders. So Korean ship industry is required to identify problems related to the current Korean ship recycling issues and try to take appropriate actions.

Keywords: Ship recycling, Europe, Korea, Inventory of Hazardous Material, Hong Kong Convention

Executive Summary

Like other vehicles, ships also have a limited life span that is normally 25 years. However, the life span may become shortened or lengthened depending on a fluctuating freight rate situation. There have been great concerns linked to the ship recycling industry, induced by a narrow economic point of view guiding the measures taken by the industry since the costs for human health and the environment are not counted into the scrapping price.

Between 500 and 1,300 sea-going ships of over 1000 GT were dismantled worldwide every year for the last two decades. Approximately 74% of these ships have been dismantled in South Asia including India, Bangladesh, and Pakistan where the environmental and safety regulations can be easily avoided and the recycling method used in these areas is in 95% of the cases “beaching”. Mudflats are polluted by contaminants from ships including waste oils, heavy metals such as lead, mercury, cadmium, zinc, copper, etc., and other pollutants such as PCBs, PVC, and asbestos. Due to the lack of protective equipment and unsafe hot and explosive work conditions, workers are vulnerable to hazardous fumes and dangerous materials. In addition, most people working in the business earn only USD 1 to 2 a day, which is not enough compensation at all to do such a hard work.

To handle the increasing international concerns caused by shipbreaking practices in the developing world, the parties to the Basel Convention, the International Labor Organization (ILO), and the International Maritime Organization (IMO) have started work on the issues. The Basel Convention on the control of transboundary movements of hazardous wastes and their disposal has in 2004 defined the ships as hazardous waste, with related restrictions when it comes to sending them to developing countries, but the Convention does not prohibit the transboundary movement of the ships, instead a prior informed consent (PIC) procedure is used.

The ILO adopted in 2002 “Safety and health in shipbreaking; Guidelines for Asian countries and Turkey” that provides guidance to ensure safe work in shipbreaking by advising on the transformation of informal sector activities into formal organized ones. However, like other ILO guidelines, the guideline is not legally binding, but intended to influence the establishment of effective national systems, procedures, and regulations to deal with problems of shipbreaking activities.

The IMO adopted the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (the Hong Kong Convention) in May 2009. The Convention covers all the issues related to ship recycling, including the environmental problems generated during the shipbreaking process by hazardous contaminants such as asbestos, hydrocarbons, ozone-depleting substances, heavy metals and others. In addition, it deals with the working and environmental conditions at the ship scrapyards to protect workers. However, it is still unknown when the Convention will come into force since several conditions have to be fulfilled.

In Europe, since they have owned and operated a number of ships for a long time, the accumulated volumes of ships to be scrapped are also considerable. Europe is not able to handle all their old ships in their territory due to the lack of scrapping yards. So, many toxic and dangerous ships from Europe are sent to scrapping yards in developing countries in Asia. In addition, many of the ships being operated by European international shipping lines are registered in third countries to avoid given responsibilities.

In order to deal with the problems from the ships they send, European countries have in 2007 drawn up a consultation paper “Green Paper on Better Ship Dismantling” that suggests

various options to prepare the ground, and intensify future action on the development of ship recycling. One year after, an “EU Strategy for Better Ship Dismantling” was adopted to propose a range of measures intended to improve ship dismantling conditions in the future. In March 2012, “A Proposal on Ship Recycling” was published to make a “Ship Recycling Regulation” regardless the entry into force of the Hong Kong Convention that is hard to predict and the regulation is now waiting for its adoption by the European Parliament and the Council of Ministers. This development is expected to speed up the Hong Kong Convention’s entry into force.

In Korea, they send approximately ten ships to the Asian scrapping countries every year, while small ships that are less than 500 GT are dismantled in domestic recycling facilities. Most of these domestic facilities are economically very poor and cannot continue their business with only ship recycling, since supplies of ships to be scrapped do not occur regularly. Only one facility out of 67 has a treatment facility for hazardous materials such as asbestos, polychlorobiphenyl (PCB), heavy metals, refrigerants, hazardous paints, oils, etc. In addition, approximately 200 persons who have the ability to dismantle ships are estimated to remain and it is not to be expected there will emerge a new work force unless the ship recycling conditions are improved.

Korea has some ship recycling related regulations. These are “Marine Environment Management Act” that requires ship scrappers to hand in a set of declaration papers before scrapping ships, “Wastes Control Act” that controls the various wastes from the ships, and “Public Waters Management Act” that asks the scrappers to obtain a permission from a supervisory authority to carry out the scrapping process on the sea.

Korea is one of the countries that operate a large number of ships. Most of Korean ship owners recognize reinforcements of the ship recycling environment in line with the Hong Kong Convention. However, it is expected that, after the Hong Kong Convention comes into force, the ship owners will be required to spend considerable expenses related to drawing up the Inventory of Hazardous Materials (IHM) and carrying out various tests during the whole lifetime of the ships. So they are paying attention to changes in the ship recycling regulations while waiting until the Hong Kong Convention comes into force.

Korean shipbuilders, who are responsible for 37% of the world’s shipbuilding, will be obliged to carry out initial surveys for the IHM for new ships according to the Hong Kong Convention. In 2010, a working group comprised of representatives from shipbuilders, a ship equipment research institute, a ship inspection agency, and an association of shipbuilders drew up “Guidelines for the preparation of the inventory of hazardous materials on new ships” based on the regulations of the Convention and the guideline will enable shipbuilders to perform surveying of the ships more efficiently.

The Korean Ship Inspection Agency will certify the inspection of the IHM. Although the shipbuilders can survey their new ships and prepare the IHM, in practice the inspectors are expected to perform all initial surveys, renewal surveys, change-replacement-repair surveys and final surveys onboard.

As Europe is strengthening the ship recycling regulations, it is anticipated that Korea being responsible for major parts of ship industries are likely to be influenced more than other countries and it is necessary to prepare measures for how to respond in advance. This thesis has identified a number of measures the various stakeholders need to take as outlined below.

- Ship recycling facilities:
 1. To prepare Ship Recycling Plans (SRP)
 2. To meet a set of environmental and safety standards
- Ship owners:
 1. To prepare the Inventory of Hazardous Materials for all ship they possess
 2. To carry out several surveys for the Inventory of Hazardous Materials; initial survey, renewal survey, change-replacement-repair survey and the final survey
- Shipbuilders:
 1. To draw up the Inventory of Hazardous Materials for new ships
 2. To be expected to increase requirements on the Inventory of Hazardous Materials for European owners who are going to be regulated by the European Ship Recycling Regulation
- Ship Inspection Agency:
 1. To certify and verify the Inventory of Hazardous Materials
- Government:
 1. To deal with international ship recycling issues together with other countries
 2. To give a strategy to encompass all ship-related industries to cooperate for the ship recycling

In order to handle the variety of influences as outlined above, the following countermeasures for each industry actor are to be considered.

- Ship recycling facilities
 1. To give financial support to the recyclers
 2. To secure protective equipment and machineries to reduce manual work
 3. To make sure that environmental accidents do not occur by developing accurate and concrete working manuals
 4. To train new workers through sufficient safety educational programs and improve work conditions in the facilities
- Ship owners
 1. Prepare a Ship Recycling Policy
 2. Inventories of Hazardous Materials for new builds
 3. Inventories of Hazardous Materials for existing ships
- Shipbuilders
 1. To ask ship equipment manufacturers to provide them with necessary and useful information on hazardous materials in the equipment
 2. To reduce or replace hazardous materials
 3. To make the ship easy to dismantle
 4. To have computing systems to input information of the hazardous materials
- Ship Inspection Agency
 1. To train new inspectors for future increasing requirements of the Inventory of Hazardous Materials
 2. To prepare qualifying requirements to select inspectors for the inventory of Hazardous materials
- Government
 1. To embrace international regulations into domestic law
 2. To enact a single ship recycling regulation separate from other marine environmental regulations.

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Abbreviations

CAS	Condition Assessment Scheme
DWT	Dead weight tons
ESM	Environmentally Sound Management
FOC	Flags of Convenience
GT	Gross Tonnage
ILO	International Labor Organization
IHM	Inventory of Hazardous Materials
IMO	International Maritime Organization
LDT	Light Displacement Tonnage
MDTFs	Multi-donor Trust Funds
MEPC	Marine Environment Protection Committee
PCB	Polychlorobiphenyl
PIC	Prior Informed Consent
PVC	Polyvinyl chloride
SRP	Ship Recycling Plan
TEU	Twenty foot equivalent container units

1 Introduction

1.1 Background and Problem Definition

Like other vehicles, ships also have a limited life span. Even though ships are normally dismantled within 25 years after being operated at first, the life span may become shortened or lengthened depending on a fluctuating freight rate situation. Ship operators tend to sell the ships when the world or national economy is in downturn because their profits do not surpass their maintenance costs that are mainly affected by soaring oil price.

There have been great concerns towards the ship recycling industry, induced by a narrow economic point of view guiding the measures taken by the industry. Since the costs for human health and the environment are not counted into the scrapping price, many old ships are being destined to places where the environmental and safety laws are not strict and secured even though ship breaking is a dangerous activity. The largest ship breaking yards responsible for approximately 74% of ship breaking in the world are located in South Asia (see Figure 2-7).

Mudflats on which ship-scrapping activities are taking place by beaching method¹ are polluted by contaminants from ships including waste oils, heavy metals such as lead, mercury, cadmium, zinc, copper, etc., and other pollutants such as PCBs, PVC, and asbestos. Due to the lack of protective equipment and unsafe hot and explosive work conditions, workers are vulnerable to hazardous fumes and dangerous materials (NGO Shipbreaking Platform, 2011).

In Chittagong, Bangladesh, livelihoods of fishermen are threatened by the surrounding shipbreaking industry, wiping out 21 species and endangering 11 other species, while 40,000 protected mangrove trees were in danger of being cut down in 2009 alone to make space for new shipbreaking yards (NGO Shipbreaking Platform, 2011). In addition, it is reported that one in six of workers at Alang, India's biggest scrapping site, is suffering from asbestosis, the occurrence of which is six times more frequent than in the Indian mining industry (Commission of the European Communities, 2007).

These facilities located in the Indian sub-continent rarely conform to environmental standards. They do not have pollution prevention processes or reception facilities and the treatment of wastes are hardly found. Most of people working earn only USD 1 to 2 a day, which is not enough compensation at all to do such a hard work (Park, 2009).

Between 500 and 1,300 sea-going ships of over 300 GT² are dismantled worldwide every year for the last two decades as the figure below shows. Detailed data is presented in Appendix 1. There have been three peaks of dismantling volume so far. These were in 1985, 2003, and 2010, when the shipping market conditions were in downturn. Especially the single-hull tankers that were to be phased out in 2010 played an important part to add dismantling volumes.

¹ Beaching method: This is one of the methods to break ships. The ships are dragged up to the beach by using the ebb and flow of the tide to be dismantled. This is explained in detail on page 13.

² Gross Tonnage (GT) is calculated by measuring a ship's volume from keel to funnel, to the outside of the hull framing. Deadweight tonnage (DWT) is how much a ship can carry or can safely carry. For instance, tankers that carry oil have comparably more DWTs compared to a cruise ship where weights of people are not heavy. So tankers have DWTs approximately two-thirds to double the GT and the passenger ships have quite small DWTs compared to their GT.

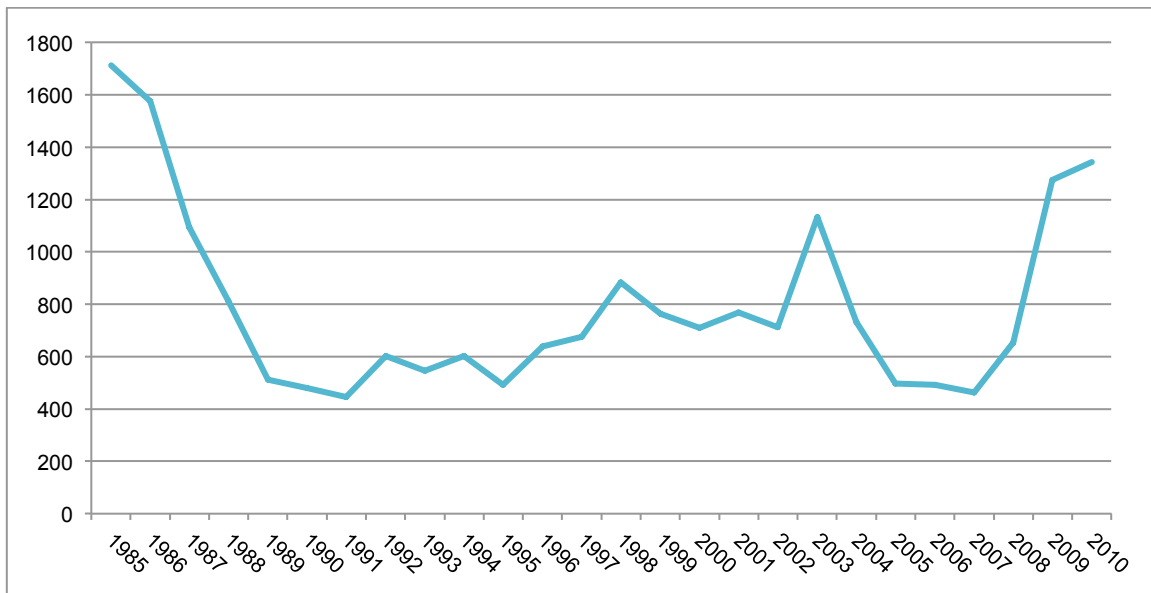


Figure 1-1 Change in numbers in international demolition of ships of 300 GT and over from 1985 to 2010

Source: ISL (2011)

As more ships come to the scrapyards in South Asia, it is obvious that environmental and safety problems are going to be much more severe. In order to deal with these problems, the international bodies: the Basel Convention, the International Labor Organization (ILO), and the International Maritime Organization (IMO) have started endeavors to improve the governance of ship recycling.

The Basel Convention on the control of transboundary movements of hazardous wastes and their disposal is an international treaty that was designed to reduce the export and import of hazardous wastes between all countries that have ratified the Convention, and especially to prevent, or at least strictly regulate, transfer of hazardous wastes from developed countries (mostly OECD³) to less developed countries. The parties joining the Convention began to recognize a ship as a waste at the seventh meeting of the Conference of the Parties in 2004 and they invited IMO to work on establishing mandatory requirements of environmentally sound management of ship dismantling. To assist in improving the health and safety of workers, the ILO published in 2004 “Safety and health in shipbreaking. Guidelines for Asian countries and Turkey”.

The IMO adopted the “Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships” at the 59th MEPC (Marine Environment Protection Committee) session in 2009, which was attended by delegates from 63 countries. After the Convention comes into force, ships sent for recycling should submit an inventory of hazardous materials (IHM) having been updated during their entire life to ship recycling yards. Also, the recycling yards will be required to provide a “Ship Recycling Plan”, explaining how to dismantle ships with the given IHM. There are four guidelines to assist States to implement the Convention: Guidelines for the Development of the Inventory of Hazardous Materials, Guidelines for the Development of the Ship Recycling Plan, Guidelines for Safe and Environmentally Sound Ship Recycling, and Guidelines for the Authorization of Ship Recycling Facilities. Two further guidelines: Guidelines for Survey and Certification of Ships

³ OECD: Organization for Economic Co-operation and Development

under the Hong Kong Convention and Guidelines for Inspection of Ships under the Hong Kong Convention, are expected to be adopted at the 64th MEPC session.

At European level, a Green Paper on better ship dismantling was adopted and an EU strategy on ship dismantling was proposed by the European Commission in 2007 and 2008 respectively. The strategy proposed measures to deal with existing poor ship dismantling environment as soon as possible before the Hong Kong Convention comes into force. In fact, it is expected that the Convention will enter into force only after several years as the three conditions required for it to come into force are: 1. not less than 15 States who have either signed it without reservation as to ratification, acceptance or approval, or have deposited the requisite instrument of ratification, acceptance, approval or accession in accordance with Article 16; 2. the combined merchant fleets of the States mentioned in paragraph 1.1 constitute not less than 40 percent of the gross tonnage of the world's merchant shipping; and 3. the combined maximum annual ship recycling volume of the States mentioned in paragraph 1.1 during the preceding 10 years constitutes not less than 3 percent of the gross tonnage of the combined merchant shipping of the same States.

The European Commission proposed tighter laws on ship breaking in March 2012 in order to speed up the Hong Kong Convention's entry into force. After the proposal is adopted, European ships will have to carry the IHM present on board and the amount of hazardous materials should be reduced before the ships are sent to a scrapping yard that meets a set of environment and safety requirements. It also needs to be included on a list of authorized facilities worldwide. European ships are only allowed to be scrapped in facilities on the list.

The Republic of Korea (South Korea, hereafter just referred to as Korea) is one of the largest countries when it comes to shipping and shipbuilding industry. For recent past years, Korea is in charge of approximately 38% of the world's shipbuilding and a number of ships are ordered by developed countries including the 27 European Union countries⁴. This state of affairs is expected to continue although Chinese shipbuilding industry is growing very fast. In addition, Korea owns 1,189 ships above 1000 GT equivalent to the 9th place among the countries owning most ships.

As environmental and safety standards are higher by international conventions and EU, the influences on Korea's ship-related industries, including shipbuilding, shipping, and ship scrapping, seem also to be considerable. International shipping companies will require shipbuilding companies to draw up the IHM as well as reduce the use of hazardous materials more than the standard when building ships. However, ships having the IHM do not exist at current.

Ships owned by Korea's shipping companies are also sent to scrapping yard located in South Asia or China since the capacity of Korea's ship scrapping companies can only deal with rather small ships below 1000 GT. As Korea owns a large number of ships, the number of ships sent to international scrap yards will increase. However, after the Hong Kong Convention comes into force, the shipping companies will face difficulties to get rid of old ships as only facilities on the lists will be allowed to dismantle ships from the parties ratifying the Convention.

⁴ EU-27; 27 member states who have joined European Union: Belgium, France, Austria, Bulgaria, Italy, Poland, Czech Republic, Cyprus, Portugal, Denmark, Latvia, Romania, Germany, Lithuania, Slovenia, Estonia, Luxembourg, Slovakia, Ireland, Hungary, Finland, Greece, Malta, Sweden, Spain, Netherlands, and United Kingdom.

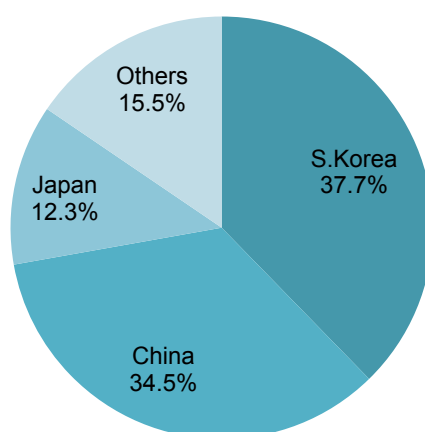


Figure 1-2 Number of Completions by Country of Shipbuilding in Jan-Jun, 2012

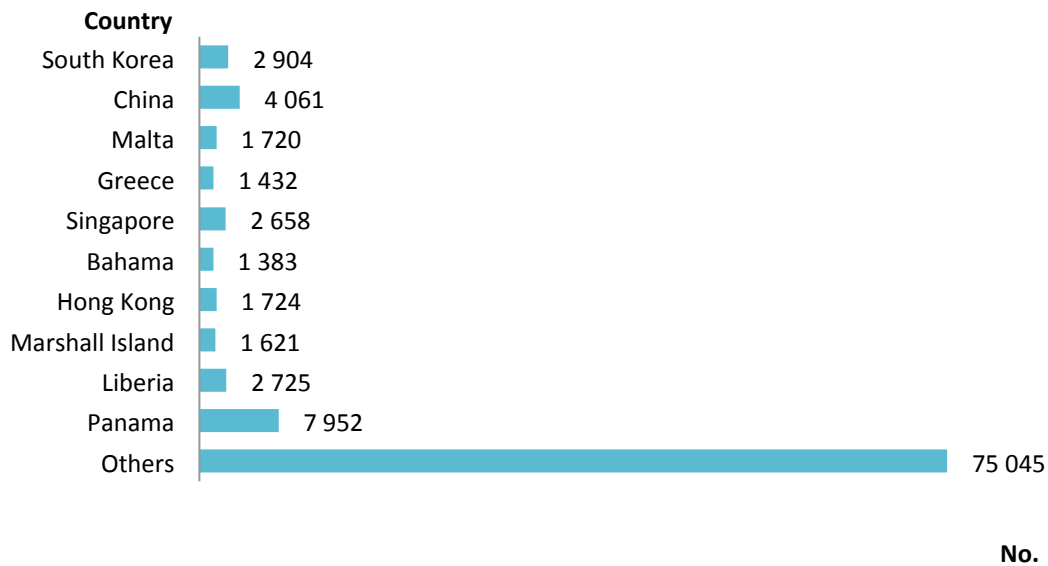
Source: Clarkson (2012)

Table 1-1 World Fleet by Nationality of Owner in 2010

Country	No. of ships	Country	No. of ships
Germany	3,827	Vietnam	562
Japan	3,796	India	534
China	3,651	Malaysia	526
Greece	3,213	France	467
Norway	1,986	Canada	436
U.S.A.	1,972	UAE	426
Russia	1,892	Spain	392
Turkey	1,214	Sweden	301
South Korea	1,189	Cyprus	287
U.K.	1,128	Belgium	249
Singapore	1,021	Saudi Arabia	176
Denmark	980	Brazil	172
Indonesia	953	Iran	142
Netherlands	893	Kuwait	80
Italy	836	Qatar	78
Hong Kong	713	Others	52,063
Taiwan	662	World Total	86,817

Note: 1,000 GT and above

Source: IHS Fairway (2011)



Note: 1) 1000 GT and above
 2) Excludes CO₂ Tankers, Bitumen & Coal/Oil Mixture Tankers

Figure 1-3 World Fleet by Major Registration of Owner in 2010

Source: IHS (2011)⁵

The ship owners tend to register their ships in countries where they can avoid various expenses, such as taxes and fees, and strict regulations like limited number of foreign sailors. It is called ‘Flag of Convenience (FOC)’ and is used by a number of countries, especially developed countries like Japan and USA. The countries used for FOC is Malta, Singapore, Bahamas, Marshall Island, Liberia, Panama, and others. It is an international loophole commonly used by international shipping companies and it is estimated that 487 million GT out of 750 million GT, which account for 65% of the entire global GT, are using FOCs. In fact, it is difficult to catch which shipping lines and countries exploit the FOC because of its nature to avoid a number of taxes and regulations (Han, 2012).

1.2 Objectives and Research Questions

Scrapping of old ships is a considerable industry. Ship scrapping is today taking place in countries with low safety and environmental standards since the major expense to scrapping vessels is connected to labor costs and regulatory compliance. This circumstance has been heavily criticized and policies and approaches of how to deal with this have been discussed during a longer period, even after the adoption of the Hong Kong Convention.

Korea is playing a big role in shipbuilding industry and possesses a number of ships going oversea. It has been participating in a number of IMO hosted international conferences and other global meetings related to ship environment and its development. However, in international literature little has been written about how Korea discusses the ship recycling issue and acts on it.

The first objective of this paper is to find out what the attitudes towards the Hong Kong Convention and European ship dismantling-related policies are from the side of Korea’s ship-

⁵ The reason why the total number of ships is different in Table1-1 and Figure 1-3 is the latter excludes some types of ships such as CO₂ tankers and Bitumen and coal/oil mixture tankers.

related industries, including shipbuilding companies, shipping companies, ship scrapping companies, ship register companies, and the government. Next, the second objective is to look into how the Korean industries are affected by the adoption of the Hong Kong Convention and by European countries that dominate the shipping markets, and to suggest countermeasures. In order to address these objectives, the following research questions have been formulated.

- How are the Korean ship industries affected by changing international ship recycling regulations, including the European Ship Recycling Regulation, and what kind of problems are going to be met in each of the sectors?
- What kind of countermeasures can be prepared in response to the international regulations?

1.3 Target Audience

This thesis targets in particular professionals in Korean and European ship industries who are preparing for the upcoming Hong Kong Convention's entry into force and the European Ship Recycling Regulation. In addition, Korean policy makers responsible for ship recycling may also be interested in the thesis. For policy makers and other interested parties in Europe and elsewhere, the thesis will provide an insight into the situation and discussion in the Republic of Korea.

1.4 Scope and Limitations

Ship recycling includes all activities from preparing a ship dismantling plan to dismantling the ship and collecting reusable materials. Terms of ship scrapping and ship dismantling are going to be used in the same meaning as ship recycling.

The geographic boundary for this research is limited to Europe and Korea. Conditions of ship recycling in South Asia in which the current ship scrapping is taking place in hazardous and dangerous ways are going to be commented, but stakeholders, regulations and policies in Europe and Korea are what is mainly going to be covered. The 27 States in the EU are together one of the largest shipping industry actors who can influence and improve the current ship recycling states in either voluntary or mandatory ways and Korea constructs approximately 38% of recent modern sea-going ships over 1000 GT as well as it owns a large number of ships.

The regulations and policies dealt with in this thesis are restricted to the Basel Convention, the ILO guideline, the Hong Kong Convention, and those at EU level and in Korea. The local recycling policies or regulations are not going to be covered.

Size of ships covered is sea-going vessels over 500 GT that is the minimum weight the Hong Kong Convention will regulate.

The stakeholders included in the thesis are shipbuilding, shipping, ship inspection agencies and governments.

1.5 Methodology

The methodology used to answer the research questions and accomplish the objectives of this thesis is to apply a literature review and stakeholder interviews.

First of all, in order to understand the current status of the ship-related industry market, including ship recycling industry, analysis including analytical data was conducted using

credible sources that a number of shipping and shipbuilding companies use for their business. Academic articles and a website run by an NGO who works with ship recycling were used to see current ship-recycling working environment in South Asia. Next the ship recycling policies existing both in Europe and Korea were found from official documents and academic articles dealing with the policies.

Interviews with Korean stakeholders working in ship industries, like shipping, shipbuilding, ship recycling, ship register, the government and academy, were conducted to look at the current situations on ship recycling and find out challenges and attitudes towards changing ship recycling conditions as pressured by Europe.

1.6 Structural Outlines

The thesis is comprised of seven chapters including Chapter one, Introduction.

In Chapter two, a general international ship recycling status is presented. It is shown the time when the ships are going to be dismantled, historical and expected future ship scrapping volumes since 2005, and the method to dismantle old ships.

In Chapter three, several international governances on ship recycling issues are going to be listed. The Basel Convention, the ILO shipbreaking guidelines, and the Hong Kong Convention are going to be summarized as to what and how they are doing for the ship recycling as well as the history of several actions done by Europe, from Green Paper to a strategy, and to the ship recycling proposal in order to handle the problems generated by the European ships recycled in developing countries.

In Chapter four, the Korean ship recycling status is shown. The historical volumes of ship recycling, a description of current ship recycling yards, ship owners, shipbuilders, ship inspection agencies towards the ship recycling can be found in this chapter. In addition, several regulations related to the ship recycling are listed and described.

In Chapter five, current ship industries' attitudes and views on ship recycling are described. This chapter is based on the interviews and it is possible to see practical perspectives on the Korean ship recycling industry.

Chapter six is a discussion part that is combining all the findings from the literature review and the interviews to answer the two research questions.

Finally in Chapter seven, the conclusions of this thesis are presented.

2 International Ship Dismantling Practices

2.1 When to Dismantle Ships

Ships have been playing a big role to transport bulky commodities since prehistoric times; stones used to build Egyptian pyramids or Stonehenge were moved by ships and the international shipping industry carries approximately 90 percent of the world trade commodities at present, which means the import and export of goods on this scale would be impossible without ships (International Chamber of Shipping, 2012). Shipping industry is expected to grow continuously by providing competitive freight costs to the benefit of people.

There are 103,392 ships that are over 100 Gross Tonnage (GT), including fishing boats and other ships, on 2010 basis (Nam, 2011). Panama has the largest number of registered ships among countries: 7,986 ships, while the figures for other big countries are: USA: 6,371 ships, Japan: 6,150, Russia: 3,485, Korea: 2,913, Liberia: 2,726, Norway: 1,995, Italy: 1,649, and UK 1,638 (Nam, 2011).

Among a total of 103,392 ships sailing on the sea currently, 17,148 ships have been constructed during the past four years. 43,959 ships equivalent to nearly 43 percent of world fleets will end their life shortly as ships' average life is twenty-five years (Nam, 2011). Every year approximately 200 to 600 vessels of over 2000 dead weight tons (DWT) are dismantled worldwide (Commission of the European Communities, 2007).

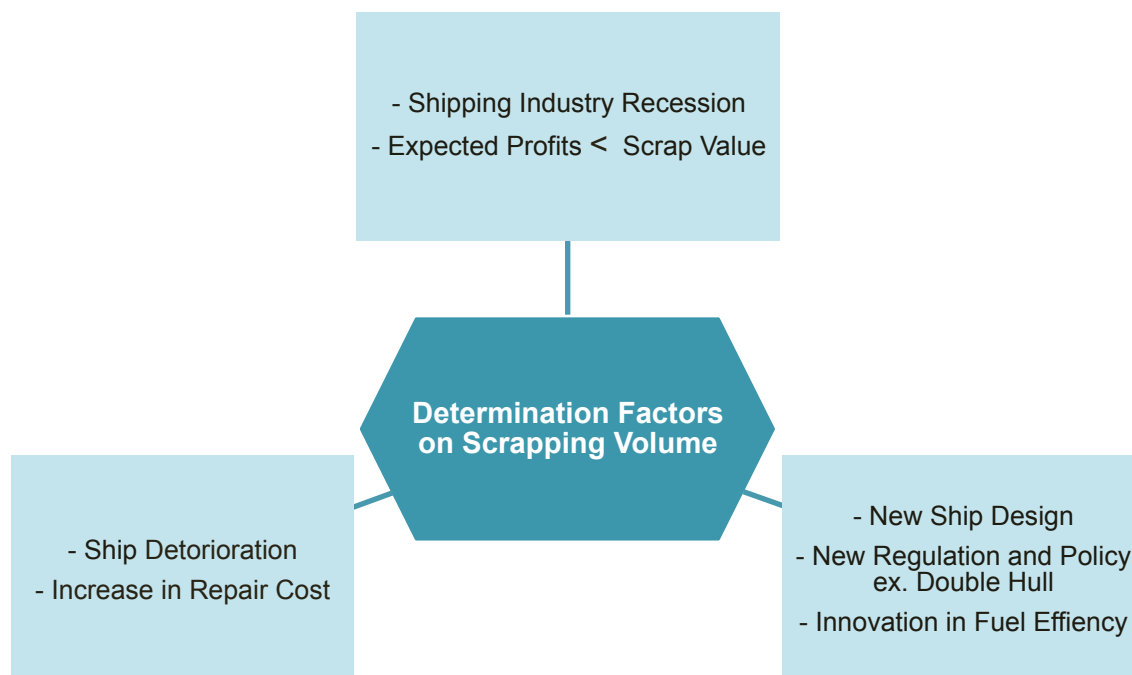


Figure 2-1 Determination Factors on Ship Scrapping Volume

Source: Park (2012)

There are various factors determining when ships are dismantled. The first reason comes from ships per se, such as ship deterioration and increase in repair cost as ships become older. Next big factor is recessions in shipping industry when shipping companies tend to sell ships as

expected profits do not surpass scrap value. In addition, when new ship designs appear and fuel efficiency is improved, old ship scrapping volumes also increase simultaneously. New environment and safety regulations or policies that enter into force affect a change in scrapping volumes as well. Phasing out of single-hull oil tankers has been and will keep scrapping volumes up until 2015 when only double-hull oil tanker can sail on the sea.

2.2 Historical Ship Scrapping Volumes

Total Historical Ship Scrapping Volumes 2005-2010

The total historical ship scrapping volumes from 2005 to 2010 are shown below.

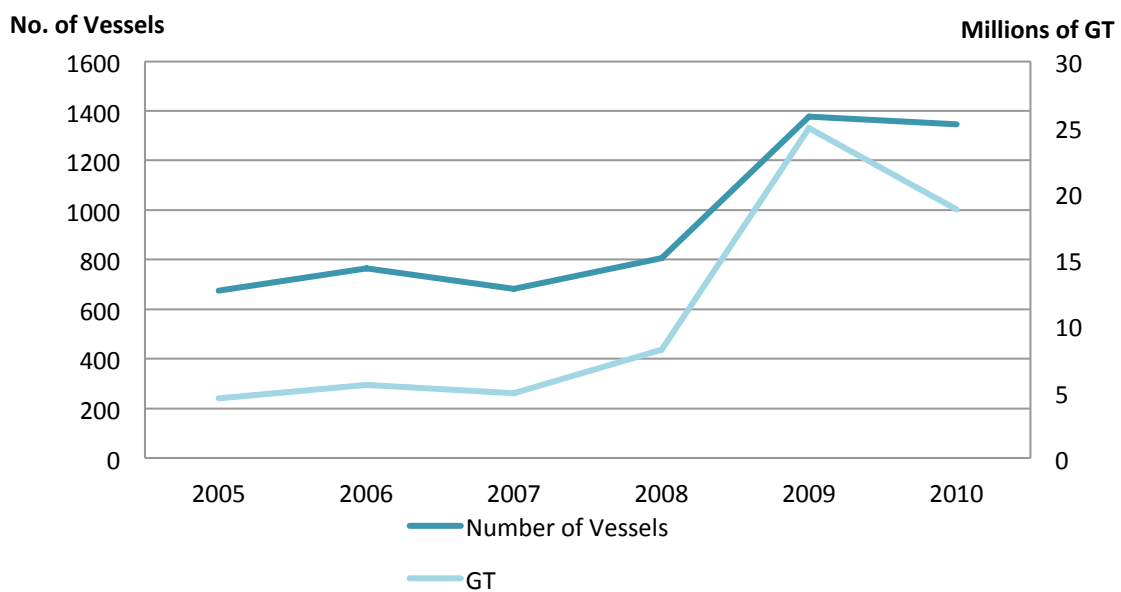


Figure 2-2 Total historical ship scrapping volumes, all types (GT and number of vessels)

Source: Lloyd's (2011)

In 2005 the number of ships dismantled internationally was very low due to strong freight markets. Shipping companies retained the ships including old ships almost being ready for scrapping – as many as possible in order to accommodate a lot of increasing commodities to transport (Stuer-Lauridsen, Jesen, Odgaard, Husum, Olsen, & Ringgaard, 2007). However, since 2007 the volumes of scrapped ships increased considerably due to the global financial crisis and the peak scrapping time was 2009.

Historical Scrapping Volumes by Countries 2005-2010

The estimated level of historical scrapping by countries of ship registry is summarized in the table below.

Table 2-1 Historical ship-scraping volumes by countries of ship-registry

	2006		2007		2008		2009		2010	
	No.	1,000 GT	No.	1,000 GT	No.	1,000 GT	No.	1,000 GT	No.	1,000 GT
Panama	92	1,190	71	1,037	105	1,781	369	8,580	220	4,375
Liberia	18	540	16	285	43	1,480	96	2,873	63	1,925
Singapore	7	83	6	62	5	44	19	1,000	28	1,086
Bahamas	5	134	5	102	3	66	36	1,084	24	483
Norway (NIS)	4	71	14	299	3	48	19	676	19	481
Malta	17	318	10	167	26	614	39	851	33	449
St Vincent & the Grenadines	24	390	8	40	33	356	39	502	39	444
Marshall Islands	1	14	4	123	5	104	32	1,057	15	437
India	8	158	11	144	5	46	11	210	23	345
Hong Kong	4	168	3	65	6	352	23	573	10	340
Cyprus	7	91	2	27	10	206	21	409	17	264
U.S.A.	37	244	28	156	42	252	18	134	24	213
China	12	193	22	286	5	51	18	248	19	210
Greece	28	51	18	69	15	139	18	199	27	210
Korea (South)	9	23	5	32	5	58	21	258	15	165
Italy	13	75	15	41	6	4	6	43	12	126
Indonesia	42	75	27	31	19	87	12	79	12	126
Russia	37	117	54	153	36	115	40	135	33	108
Bulgaria	1	2	1	16	1	2	6	89	11	98
Egypt	-	-	1	5	2	71	1	4	4	97
Iran	4	79	4	57	-	-	6	76	6	95
U.K.	16	118	14	56	11	10	8	157	15	88
Malaysia	2	1	2	1	-	-	2	17	6	77
Thailand	8	30	6	21	11	24	11	113	8	65
Turkey	7	27	8	8	6	36	20	132	19	65
Canada	4	11	3	21	2	2	3	21	4	54
Saudi Arabia	1	50	3	65	1	3	4	45	4	51
Philippines	7	12	1	6	11	96	10	190	6	47
Japan	41	14	51	15	18	7	9	61	4	47
Brazil	4	5	2	8	1	24	3	75	3	41
Bermuda	1	26	1	12	1	44	4	124	1	39
Ukraine	6	17	3	16	11	28	12	72	7	34
Others	330	1,178	316	1,291	414	2,026	479	4,206	615	6,099
World Total	797	5,505	735	4,718	862	8,173	1,415	24,292	1,346	18,786

Source: IHS Fairplay (2011)

As explained in the introduction part above, the vessels can be registered in various countries which give various benefits of lower costs by keeping taxes, fees, or avoiding various sorts of environmental and safety regulatory systems. The FOCs are used for almost two ships out of three in the European Union's end-of-life fleet alone and Panama, Liberia, Saint Vincent and the Grenadines, Bahamas, Cyprus, Malta, and some other countries are commonly exploited for FOCs (NGO Shipbreaking Platform, 2012). So it is estimated that the volume of scrapping ships especially in developed countries including European countries, Japan, and USA increase. Since Korea does not allow Korean shipping lines to use the FOC according to the Customs Law, the scrapping volume is not different from the data above.

Historical Scrapping Volumes by Ship Type

The historical scrapping volumes by ship type are shown in the figures below.

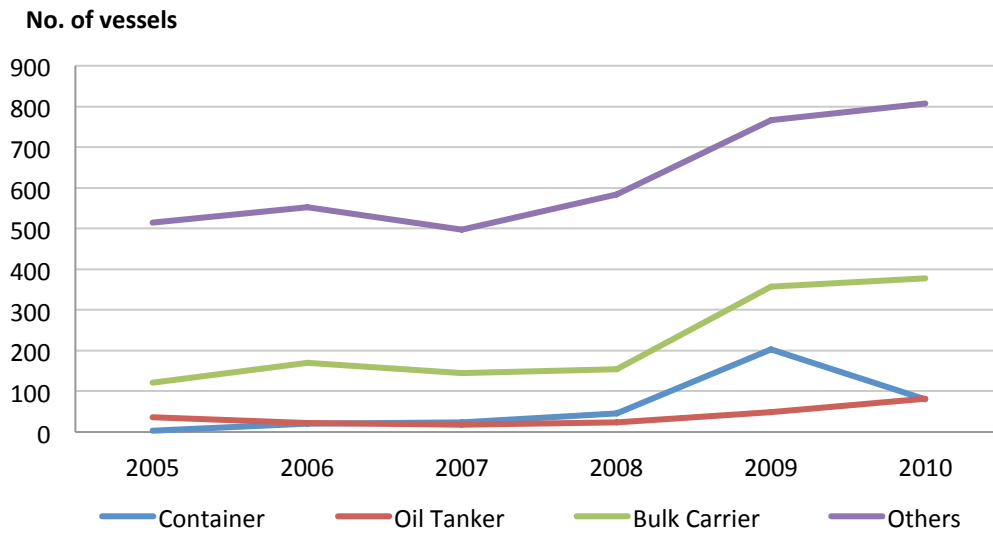


Figure 2-3 Historical scrapping volumes by ship type

Source: Lloyd's (2011)

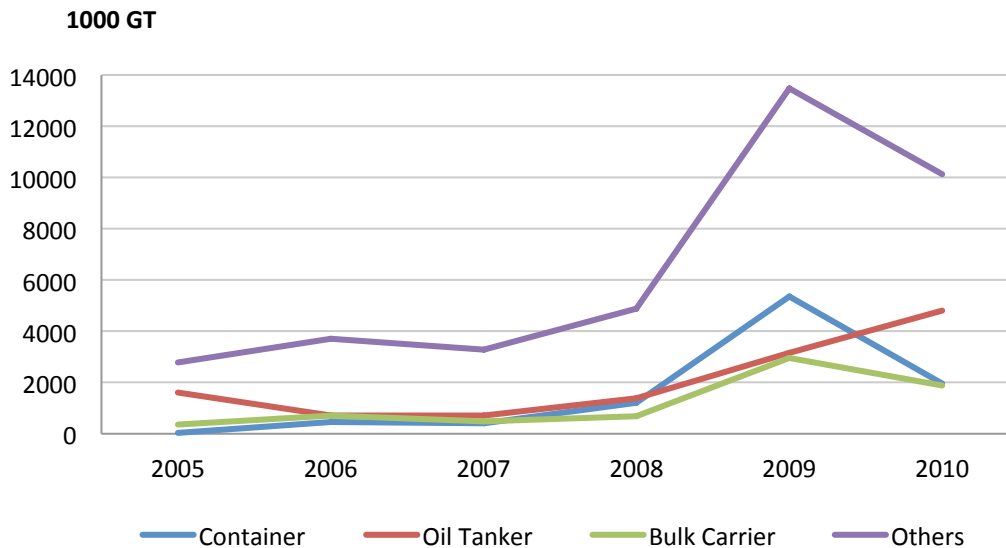


Figure 2-4 Historical scrapping volumes by weight

Source: Lloyd's (2011)

The volumes scrapped were kept steady from 2005 due to strong freight markets, but increased considerably, especially bulk carriers and containers, from 2008 because of relatively

strong drops in the freight rates generated by the global financial crisis (Knapp, Kumar, & Remijn, 2008).

On the other hand, the volume of scrapped oil tankers has been increasing continuously no matter what the freight rates. Single hull tankers owned by countries that have ratified Annex I Regulations for the Prevention of Pollution by Oil of International Convention for the Prevention of Pollution from Ships (MARPOL)⁶ have to be phased out in at least 2015. The oil tankers are divided in three categories and each category has different final phasing-out date. The full timetable is as follows:

Table 2-2 Timetable of single hull tankers' final phasing-out date

Category of oil tanker	Date or year
Category 1	5 April 2005 for ships delivered on 5 April 1982 or earlier 2005 for ships delivered after 5 April 1982
Category 2 and Category 3	5 April 2005 for ships delivered on 5 April 1977 or earlier 2005 for ships delivered after 5 April 1977 but before 1 January 1978 2006 for ships delivered in 1978 and 1979 2007 for ships delivered in 1980 and 1981 2008 for ships delivered in 1982 2009 for ships delivered in 1983 2010 for ships delivered in 1984 or later

Source: IMO (2011)

A number of single-hull tankers in category 2 and 3 were dismantled in 2010 but they can be continued in operation beyond 2010 if the ships have satisfactory results from Condition Assessment Scheme (CAS)⁷. They must not go beyond the anniversary of the date of delivery of the ship 2015 or the date on which the ship reaches 25 years of age after the date of its delivery, whichever is earlier (IMO, 2012).

2.3 Expected Future Scrapping Volume

According to the two graphs below, the ships currently under construction are much bigger than the old ships. While the total number of sea-going ships is increasing, as the ships are getting older, GT of old sea-going vessels are much lighter than new ships. The new ships which are expected to be sent to scrapyards in 25 to 30 years since the average life span of a ship is 25 years, which means there will be full of ships at the scrapyards 25 years later and generate a number of issues if the ship recycling is not going to be managed properly. In addition, all single-hull tankers over 25 years will add the number of scrapping ships for the next three years.

⁶ International Convention for the Prevention of Pollutions from Ships (MARPOL); MARPOL is an international convention adopted in 1973 to deal with the environmental issues generated by ships. It is comprised of 6 annexes; Annex I Regulations for the Prevention of Pollution by Oil, Annex II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk, Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form, Annex IV Prevention of Pollution by Sewage from Ships, Annex V Prevention of Pollution by Garbage from Ships, and Annex VI Prevention of Air Pollution from Ships) and Annex I Regulation for the Prevention by Oil came into force in 1983 and amendments for new oil tankers to have double hulls are made in 1992.

⁷ Condition Assessment Scheme (CAS); CAS for tankers was adopted in 2001 to apply certain oil tankers under the MARPOL convention. It requires more stringent and transparent verification of the reported structural condition of the ship and that documentary and survey procedures have to be carried out properly and completed (IMO, 2001).

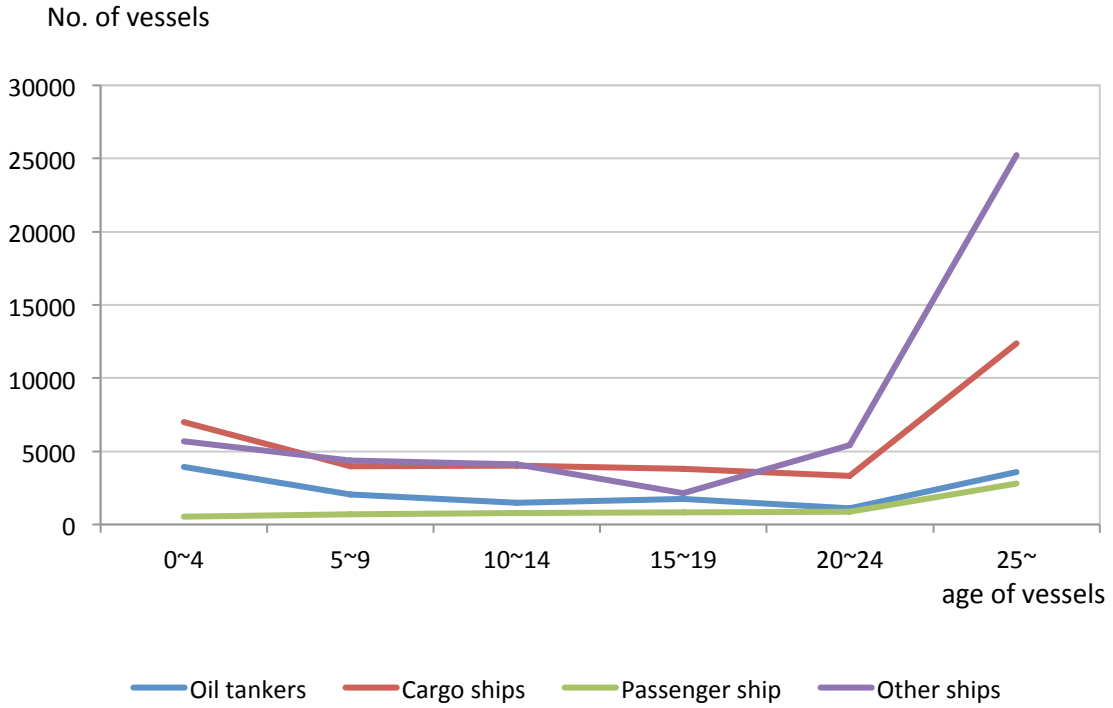


Figure 2-5 Number of Ships according to their type and age in 2010

Source: Lloyd's (2011)

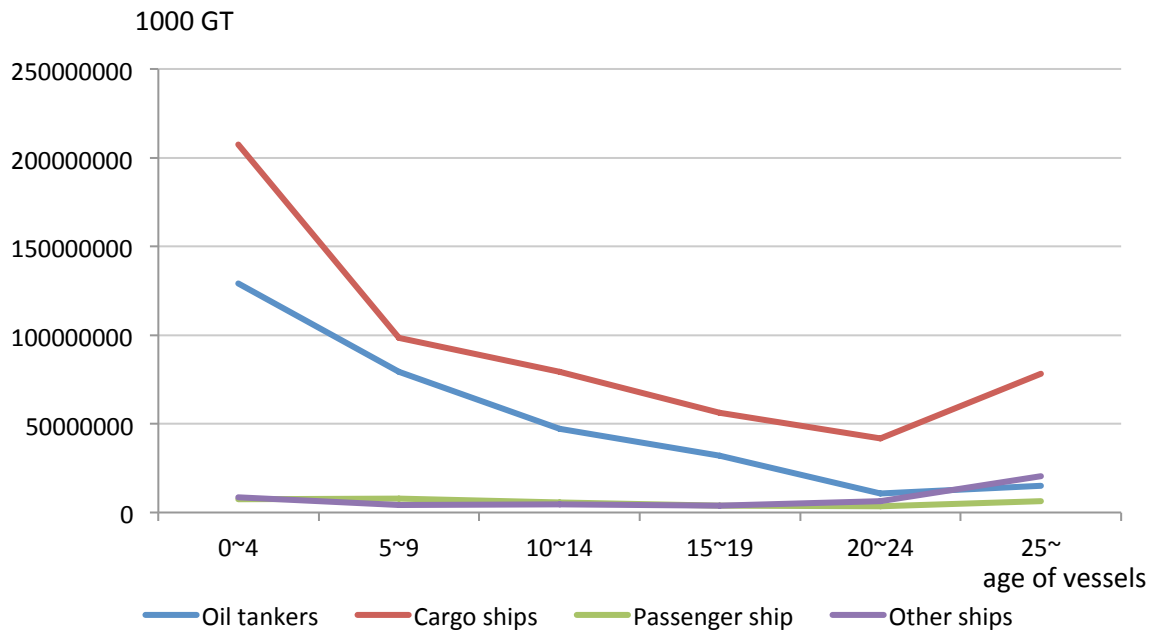


Figure 2-6 GT of Ships according to their types and ages

Source: Lloyd's (2011)

2.4 Methods to Recycle Ships

On average 700 sea-going ships are dismantled each year worldwide and the scrapping volume reached the peak in 2009 when 1,375 ships equivalent to 18,786 GT disappeared due to low freight rates (Nam, 2011). At current two thirds or more of these ships are scrapped in developing countries located in South Asia, especially India, Bangladesh and Pakistan. These countries are occupying approximately 74% of the world ship recycling market while China accounts for 20% and Turkey 4% of the market in 2010.

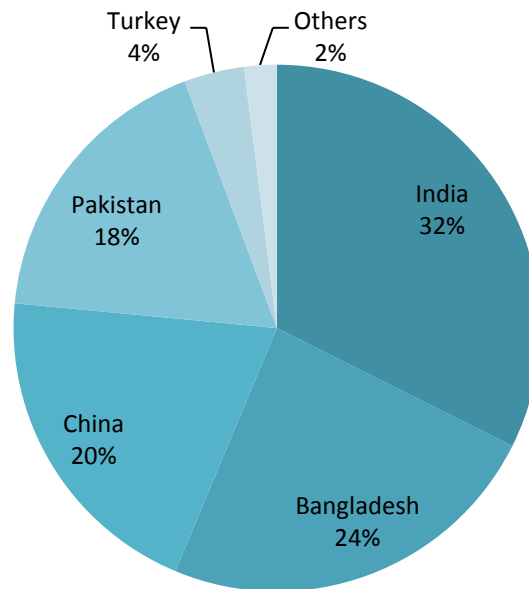


Figure 2-7 Ship recycling market share in 2010

Source: IHS Fairplay (2011)

There are four general methods to dismantle ships; beaching, slipway, alongside, and drydock.

Beaching

Beaching is the way today used in 95% of the cases in developing countries; for instance, Chittagong in Bangladesh, Alang in India, and Gadnani in Pakistan. These areas have very big tidal ranges and expansive mudflats that enable ships to locate over mudflats at spring tides. Large winches attaching to chains or heavy steel wire hawsers tied by ships are used to pull the ships onto the beach. Next reusable items are collected separately and steels are cut by oxygen cutting. The steels cut are dragged by winches if they are large, but mostly the large blocks are cut into small pieces to carry by people. The pieces cut again into two by four meter pieces are sold for cold rolling (Lloyd's Register, 2011).

The beaching method is used mostly in the developing countries where the environmental regulations and labor rights are either rather weak or not existing. The majority of workers earn not more than EUR 2 a day and child labor is commonly found. Workers do not have sufficient safety gears that can get them injured or killed in dangerous accidents caused by falling heavy metal plates, gas explosions or gas suffocation at site. In addition, people who are exposed constantly by toxic pollutants are suffering from fatal occupational diseases, such as lung cancer. In 2010, 39 workers were reported to die in India, but the actual number is probably higher and it has been estimated that hundreds workers have died in the

shipbreaking yards in South Asia. Moreover, tons of pollutants that are absorbed into the sand and accumulated on the yards can be washed back into the sea, which causes environmental damages such as changing climate, rising sea level, destroying biodiversity of the region or extinguishing fishing communities (NGO Shipbreaking Platform, 2011).



Figure 2-8 Ships broken by beaching method; A large steel block is being dragging by human forces in Chittagong, Bangladesh

Source: YPSA (2009)

Slipway

Slipway method is similar with the beaching method in the way that ships are stranded both on the land and the sea. A critical difference between them is that slipway recycling is typified by no tide, which enables to predict and control the contaminants by ships. The steel pieces are removed from the ship by mobile crane on the shore. As the ship becomes light, it is dragged up to the shore to continue further processes (Lloyd’s Register, 2011).

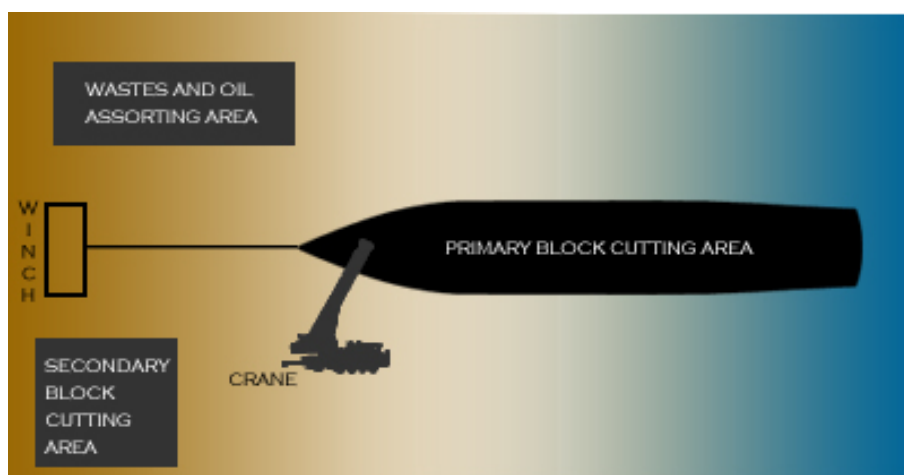


Figure 2-9 Slipway method

Source: Adopted and simplified from “Final Report on Ship Recycling in Korea according to The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships”, Korea Coast Guard, 2009, p.103

Alongside

This method is readily found in Chinese yards. The ship is anchored alongside in the sheltered waters at wharf. Then pieces are taken apart from the top to bottom until only the double bottom is left. The process is called ‘Top down’. The pieces broken are carried by cranes on the shore. The canoe called as the ship is remained with only double bottom is continued to break until either lifted out in one piece, or sent to dry dock for final cutting. Since there is no tide, concentrations have less possibility to disperse and can be properly monitored and controlled and cleaned (Lloyd’s Register, 2011).

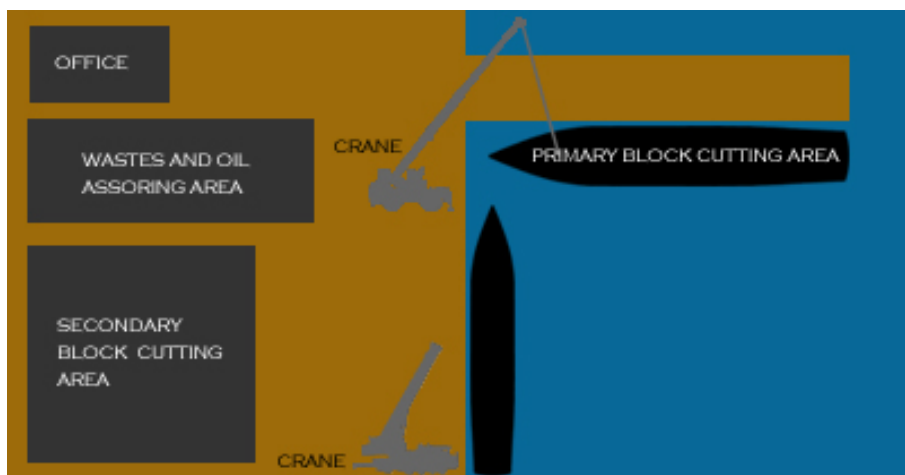


Figure 2-10 Alongside method

Source: Adopted and simplified from ‘Final Report on Ship Recycling in Korea according to The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships’, Korea Coast Guard, 2009, p.103

Drydock

Drydock method is to dismantle all the parts of the ship piece by piece at the drydock. So, it is called as the safest and cleanest ship breaking way where the chances of polluting waters by accident are zero and the dock is cleaned before the next ship comes to be recycled in order to avoid accumulations of contaminants. However, the method is relatively more expensive than other methods to build and maintain drydock, so it is only found in some European countries.

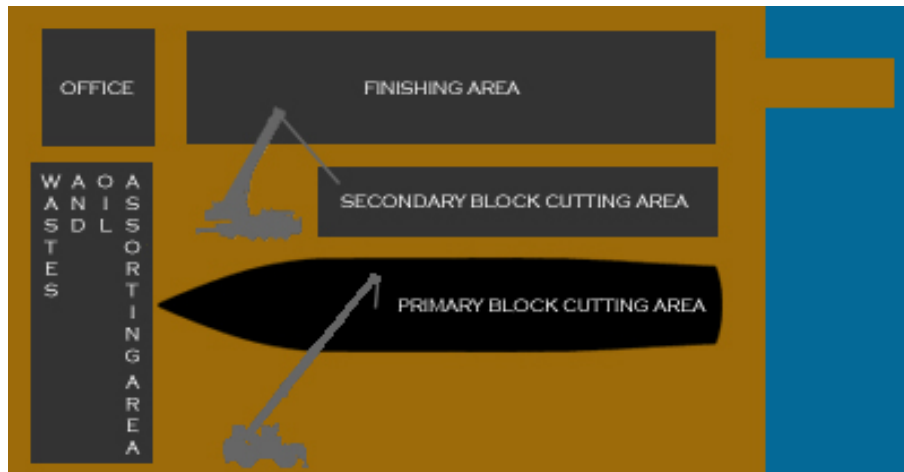


Figure 2-11 Drydock method

Source: Adopted and simplified from 'Final Report on Ship Recycling in Korea according to The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships', Korea Coast Guard, 2009, p.104

3 International Governances on Ship Dismantling

To answer to the increasing international concerns caused by shipbreaking practices in the developing world, especially South Asia using “beaching method”, the parties to the Basel Convention, the International Labor Organization (ILO), and the International Maritime Organization (IMO) have started work on the problems.

3.1 Basel Convention

The Basel Convention is the principal international legal instrument regulating the transboundary movement and disposal of hazardous wastes from developed countries, in particular 34 OECD countries⁸, to developing countries. Three main objectives that the Basel Convention pursues are

1. Minimization of the production of waste at source; Article 4(2)(a) “ensure that the generation of hazardous wastes and other wastes within it is reduced to a minimum, taking into account social, technological and economic aspects”;
2. Environmentally sound management and disposal of waste; Article 4(2) (c) “ensure that persons involved in the management of hazardous wastes or other wastes within it take such steps as are necessary to prevent pollution due to hazardous wastes and other wastes arising from such management and, if such pollution occurs, to minimize the consequences thereof for human health and the environment”; and
3. Minimization of transboundary movement of hazardous wastes and other wastes through national self-sufficiency in waste management; “ensure that the transboundary movement of hazardous wastes and other wastes is reduced to the minimum consistent with the environmentally sound and efficient management of such wastes, and is conducted in a manner which will protect human health and the environment against the adverse effects which may result from such movement”.

However, the Convention does not prohibit the transboundary movement of hazardous wastes, instead a prior informed consent (PIC) procedure is used. The procedure is shown in Figure 3-1 below.

The state of export should send a prior notification to the states concerned by a transboundary transport of wastes and the states of import respond in writing whether they accept the transport with or without conditions, deny the transport or request additional information. The state of export can move the wastes when it has received the confirmation of the PIC from the importing States.

⁸ 34 OECD member countries; Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States

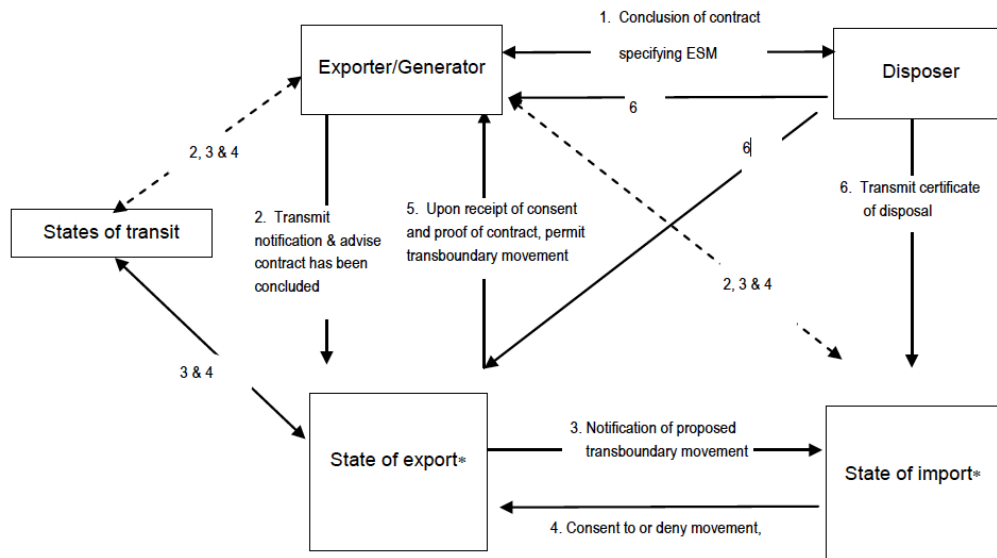


Figure 3-1 Basel Convention Prior Informed Consent Procedure

Source: CIEL (2011)

In October 2004, the Basel Convention Conference of Parties (COP) affirmed that a ship could be defined as waste and the parties have to fulfill their obligations under the Basel Convention, in particular with respect to prior informed consent, minimization of transboundary movement of hazardous waste and the principle of environmentally sound management.

The parties to the Basel Convention adopted the “Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships (Basel Technical Guidelines)” published in 2003. The guidelines provide “information and recommendations on procedures, processes and practices that must be implemented to attain Environmentally Sound Management (ESM) at facilities for ship dismantling”. The ESM has three different phases of ship breaking, which are preparation on the ship, environmental management plan, and ship dismantling facility.

Table 3-1 Three phases of an environmentally sound ship dismantling process

Preparations on the ship	<ul style="list-style-type: none"> • Preparation of an inventory list of onboard hazardous/polluting wastes • Removal/cleaning – liquids, including fuels and oils • Securing the vessel by ensuring safe access to all areas and safe conditions for hot work. • Removal of equipment
Environmental Management Plan	<ul style="list-style-type: none"> • Environmental Impact Assessment • Inventory of best practices • Waste management plan • Contingency preparedness plan • Monitoring plan
Ship dismantling facility	<p>Minimum key functionalities of a model facility:</p> <ul style="list-style-type: none"> • Containment • Workstations for secondary dismantling and sequential breakdown into component elements. • Specially equipped workstations for removal of hazardous and toxic materials • Temporary storage areas for benign materials and steelwork. • Secure storage areas for hazardous wastes. • Storage areas for fully processed equipment and materials that are ready for reuse, recycling or disposal. • Proximity to proper disposal facilities.

Source: CIEL (2011)

3.2 International Labor Organization (ILO)

The International Labor Organization (ILO) is the international organization responsible for drawing up and overseeing world’s labor standards. It decided to revise, review and adopt the first guidelines on safety and health in shipbreaking in selected Asian Countries and Turkey in 2002. The guideline “Safety and health in shipbreaking; Guidelines for Asian countries and Turkey” provides guidance to ensure safe work in shipbreaking by advising on the transformation of informal sector activities into formal organized ones (International Labour Office, 2003).

Objectives of the guideline is to contribute “to the protection of shipbreaking workers from workplace hazards and to the elimination and control of work related injuries and diseases, ill health, and incidents” and “to assisting and facilitating the improved management of occupational safety and health issues in or about the workplace” (International Labour Office, 2004).

The guideline divides into two parts, national framework contributing to define the general responsibilities and rights for employers, workers and regulatory authorities in shipbreaking activities and the next part, safe shipbreaking operations providing recommendations on the management of hazardous substances and preventative measures for workers against hazardous materials by training program (International Labour Office, 2004).

Like other ILO guidelines, the shipbreaking guideline is not legally binding, but intended to influence the establishment of effective national systems, procedures, and regulations to deal with problems of shipbreaking activities, especially in South Asian countries that do not have enough strict regulations and policies on the activities.

3.3 International Maritime Organization (IMO)

The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (the Hong Kong Convention) was adopted by delegates from 63 countries at IMO's Marine Environment Protection Committee (MEPC) 59th session held in Hong Kong, China, from 11 to 15 May 2009.

The terminology of “ship recycling” was first raised at the MEPC 44th session in 2000 and the first guideline called “IMO Guidelines on Ship Recycling” was adopted at the 49th MEPC session in July 2003. The guideline gives advices to all stakeholders in the recycling process, including shipbuilding and maritime equipment industries, ship owners, ship repairers, recycling yards, and flag, port and recycling States. It impressed there is virtually nothing that goes to waste in the process of recycling ships and it can contribute positive conservation of energy and resources. In addition, it recognized that ensuring safe working practices and protecting environment are necessary to minimize potential problems in the yards (IMO, 2012).

The concept of a “Green Passport” was also introduced in this guideline. It noted that all materials used to build ships might contain potentially hazardous and dangerous substances harmful to human health or the environment. By drawing up a Green Passport containing the inventory of hazardous materials by shipbuilding stage and passing the document, which will be updated as any considerable changes in materials or equipment are taking place, to the purchaser of the ship and finally to the recycling yard, it was believed that a number accidents generated by the hazardous materials would decrease (IMO, 2012).

Subsequently, the IMO decided to develop a new legally binding instrument on ship recycling at the 53th MEPC session in 2005 and the instrument would provide regulations for “the design, construction, operation and preparation of ships so as to facilitate safe and environmentally sound recycling, without compromising the safety and operational efficiency of ships”, “the operation of ship recycling facilities in a safe and environmentally sound manner”, and “the establishment of an appropriate enforcement mechanism for ship recycling, incorporating certification and reporting requirements” (IMO, 2005).

Finally, the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships of 2009 (the Hong Kong Convention), aiming to systemically manage the practices of ship recycling and having taken three and a half years to develop in cooperation with the Parties to the Basel Convention and ILO, was adopted at the 59th MEPC session in Hong Kong attended by representatives of 63 States, two Associate Members, the Secretariats of the Basel Convention and of ILO, and other stakeholders. The Convention covers all the issues related to ship recycling including the environmental problems generated during breaking process by hazardous contaminants such as asbestos, hydrocarbons, ozone-depleting substances, heavy metals and others. In addition, it deals with the working and environmental conditions at the ship scrapyards to protect workers (IMO, 2012).

The new Convention covers the practices of ship recycling from the design to construction, operation and preparation of recycling. The process should be done in an environmentally sound way regardless of operational efficiency of ships. The ships under the Convention have to carry an inventory of hazardous materials documented at the construction stage in a case of new ship or during the operation in a case of ships in service.

The hazardous materials listed in Appendix 1⁹ of the Convention are restricted or prohibited for use in shipyards and ship repair yards and inside ships. The ship owners will be required to conduct an initial survey to inspect the IHM and additional surveys that will be done at least every 5 years during the life of the ships. The IHM is required to be updated after any installations of materials listed in Appendix 2¹⁰ of the Convention. Last, a final survey will be needed prior to recycling.

After the Convention comes into force, the ships can only be sent to ship recycling places that have implemented management systems, procedure and techniques in accordance with the Convention. Before the ship to be recycled is anchored, a “Ship Recycling Plan” will be required from the ship recycling yard. The plan has to explain the manner of ship recycling, taking account of the particulars and its inventory. Parties to the Convention will be required to oversee ship recycling facilities and that they comply with the Convention.

In the last two years, four guidelines have been completed and adopted to assist States. These are: “Guidelines for Development of the Inventory of Hazardous Materials, 2011”, “Guidelines for the Development of the ship recycling Plan, 2011”, “Guidelines for Safe and Environmentally Sound Ship Recycling, 2012”, and “Guidelines for the Authorization of Ship Recycling Facilities, 2012”.

Two further guidelines developed to assist the Convention are waiting to be adopted. This is expected to happen at the 64th MEPC held in October 2012. The guidelines are “Guidelines for Survey and Certification of Ships under the Hong Kong Convention” and “Guidelines for Inspection of Ships under the Hong Kong Convention”.

According to Article 17 of the Convention, three conditions, listed in the introduction part, have to be fulfilled so that the convention comes into force. The table below tells that the ratifying states have to represent not less than 15 States that own at least 383,192,922 GT of merchant fleets and recycling facilities whose combined maximum annual ship recycling volumes is at least 11,495,788 GT (Mikelis, 2012).

Table 3-2 Conditions for the Hong Kong Convention coming into force

	World fleet GT	40% of world merchant fleet GT	3% of ship recycling volume of 40% of world merchant fleet GT
2001	574,551,264	229,820,506	6,894,615
2002	585,583,396	234,233,358	7,027,001
2003	605,218,368	242,087,347	7,262,620
2004	633,321,120	253,328,448	7,599,853
2005	675,115,956	270,046,382	8,101,391
2006	721,855,399	288,742,160	8,662,265
2007	774,936,508	309,974,603	9,299,238
2008	830,704,412	332,281,765	9,968,453
2009	882,264,804	353,053,922	10,591,618
2010	957,982,304	383,192,922	11,495,788

Source: IHS Fairplay (2011)

⁹ Appendix 1-Controls of hazardous materials is listed in the Appendix 2 below.

¹⁰ Appendix 2-Minimum list of items for the inventory of hazardous materials is listed in the Appendix 3 below.

There were five countries that signed the convention on the condition of ratification until the 30 of November in 2011.

Table 3-3 Countries who signed the Hong Kong Convention

No.	Country	Condition	Date of sign
1	France	Subject to ratification	19 November 2009
2	Italy	Subject to ratification	2 August 2010
3	Netherlands	Subject to acceptance	21 April 2010
4	Saint Kitts and Nevis	Subject to ratification	27 August 2010
5	Turkey	Subject to ratification	26 August 2010

Source: Korean Register of Shipping (2012)

However, it is difficult to find international shipping activities by the five countries above and still 10 countries are needed to fulfill the first condition. In reality the three conditions seem to be difficult to fulfill since the world merchant fleets are owned by rather developed countries and many of these countries are allowed to use the FOCs.

Table 3-4 Volume and percentage of world merchant fleet by countries in 2010

	2010		
	No.	1,000 GT	GT as percent of world
Panama	220	4,375	23.29%
Liberia	63	1,925	10.25%
Singapore	28	1,086	5.78%
Bahamas	24	483	2.57%
Norway(NIS)	19	481	2.56%
Malta	33	449	2.39%
St Vincent & the Grenadines	39	444	2.36%
Marshall Islands	15	437	2.33%
India	23	345	1.84%
Hong Kong	10	340	1.81%
Cyprus	17	264	1.41%
U.S.A.	24	213	1.13%
China	19	210	1.12%
Greece	27	210	1.12%
Korea (South)	15	165	0.88%
Italy	12	126	0.67%
Indonesia	12	126	0.67%
Russia	33	108	0.57%
Bulgaria	11	98	0.52%
Egypt	4	97	0.52%
Iran	6	95	0.51%
U.K.	15	88	0.47%
Malaysia	6	77	0.41%
Thailand	8	65	0.35%
Turkey	19	65	0.35%
Canada	4	54	0.29%
Others	615	6,099	33.85%
World Total	1,346	18,786	100.00%

Source: IHS Fairplay (2011)

Since 97 percent of the ships are dismantled in five developing countries, Bangladesh, Pakistan, India, China and Turkey, the third condition is rather hard to meet. If Turkey recycling 4 percent of world fleets in its ship recycling facilities ratifies the Convention or join European Union in the near future, the Convention will come into force faster than expected. The experts anticipate the Convention's entry into force will be later than 2015.

3.4 Joint Working Group on Ship Dismantling

The Joint Working Group, consisting of the Parties to the Basel Convention, ILO Governing Body and IMO Marine Environment Protection Committee, was established to avoid duplication of work and overlapping of responsibilities and competencies related to ship recycling processes between the three organizations. In addition, the group aims to identify any possible gaps, overlaps or ambiguities in the guidelines conducted by these organizations by undertaking a comprehensive initial examination and to promote their implementation by considering mechanisms.

Since the Hong Kong Convention still has not come into force, the Basel Convention is the strongest regulator to the ship recycling industry. However, its range of responsibility is likely to decrease to control only to the rather small ships that are not handled by the Hong Kong Convention.

International Ship Recycling Trust Fund (ISRT)

The International Ship Recycling Trust (ISRT) Fund was established in May 2006 before the Hong Kong Convention was adopted. It aims to provide a financial mechanism to support national initiatives with purpose to strengthen their capacity for enhancing safe and environmentally sound ship recycling in developing countries. It will impose financial responsibilities to ship owners and ship registration countries to support technical cooperation programs (IMO, 2012).

The ISRT is one of six Multi-donor Trust Funds (MDTFs)¹¹ aimed at contributing to deal with specific issues by technical cooperation between nations. The MDTFs have been donated USD 7.3 million according to the 62nd MEPC session in June 2012. There are currently 19 financial arrangements in operation, 10 of which had been established with government agencies of Canada, Egypt, Italy, Norway, Korea, UK, and USA and the rest with international and regional organizations and industry (IMO, 2012).

Although the ISRT is meaningful in itself, there has not established clear rules how to operate the fund yet. As it is one of MDTFs, it is unknown that how much donation from the combination of funds is expected to be used for ship recycling. In addition, the ISRT itself has to discuss and determine the fund management and fund users, questions that have not been decided so far.

3.5 Development of European Policies on Ship Recycling

General Description of European Shipbuilding and Ship operating Industry

There are approximately 150 large shipyards in Europe and 40 out of them construct international sea-going commercial vessels. The European shipyards focus on the construction

¹¹ Multi-donors Trust Funds (MDTFs) is consisted of six funds which are The International Maritime Security Trust (IMST) Fund, The International Search and Rescue (SAR) Fund, The International Ship Recycling Trust (ISRT) Fund, The IMO Malacca and Singapore Straits Trust Fund, The IMO Djibouti Code of Conduct Trust Fund, and The London Convention/Protocol TC Trust Fund.

of rather complex and higher value vessels such as cruise ships, ferries, offshore vessels, megayachts and dredgers with their innovative technologies to avoid strong global competition from Asian shipbuilders; Korea, China, and Japan. Europe builds 77 percent of the world passenger vessels including cruise ships and ferries and 17 percent of non-cargo vessels. These segments make up rather small market share in the world order book and the market demands are usually generated by the domestic markets (Ecorys , 2012).

It is reported that there are 405 European containership companies operating liner-shipping services worldwide. The detail is shown in Table 3-3 below. Denmark, Switzerland, and France have jointly nearly 30 percent of the market share in terms of total TEU¹² vessel capacity. Greece that is one of the major ship-owning countries is not included in the list as a major containership operator (UNCTAD, 2011).

Table 3-5 The 20 large containership-operating economies, January 2011

Country	Vessel capacity TEU	Vessel capacity, percentage of world capacity	Number of ships, 2010
Denmark	1891 051	11.60%	485
Switzerland	1 771 621	10.90%	439
France	1 190 894	7.30%	383
China	1 141 708	7.00%	398
Singapore	1117000	6.90%	492
Taiwan	1 113 598	6.90%	337
Japan	1085802	6.70%	296
Germany	1 025 650	6.30%	412
South Korea	906 259	5.60%	336
Hong Kong	661 531	4.10%	190
Chile	449 913	2.80%	149
USA	318 297	2.00%	337
Israel	281 532	1.70%	73
Kuwait	178 599	1.10%	47
Belgium	137 090	0.80%	163
Netherlands	132 483	0.80%	191
Iran	90 288	0.60%	42
Malaysia	85 967	0.50%	74
Italy	80 080	0.50%	95
United	69 896	0.40%	47
World	16 253 998	100.00%	688

Source: UNCTAD (2011)

¹² TEU - twenty foot equivalent container units

Ship Scrapping Status

In terms of the ship scrapping industry in Europe, Turkey (scrapped 1,082,446 dwt), Romania (16,064 dwt), Denmark (15,802 dwt) and Belgium (8,807 dwt) belong to top 10 scrapping countries worldwide in 2010 according to IHS Fairplay. However, the number of ships scrapped are very small compared to the largest ship scrapping yards in Asian countries. India only handled 9,287,775 dwt in 2010 (UNCTAD, 2011).

Since European countries have owned and operated a number of ships for many decades, the accumulated volume of ships to be scrapped is also considerable. The total volume to be scrapped will increase with not only commercial vessels but also around 100 warships and other government vessels flying EU flags that are likely to be decommissioned in the next 10 years.

Europe is not able to handle all their ships and their scrapping due to the lack of scrapping yards to deal with the ships. Therefore, many toxic and dangerous ships from Europe are sent to scrapping yards in developing countries in Asia. In addition, like explained above, many of the ships being operated by European international shipping lines are registered in third countries to avoid given responsibilities. In consequence, the actual scrapping volume of ships from Europe is hidden. The issue is highly debated for years now, as Europe started to become concerned by the hazardous materials and safety matters generated by the ships they send to developing countries.

Waste Shipment Regulation (WSR)

According to the European Waste Shipment Regulation (EC) No 1013/2006, EU-flagged ships sent to scrapping yards are considered as hazardous wastes due to their high quantities of hazardous substances. Thus, EU countries prohibit the export of old ships to non-OECD countries without a prior informed consent.

However, this legislation is almost systematically not functioning for EU-flagged ships with reasons of the lack of recycling capacity available in Europe and economic matters such as high labor costs and internalization of environmental costs. In addition, identifying when a ship becomes waste is difficult since ship owners can decide to send them for recycling in international waters or in waters under the jurisdiction of the recycling state where the Waste Shipment Regulation is nearly impossible to apply. Moreover, most of the commercial ships that are decided for dismantling leave for Asia full of commodities to transport and they are sent to scrapping yards after final trading. If the ship owner so decides, the ship can also be registered with a FOC before the decision to scrap it is formally taken. For this reason, EU port and relevant authorities cannot intervene in most cases.

Green Paper on Better Ship Dismantling

In May 2007, the European Commission published a consultation paper on how to make the dismantling of old ships safer for both workers and the environment. The Green Paper, as a consultation document, does not present a specific plan but suggests various options to prepare the ground, intensifying future action on the development of ship recycling (Commission of the European Communities, 2007).

The Green Paper supported the development of an international Ship Recycling Convention, which is the current Hong Kong Convention, and requires a stronger role for the EU itself to deal with the ship recycling. It proposes a sustainable financing scheme for clean dismantling by a "Ship Dismantling Fund" levied by the shipping industry (Commission of the European Communities, 2007).

For the short and medium term, it suggests better enforcement of the Waste Shipment Regulations by more checks at European ports, additional guidance by the Commission and the Member States such as a list of ‘clean’ ship dismantling facilities, more systematic cooperation and information exchange between the Member States, and between them and the Commission, more cooperation with certain third countries, in particular recycling states, and a policy that focuses on warships and other states-owned ships and commercial vessels that regularly operate in EU waters (Commission of the European Communities, 2007).

EU Strategy for Better Ship Dismantling

The European commission adopted an “EU Strategy for Better Ship Dismantling” in May 2008, one year after the Green Paper was published. The EU strategy proposes a range of measures intended to improve ship dismantling conditions in the near future, during the interim period before the IMO Convention comes into force. The measures presented in the Strategy are (Commission of the European Communities, 2008):

- Start preparations for establishing measures on key elements of the envisaged Hong Kong Convention, in particular, concerning surveys and certificates for ships, essential requirements for recycling facilities and rules on reporting and communication.
- Further assess the option to include in the ship recycling measures, amongst others, rules for the clean dismantling of warships and other government vessels.
- Encourage voluntary industry action by various measures, such as an EU-wide public campaign, an award for exemplary activities and guidance with a list of clean ship dismantling facilities.
- Improve enforcement of the current waste shipment law with regard to end-of-life ships by guidance from the Commission, more multilateral cooperation.

The strategy also suggested that the Commission should review the feasibility of the following measures:

- Examine the feasibility of rules on a list of ships ready for scrapping.
- To further assess the feasibility of developing a certification and audit scheme for ship recycling facilities worldwide and evaluate how it can be ensured that a maximum number of ships, including ships flying the flags of Member States go for dismantling to facilities certified and audited under this scheme.
- Assess the feasibility of the option of a mandatory international funding system for clean ship dismantling (“ship dismantling fund”).

A Proposal on Ship Recycling

The European Commission published “A Proposal on Ship Recycling” in March 2012 to ensure that the European ships should be recycled only in facilities that are environmentally sound and safe for workers. The new rules, that will take the form of a Regulation and is waiting for its adoption by the European Parliament and the Council of Ministers, proposes a system of survey, certification and authorization for large commercial sea-going vessels flying the flag of an EU Member State. It deals with the ships’ whole life cycle from construction to operation and recycling. The System builds upon the Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships and aims at speeding up the Convention’s practical entry into force without waiting for its ratification and formal entry into force.

The proposal requires European ships to draw up the IHM present on board and apply for an inventory certificate. Before the ships are delivered to recycling facilities, the amount of hazardous wastes on board, such as cargo residues, fuel oil, and other, should be reduced.

The ships are allowed to be dismantled in the facilities that meet a set of environmental and safety requirements. The facilities are examined whether they respect the environmental and safety regulations or not by relevant authorities and then the facilities can be included on a list of authorized facilities. These can be located outside Europe if they meet the level of European laws. Some requirements are stricter than those foreseen by the Hong Kong Convention and enable to trace the hazardous waste resulting from dismantling in an environmentally sound way.

To ensure compliance, ship owners should report their ships to be dismantled to national authorities before sending them to recycling facilities. The relevant authorities easily find illegal recycling by comparing the inventory certificate they issued and the list of ships that have been recycled in authorized facilities. The ships that do not observe the law will receive sanctions that will be specific and precise.

Current Status

The regulation proposed by EU would implement the Hong Kong Convention on ship recycling. However, the EU thinks the Hong Kong Convention is not expected to enter into force until 2020 and it is considered to be too late to restrict single-hulled tankers that have to be phased out until 2015. In addition the current economic recession will increase the scrapping volume. With these reasons, the EU proposed to strengthen the regulations and take actions at the EU level independently.

However, some problems detected have to be addressed. According to the proposal, member states should introduce “effective, proportionate and dissuasive penalties” to ensure proper recycling. However, the vessels that are scrapped within only six months will be penalized and the ship owners can avoid a penalty if the ships are not sold for scrap. Besides, small non-ocean going ships and military vessels are not subject to the regulation since they are usually broken up in EU or OECD countries.

Since the draft regulation is expected to apply in a few years, the ship-related industry has to consider and take actions to prepare for the future regulations. While the European ship builders who construct rather small ships or non-ocean going ships are not influenced considerably by changing regulations, the international shipping lines have to urgently look into the regulations carefully and draw up the IHM for ships as soon as possible.

4 Korean Ship Recycling

4.1 History

While for the last 25 years most of ships globally are going to India, Bangladesh, and Pakistan to be scrapped, ship recycling industry was a common feature in Japan, Korea, and Taiwan during the late 1960s to early 1980s with lower labor costs and a domestic demand for steel. However, the industry has declined due to strengthening environmental and safety regulations and increasing labor cost.

4.2 Ship Scrapping Volumes

According to statistics published by Korea Coast Guard, the number of ships scrapped between January and August of 2011 was 148, corresponding to roughly 61,400 GT (Korea Register of Shipping, 2011). A reason why a number of small ships (below 100 GT) that were scrapped increased considerably, was a land reclamation government project on the west coast and a lot of small ship vessels were decided to be sold to the government because the poor owners could not afford moving them to other places. Most small vessels sold were dismantled in domestic scrap yards.

90 percent of ships dismantled between 2009 and Aug 2011 are less than 500 GT and the rest (10%) also sailed along the Korean Coast. In other words, most of the ships being dismantled in Korea are not applicable to the Hong Kong Convention (Korea Register of Shipping, 2011).

Table 4-1 Number of ships scrapped in Korea in 2009 to August 2011

	Total No. of ships scrapped	Type				Gross Tonnage (GT)					
		Tankers	Fishing vessels	Cargo ships	Others	~100	100~500	500~1000	1000~5000	5000~10000	10000~
Total 2011	913	22	716	38	137	660	164	54	32	2	1
Aug 2011	148	7	76	10	55	78	50	10	8	1	1
2010	582	8	501	15	58	479	60	31	11	1	0
2009	183	7	139	13	24	103	54	13	13	0	0

Source: Korea Register of Shipping (2011)

4.3 Ship Scrapping Yard

67 recycling facilities are counted to exist in Korea. 25 facilities out of them can dismantle over 500-tonnage-ships and seven facilities are able to scrap over 1000-tonnage-ships using their own equipment. Except for these seven facilities, others rent land and equipment like cranes and necessary machines from a ship repairing company, that is, most of the ship scrapping companies are small (Korea Maritime Institute, 2011). Recently only eight facilities have scrapped over 500-tonnage-ships, which all had sailed along the Korean coast.

Table 4-2 Locations of ship recycling facilities in Korea

	Total	Busan	Goosan	Incheon	Yeosoo	Jeju	Others
Number	67	21	15	8	5	2	16

Source: Korea Maritime Institute (2011)

The companies cannot continue their business with only ship recycling, since ships to be scrapped do not occur regularly. So, most of them run ship repairing or ship rescuing

businesses or marine transportation together with ship recycling. For this reason, the tendency to have mixed business is common to most of ship recyclers and the ship scrapping industry is small.

One facility has a treatment facility for hazardous materials such as asbestos, polychlorobiphenyl (PCB), heavy metals, refrigerant, hazardous paints, oil, etc. (Korea Register of Shipping, 2011).

In general, one facility hires a work force of zero to five persons and the maximum human resources available were 20 people and the minimum was two. It is estimated that Korea has approximately 200 persons who have the ability to dismantle ships and most of them were educated in the 1970s to 1980s when the Korean ship scrapping industry provided good profits. So, the average age of them are around 50-60 and most young people avoid working at ship recycling facilities since the work is regarded as dangerous, dirty and a difficult job. In addition, the workers are usually hired temporarily when ship dismantling takes place at the facility (Baek, 2012; Korea Register of Shipping, 2011).

The common method to use when dismantling ships in Korea is a slipway. The wastes and recyclable materials are separated and collected at sea before the ship is dragged on the shore. Then, upper structures like the steering house is cut by oxygen cutting and lifted up by a crane to be put down on land. After being somewhat lightened, the ship is landed on the shore by a winch. It is a dangerous process since the wire used many times is easily snapped and may hurt surrounding people. The existing materials like waste oil in the tank are collected for reuse and a safety check of the tank is made. The recyclable materials are sold to scrap iron-treating facilities and steel companies and other waste are discarded or treated by third treatment facilities (EBS, 2009; Korea Register of Shipping, 2011).



Figure 4-1 Dadae ship recycling facility

Since the slipway method does not have safety boundary between the sea and the shore, it does not guarantee that the pollution generated by the ships does not enter into the sea. Wastes may possibly fall into the sea by accident and they can accumulate at the bottom of the sea. Oxygen cutting can generate toxic gases and they risk harm people's health seriously. It seems that people are troubled with lung-related illnesses, but the poor facilities cannot provide health insurance or examination.

4.4 Ship owners

During the past 10 years, Korean sea-going ships have increased considerably in both weight and numbers. So, after the Hong Kong Convention comes into force, ship owners will be required to spend considerable expenses related to drawing up the IHM and carrying out various tests during the whole lifetime of the ships. It is estimated that Korea has 1,189 ships

of 1000 GT and above in 2010 (See Table1-1). If it is assumed that the initial test for existing ships costs around EUR 2,000, total test costs for the ships are estimated at approximately EUR 2.4 million (Kim, 2009).

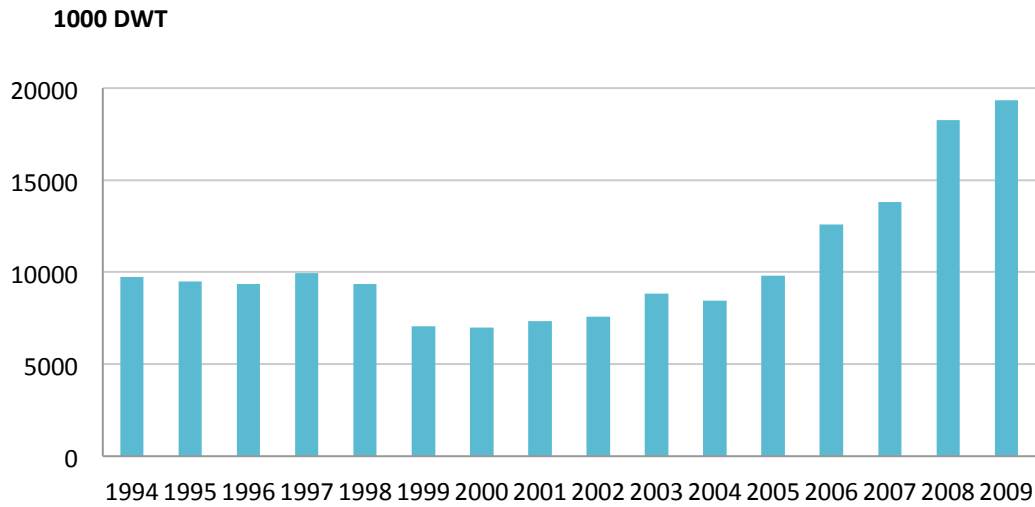


Figure 4-2 Change in the size of Korea's ocean-going ship

Source: Korea Maritime Institute (2011)

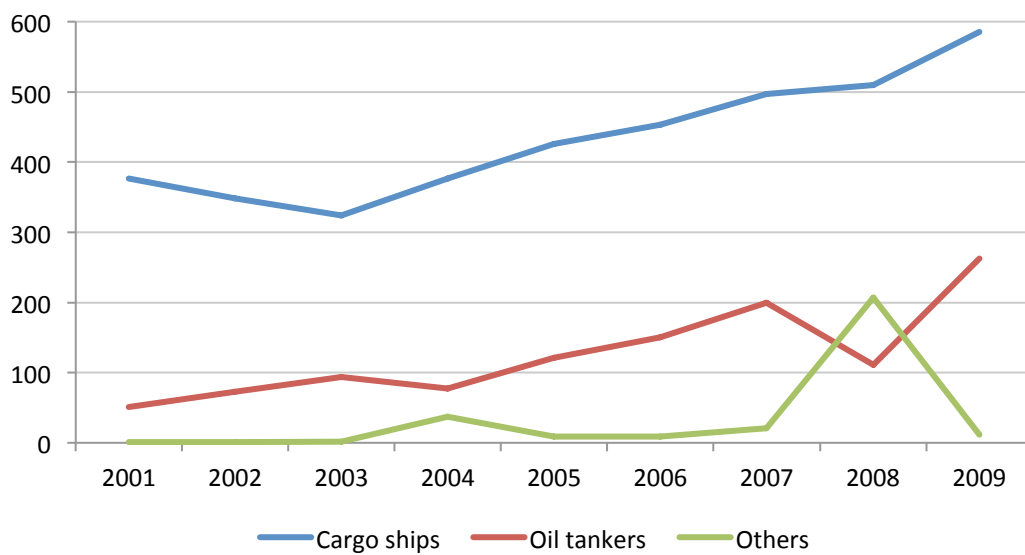


Figure 4-3 Change in numbers of sea-going vessels in Korea

Source: IHS Fairplay (2011)

Most of Korean ship owners recognize reinforcements on ship recycling environment along with Hong Kong Convention. However, they do not carry out the IHM since it requires a lot of expenses to the owners alone in the current system. So they are paying attention to changing in ship recycling regulation and waiting until the Hong Kong Convention comes into force.

4.5 Shipbuilders

In 2010, a working group comprised of representatives from shipbuilders, a ship equipment research institute, a ship inspection agency, and an association of shipbuilders drew up “Guidelines for the preparation of the inventory of hazardous materials on new ships” based on the regulations on the Convention.

According to the guideline, shipbuilders are obliged to carry out initial surveys for the IHM to new ship. Since it is anticipated to be troublesome to collect a number of data since a ship needs a large number of equipment pieces to be built, the shipbuilders can ask ship equipment manufacturers that supply materials and equipment to submit documents containing data on the type and amount of hazardous materials, locations of hazardous materials and methods to remove the hazardous materials. It will reduce the workload to inspect all equipment for the shipbuilders. In addition, the shipbuilders should take measures to reduce or not use hazardous materials as much as possible.

The guideline provides not only a working manual for drawing up the IHM but also the standardized various forms for the IHM, which reduce unnecessary time to prepare the IHM.

4.6 Ship Inspection Agency

In Korea there are two ship inspection agencies, Korean Register of Shipping and Korea Ship Safety Technology Authority, and they will certify the inspection of the IHM. Although the ship builders can survey their new ships and prepare the IHM, in practice Korea Register of Shipping Engineering that is a subsidiary of the Korea Register of Shipping will be expected to conduct all practical surveys onboard.

4.7 Current Regulations on Ship Dismantling

There are four regulations regarding ship recycling industries: Marine Environment Management Act, Ship Safety Act, Public Waters Management Act and Wastes Control Act.

Marine Environment Management Act

Ships regulated by the Marine Environment Management Act are all ships with a gross tonnage above 100, except oil tankers that should be controlled regardless their weight.

A declaration paper¹³ containing a ship recycling plan should be submitted to the Korea Coast Guard seven days before beginning the work. Together with the declaration paper, a paper showing a recycling plan, a scrap yard use permission, a document validating that the right to the ship has been transferred to the scrapping company, and a performance paper of contaminants treatment. The plan should include: 1. A plan how to clean the scrap yard and treat contaminants before dismantling ships; 2. Precautions preparing for accidents generated by contaminant spills during dismantling process; 3. A plan to take emergency measures as accidents regarding contaminants spills take place. The Korea Coast Guard can order a correction if the declaration is not sufficient or the plan is not being implemented.

The scrapyards should equip one working ship above 5 GT with two drainage pumps, ten cutting machines, one crane above 50 tons, and 33 m² of office under the act.

If the ship recycling facility does not submit the declaration paper, around EUR 3,500 will be fined.

¹³ Annex 4 shows a form of “Declaration of Maritime Contamination Prevention Plan on Ship Scrapping”.

Wastes Control Act

Ships accumulate wastes during their life cycle and produce not only recyclable materials, but also various wastes. Especially oil from tanks and asbestos used in old ships are strictly controlled by law as specified wastes.

Table 4-3 Provisions and contents related Wastes Control Act

Related provisions	Contents
Act 2	4. "Specified Wastes" are contaminants, such as waste oil and waste acid, polluting surrounding environment, or hazardous materials harmful to human, determined by a presidential decree.
Enforcement ordinance, attachment table 1. Kind of specified wastes	6. Wastes oil 7. Wastes asbestos
Act 8 (Disposal prohibition of wastes)	1. The wastes should not be dumped at places designated for special purpose by government. 2. The wastes should not be incinerated at places not registered, certified, or permitted by law.
Act 18 (Treatment of industry wastes)	1. Those who produce industrial wastes can treat the wastes at their place by themselves or entrust others who receive a permission to treat the wastes according to Act 25, Section 3, who recycle others' wastes according to Act 46, who construct or operate waste treatment facility according to Act 4 or Act 5, or who are certified maritime wastes disposal work according to Act 70, Section 1, clause 1.

Source: Korea Maritime Institute (2011)

Public Waters Management Act

It is necessary to obtain a permission from a supervisory authority to carry out the scrapping process on the sea (public water).

Ship Safety Act

The certificate for ship scrapping work has been abolished since 1999 as the result of an amendment to the Ship Safety Act. In addition, the related provision was eliminated in an amendment of 2007.

Table 4-4 History and Contents of Ship recycling related provision of Ship Safety Act

Amendments	Contents
Ship Safety Act (11.4.2007)	Elimination of Act 16, Section 3, as an amendment
Ship Safety Act (3.24.2006) Act 16, Section 3 (Ship Rescue)	Those who rescue ships should be issued a certificate by the chief of Korea Coast Guard. However, those who rescue small ships determined by a presidential decree do not need it.
Ship Safety Act (12.17.1997) Act 16, Section 3 (Ship Rescue, etc.)	Those who recycle ships should be issued a certificate by the chief of Korea Coast Guard. However, those who scrap small ships determined by a presidential decree do not need it.

Source: Korea Maritime Institute (2011)

Among the regulations, the most direct regulation on ship recycling is "Marine Environment Management Act". After the ship recycling facility submits a declaration paper with a ship

recycling process plan, the Korea coast guard checks whether the facility carries out the plan submitted at least three times randomly. Especially there is a fine clause related to oil spill accidents. Around EUR 21,000 in case of negligence and EUR 35,000 in case of scienter will be required respectively. In other words, if the scrapper is proved to spill the oil by accident, a fine will be asked, but a lower fine as compared to the case when the scrappers did it on purpose.

There was one oil spill accident in 2011 on the west coast during the process of dragging the ships onto the shore, but it is estimated that such accidents do not occur commonly. In addition, no safety accident has taken place so far, but it is considered that people are affected by toxic gases and injured by sparks regularly since the work requires a lot of oxygen cutting processes.

5 Findings

It is hard to estimate when the Hong Kong Convention comes into force. While the IMO expected its entry into force in 2013 when adopting the Convention in Hong Kong, it is not likely to happen due to the FOCs and a current weak cooperation by Asian scrapping countries. EU anticipates the entry into force in 2020 and the interviewees in Korea gave different expectations, like not earlier than 2015 or 2020.

However, as Europe is strengthening the ship recycling regulations regardless the Hong Kong Convention ship-related industries in the world will also be affected by this development in a number of ways. Korea being responsible for major parts of ship industries is likely to be influenced more than other countries and it is necessary to prepare measures for how to respond in advance.

All the findings below are going to be written based on responses and views of various Korean ship stakeholders; ship recycling facilities, ship owners, ship builders, ship inspection agency, and the Government; expressed in interviews during the thesis work.

5.1 Ship Recycling Facilities

Several problems are discovered in the Korean ship recycling processes. First of all, since most of the ship recycling facilities are poor and do not have own land to work on and lacking most equipment, an increase in the ship recycling costs is inevitable. This also generates difficulties in controlling environment pollution since the equipment cannot be managed properly and the safety wall between the sea and land does not exist.

The safety equipment is also not sufficient and systematic safety education is also not properly carried out to workers. Most workers only wear poor and weak eye protectors and cotton masks and there seems to be high risk that explosion accidents occur due to the oxygen cutting. The oxygen cutting is also able to choke people by toxic gases. It is easily discovered that workers cough a lot and rest and drink much water to compensate sweat flow out of the body during the hot work. Most workers recognize the risks of toxic gases generated during the ship breaking and think they might have some kinds of lung problem.

The recognition regarding environment protection is quite low since most of the facilities are poor. The waste oils are removed before breaking ships, but they do not seem to have any pre-cleaning process of the tanks. In addition, most recycling facilities use the “slipway” shipbreaking method. There are high possibilities of environmental pollution by the hazardous wastes accumulated on the bottom of the sea and on the ground on which they do not spread a protective coat.

Furthermore, the number of experienced and skilled work force has been declining in Korea since young people are not willing to work at the dangerous facilities. Only the workers who were trained in 1970s and 1980s when the Korean ship recycling industry generated good profits are available and they are likely to disappear in the next ten years if proper measures such as an improvement in work conditions and training programs for new workers are not carried out. So it is important to train and secure new work forces.

After the Hong Kong Convention comes into force, the ship recycling facilities will be influenced in various ways. First of all, since the Convention requires the facilities to be environmentally friendly and safe places to work in, the facilities have to prepare safe working environment in ship recycling processes and secure safety measure programs and sufficient protective equipment and enough machinery that would reduce the manual work. In addition,

they have to develop a more specific and concrete a ship recycling plan before new ships to be scrapped come into the facilities.

However, as the facilities comply with the strengthening environmental and safety regulations, the cost to recycle ships is likely to increase, with rental cost being the major part of the full costs. Many Korean recycling facilities rent the land to work from the ship repairing companies. In addition, the Convention and future EU recycling regulation propose that international commercial ships should be recycled at approved environmentally friendly and safe recycling facilities and only some of existing Korean facilities will be able to remain.

Last, with only this declaring obligation, it is difficult to manage the facilities properly. However, since the Hong Kong Convention and future European ship recycling regulation will require a detailed specific Ship Recycling Plan (SRP) and increase duties in ship recycling facilities and Korea is expected to embrace the Convention's regulations into its domestic law, Korean ship recycling facilities are anticipated to carry out much work to comply with the regulations. It would improve the environment and worker's safety, but many ship scrappers especially those who are economically poor are likely to close down.

5.2 Ship Owners

When the Hong Kong Convention comes into force, duties of drawing up, carrying and updating the IHM during the entire lifetime of the ship will be given to ship owners. While the responsibility to make IHM for new ships is given to shipbuilders, the IHM in the existing ships should be prepared by ship owners within five years after the Convention's entry into force. However, approximately 2,000 existing ships in Korea will have trouble not only drawing up but also getting certified by the ship inspection agency within the given five years, since inspectors for the IHM lack in Korea today. In addition, it is difficult to collect data of hazardous materials especially for existing ships in accordance with IHM Part I: Materials contained in ship structure or equipment. Especially old used ships and replaced or/and repaired ships have significant trouble with data collection.

Once the initial survey has been carried out, ships are obliged to do the renewal survey at least every five year and also change-replacement-repair and the final survey will be asked until the end of life of the ships. Those surveys are likely to increase updating and maintenance costs considerably to the owners who operate a number of sea-going merchant ships.

In addition, if some of major ships recycling countries do not ratify the Hong Kong Convention, the scrapping cost will naturally increase because the ship owners are prohibited to send their ships to these non-ratifying countries. In addition, the future EU ship recycling regulation also proposes that European ships are only able to be recycled at approved facilities. It is unknown when Korea ratifies the Convention, but it is expected that as one of the leading shipping countries who operates many international commercial ships and do not allow the use of FOCs, the ratifying process will be carried out rather later than other countries.

Furthermore, the ships without the IHM are likely to be affected in the used ship market after the Convention's entry into force because handing in the IHM to the recycling facilities is necessarily required before the ships to be scrapped are sent into the recycling territory.

It is recommended that since the ship owner is not only beneficiary to the improvement of the ship recycling, the costs that have increased to comply with new regulation have to be shared by all the ship industries. So, cooperation between the industries and a funding system to provide financial aid to cover increased costs are needed to be discussed.

5.3 Shipbuilders

Four shipbuilders based in Korea are ranked among the top ten international shipbuilders in 2012. The shipbuilders recognize the internationally changing ship recycling regulations and prepare to take necessary action to respond to the Hong Kong Convention by preparing the guideline for the IHM. So far, there has not been any request on drawing up the IHM to Korean shipbuilders. However, they expect that the number of ships for which the ship owners want to have IHM will increase in the future.

They need cooperation of ship equipment manufacturers to reduce time to find out amount and location of hazardous materials, but as yet none of these manufacturers seems to be interested in the ship recycling issues until the strict ship recycling regulation affect them formally.

The ships can be designed to be dismantled easily by future ship recyclers, but the design changing process is somewhat difficult and at current shipbuilders are more attentive to build energy-efficient and low carbon ships to reduce global warming.

The shipbuilders think the role of European ship owners who is one of the main customers is very important to improve ship recycling conditions and they would not need to do anything like preparing the IHM and reduce hazardous materials if the owners do not ask and need this because of financial reasons.

5.4 Ship Inspection Agency

A number of inspectors are anticipated to be needed after the Hong Kong Convention enters into force and the new EU regulation is adopted to deal with all the existing ships and their IHMs. The agency also anticipates, like ship owners, that it will take considerable time to draw up all the IHMs for thousands of ships within the given five years due to the lack of expertise who can survey the ships and draw up and certify the IHM.

So far, there are three existing ships, one is Korean and the other two are from Panama that have certified their IHM by the Korea Register of Shipping who surveyed and certified the IHM voluntarily. It took one month for two inspectors to examine each ship and they had to inspect a number of equipment one by one by hand since the ship owners do not have the information of hazardous materials, like where they are located and how much there is. Consequently, it can be expected that considerable human resources to draw up the IHM will be required to deal with the nearly two thousand existing Korean ships after the Hong Kong Convention's entry into force. In addition, it is needed to discuss how to qualify the inspectors for the IHM.

5.5 Government

Korea Coast Guard is the main body that handles Korean ship recycling facilities. It joined the MEPC sessions as one member of the working group consisted of people from shipbuilding and shipping companies, the ship inspection agency, and the Korea Coast Guard when the ship recycling issues are covered. The working group is comprised temporarily when the MEPC sessions are held and cover all the environmental issues generated by the ships. The ship recycling problem is not severe to them yet and they just observe other countries' trends on the problems. It is rare that Korea gives opinions on the ship recycling problems.

In fact, it was found that there is only one person who is in charge of the ship recycling issues in Korea Coast Guard and he was transferred into the school of Korea Coast Guard in July,

which means there is not any person who can handle the issues on the recycling facility spots. It ends its role to receive the declaration paper.

Korea Coast Guard is looking for a responsibility when the Hong Kong Convention comes into force, in cooperation with the ship inspection company. It is expected that it will keep overseeing the pollution problems to the sea as well as to the ground. In order to do that, it sees a necessity to enact a single ship recycling regulation apart from other environmental regulations based on the international regulations of IMO or in Europe.

6 Discussion

Hundreds of sea-going ships are dismantled each year worldwide. At current two thirds or more of these ships are scrapped in developing countries located in South Asia and China. These countries handle 94 percent of the total world ship recycling volume by utilizing domestic cheap labor and weak environmental regulations. These countries usually use a “beaching method” to recycle ships. The ships are located on the expansive mudflats by using very big tidal ranges and pulled up to the beach by large winches. It contains high environmental risks to the sea and the shore. In addition, the workers’ safety and health cannot be guaranteed since the facilities would like to keep low labor costs.

For several past years, international bodies like the Basel Convention, ILO, and IMO have been dealing with the ship recycling problems, but their roles seem to be rather weak to control the ship recycling that is regarded as one of the most dangerous and hazardous industries. Although the Basel Convention “Ban Amendment” does not allow the wastes to be transferred from developed countries to developing countries, this is only binding in case either exporting or importing countries ratify the Ban Amendment and the Amendment comes into force. In other words, European dirty ships can keep on being sent to Asian poor countries. Next, since the ILO shipbreaking guideline is not legally binding, it is also not mandatory to improve worker’s safety for the Asian facilities. Though the facilities have been targeted by NGOs and receiving attention from the international society due to their high risks, they do not follow the guideline because the economical profits are firstly satisfied. Last, IMO adopted the Hong Kong Convention in 2009 to handle finally the ship recycling issues by a strict legally binding regulation. However, the Hong Kong Convention is expected to come into force a little too late, by world’s expertise not earlier than 2015, and thus the Convention cannot control the increasing number of single-hull tankers that will be sent to Asian countries in the next couple of years.

The ships scrapped in Asian countries are mainly transferred from developed countries, including Europe, Japan, North America, and Korea. These developed countries once had a large ship recycling industry, in 1970s to early 1980s, but now it has almost disappeared due to their high labor costs and tightening environmental and safety regulations while at current Korea and Japan are leading shipbuilding countries responsible for half of the world’s shipbuilding and Europe is strong to make complex and higher value ships like cruise ships. The ship recycling industry in the wealthy countries is very small and not likely to be revitalized. In summary, the domestic laws to regulate hazardousness of ship recycling activities are not systematic and severe enough.

However, the countries disposing the unsafe ships to developing countries cannot avoid the responsibilities. As the first actor who recognized the hazardousness of the old ships, Europe drew up the “Green Paper on Better Ship Dismantling” and set up the “EU Strategy for Better Ship Dismantling” in 2007 and 2008 respectively. The recent proposal of ship recycling regulation, published in March 2012, is expected to reduce the future volume of ships scrapped in poor developing countries since the ships can only be recycled in approved environmentally friendly and safe recycling facilities located in Europe and other OECD countries prior to publication of the European List of ship recycling facilities or in the facilities that are included in the European list after publication of the European List.

Europe has a lot of international containership companies but the European ship recycling facilities only accommodate maximum 5% of the ships to be scrapped occurring yearly. Although it is desirable to decrease hazardousness, risks, and various environmental and safety accidents generated in the poor facilities in Asia, it will be a big concern to treat all the

hundreds ships that are planned for scrapping. It is assumed that it could be better to allow ships to be recycled in developing countries in a safe and environmentally friendly way by drawing up the European List as soon as possible. In fact, many Asian countries are living by earnings from the ship recycling business and especially Bangladesh abstain 80-90 percent of steels supplied from the recycled ships for domestic building materials (Maruf Hossain Mohammad Mahmudul Islam, 2006).

Each ship-related industry has to strive for better ship recycling practices. To carry the IHM on both today existing and new ships until sent to the scrap yards can be the first step to show hazardous materials to scrappers. Still many ships do not have the IHM due to a low recognition of the importance of it. The ports are unable to control the ships left to the international waters and many ships can be sold to other countries before sending them to the scrapyards. Besides, many countries allow ships to register in other countries and do not recognize the necessity of the IHM. Last, International Ship Recycling to aid improvement in technologies, equipment and human resources to prevent the pollution generated by the ship recycling process is not functioning properly.

It is found that the main customer to Korean ship builders is Europe and the ship builders will be requested to draw up the IHM as the interest of it increases. It is needed to ask for cooperation of ship equipment-supplying companies to hand in necessary information concerning hazardous materials in the equipment in order to have IHM done smoothly by the ship builders. The role of the ship inspection agency that certifies and verifies the IHM as ship classification society will increase. Yet today expertise to inspect ships for the IHM lacks. More workers will be trained along with the increasing importance of ship recycling.

Yet no request to draw up an IHM for new ships have been sent by European shipping companies to Korean ship builders and only three existing ships went through the inspections to certify the IHM by Korea Register of Shipping. It is assumed that more ships carry an IHM verified by other classification societies like Lloyd's Register, based in UK, who started to issue an independently verified IHM in 2004.

In May 2012, cooperation between Norwegian and Korean entrepreneurs for energy-efficient ships, environmentally friendly designed ships, and ship recycling was discussed. This is regarded as the first meeting between Europeans and Koreans to deal with ship recycling in practice. Yet Korean ship builders are focusing on constructing high-energy efficient ships or low carbon ships, not on developing the IHM and making the ships easy to dismantle.

In Korea, despite the international concerns, recognition of the ship recycling issue seems to be generally low. The responsibility by Korean shipbuilders is left at the same time when the ships built are sent to the European ship owners, which means that the shipbuilders are not responsible for the whole 25 year-lifetime of the ships. So if there is not any request to make the IHM by European ship owners, they do not need to draw it up as well. The ship owners responsible to carry the IHM also do not want to increase the cost by drawing up and updating the IHM through several tests by the ship inspection agency. Thus, they are waiting for the European Parliament and the Council of Ministers adopt the European ship recycling regulation and that the Hong Kong Convention comes into force.

However, Korea still has to prepare and take actions towards changing international ship recycling regulations. Proper protective equipment and safety education programs in the ship recycling facilities have to be urgently required since overall the work conditions are very poor in both environmental and safety aspects. Especially the equipment to treat various wastes including oil has to be required. Since ship recycling work is very risky to do, it is important to

secure enough experienced and well-trained workers. It is necessary to carry out the educational programs to increase the number of new trained workers. In addition, the government could aid the scrapping yards financially by providing land with cheap expenses since many recyclers utilize land that is expensive to rent.

Even though the Hong Kong Convention was adopted, it is expected to take long time for it to come into force. However, it is needed to embrace the regulations of the Convention into domestic law before its entry into force since the Convention will affect considerably ship owners, shipbuilders, ship recyclers, the ship inspection agency and others. It is considered to enact a new law to accept all the regulations into the domestic law.

When the shipbuilders draw up the IHM, it is judged that manufacturers that supply ship equipment to shipbuilders have to provide information on components, contents, and removal methods of a number of hazardous materials and the shipbuilders have to engage them. It can also be considered to standardize paper forms or computing systems for procuring the equipment in order to specify information on the hazardous materials.

For the ship inspection agency, training workers who can handle the IHM is required first of all. In the future, the Korean Register of Shipping will be responsible for issuing the certification of IHM inspection and the KR Engineering Co. will inspect the ships on site. So, it is necessary to prepare the requirements of qualification of IHM inspector.

It is fair to expect ship owners to comply with the Hong Kong Convention for environmentally friendly and safe ship recycling. However, it requires a lot of works to draw up the IHM for all ships within 5 years after the Convention's entry into force. So it is important to share the experience of all the IHM related work process. In addition, it will be required to collect financial aid from not only ship owners and but also other beneficiaries for improved ship recycling. So, the all the industries related to the ship have to have regular meetings to share opinions and cooperate and strive for sustainable ship recycling practices.

While various countermeasures for the upcoming new ship recycling regulations are being discussed, the poor Korean ship recycling facilities are going to be concerned to receive financial aid to be in compliance with the strict regulations that require them to draw up "Ship Recycling Plans" and meet a set of environmental and safety standards in the facilities. It is necessary to spend a lot of money not only purchasing equipment and machineries that they have not had so far to improve working conditions and the surrounding environment but also training workers regarding new regulations. It is urgently required to gather opinions and find ways how to support the facilities by the various stakeholders that are also going to be affected by the new regulations.

The Korean ship owners are the ones that are going to be influenced the most by the new regulation. They have to carry the IHM on their ships but anticipate it will require much costs and it will be nearly impossible to have the IHM ready for all the thousands of ships within five years with the current situation with a lack of IHM training. In addition, since Korea shipping industry is in downturn, it is assumed that it would not like to use money for the new regulation and will instead put pressure on the Government when it is preparing to sign and ratify the Hong Kong Convention.

In fact, the Korean shipbuilders responsible for drawing up the IHM for new ships are likely to respond to the new regulations when ship owners ask them for the IHM. Overall, they seem to have been well ready for the upcoming requests and prepared the standard form of the IHM. To be more efficient, they have to ask the ship equipment manufacturers to send

the information of hazardous materials to reduce time to inspect all the equipment one by one and train people to work with the IHM.

While Korea is preparing for the requirements brought up by international regulations, it may also consider expanding its capacities and abilities of ship recycling by using existing work forces and equipment in the shipbuilding industry. Korea shipbuilding industry has been in downturn due to the competition from the growing Chinese shipbuilding industry and Korean shipbuilders are now more and more focusing on higher value-added industry, such as offshore-related business. Therefore, a lot of machineries and human resources are expected to be at surplus in the near future. Since several European ship owners, such as Danish Maersk and Swedish Stena, are searching for responsible ship recyclers and have already shown that they are willing to pay extra expenses to avoid the beaching recycling method, there is a potential market for new initiatives (Maersk line, 2010; Stena, 2012). The costs for transferring part of the Korean shipbuilding capacity into high-quality ship recycling facilities may well be not only compensated, but a way of securing continued use of the existing infrastructure and securing jobs for the future.

7 Conclusion

This thesis formulated two research questions, namely: 1. How are the Korean ship industries affected by changing international ship recycling regulations, including the European Ship Recycling Regulation, and what kind of problems are going to be met in each of the sectors?; and 2. What kind of countermeasures can be prepared in response to the international regulations? A background to the Korean ship recycling situation was drawn after looking into the international ship recycling conditions and existing ship recycling regulations, including the European Ship Recycling Regulation. Then, problems for Korea related to ship recycling were identified by the literature review and interviews and the countermeasures were formulated based on the findings.

The ship recycling problem has been gathering great attention from the international society for decades due to its highly risky, hazardous and unsafe working procedure. It is easily understood how dangerous it is through a number of pictures, documentaries, statistics, papers, and other materials published all around the world. In center of the problem is the fact that this activity is largely taking place in Asian developing countries while the hundreds of ships sent to these countries are from developed countries that live by the shipping industry. The Basel Convention is not sufficient to prohibit sending ships to Asian countries because importing and exporting nations should ratify the “Ban Amendment” and the ILO shipbreaking guidelines cannot play a significant role since they are not legally binding.

After the Hong Kong Convention was adopted in 2009, it becomes a main concern when it will enter into force. Representatives of the ship industries and various experts all anticipate a different date, but it is a common opinion that the Convention will not come into force earlier than 2015. Even though it takes some time to see a role for the Convention, it is obvious that it will be a strong and powerful regulation to improve the current ship recycling practices. In addition, a new European ship recycling regulation is waiting for its adoption by the European Parliament and the Council of Ministers, so the time to handle the ship recycling issues has been moved up.

So far, the ship owners and recyclers have hesitated to act according to the Hong Kong Convention mainly due to economic reasons. They do not want to increase the expenses to carry out the IHM and convert their facilities into environmentally friendly and safe working places. This is how the industries exist in the competitive society and only strict regulations aimed at making a better world to live in will change their attitudes.

As European shipping industry is going to be regulated by the future Ship Recycling Regulation and it is one of the main customers of the Korean shipbuilders, they can influence the shipbuilders to make better designed ships for easy dismantling at the end of their life and reduce hazardous wastes and materials in the ships. The Korean ship inspection agency will increase its role for the IHM and other necessary work. Shipbuilders and ship owners, ship recyclers, and the Government are going to strive for complying with the international ship recycling regulation.

The table below arranges findings from the literature review and interviews regarding how each Korea ship industries are going to be affected by the new ship recycling regulations in the Hong Kong Convention and the European Ship Recycling Regulation. It also shows the problems discovered in current ship recycling and several countermeasures to deal with them.

Figure 7-1 Possible various influences, problems, and countermeasures by new ship recycling regulations in Korean ship industries

Ship recycling facilities	
Influences	<ol style="list-style-type: none"> To prepare Ship Recycling Plans (SRP) To meet a set of environmental and safety standards
Problems	<ol style="list-style-type: none"> Lack of ship recycling facilities Insufficient safety actions and equipment Insufficient environment protection and equipment Lack of ship recycling workers
Countermeasures	<ol style="list-style-type: none"> To give financial support to the recyclers To secure protective equipment and machineries to reduce manual works To make sure that environmental accidents do not occur by developing accurate and concrete working manuals To train new workers through sufficient safety educational programs and improve work conditions in the facilities
Ship owners	
Influences	<ol style="list-style-type: none"> To prepare the Inventory of Hazardous Materials for all ship they possess To carry out several surveys for the Inventory of Hazardous Materials; initial survey, renewal survey, change-replacement-repair survey and the final survey
Problems	<ol style="list-style-type: none"> To increase expenses to carry out surveys and maintain the Inventory of Hazardous Materials during the whole life time of ship To increase cost when scrapping ships To have difficulties when selling the ships that do not carry the Inventory of Hazardous Materials both to used-ship buyers and ship recyclers To have troubles to draw up the Inventory of Hazardous Materials to all 2000 Korean existing ships within 5 years
Countermeasures	<ol style="list-style-type: none"> Prepare a Ship Recycling Policy Inventories of Hazardous Materials for new builds Inventories of Hazardous Materials for existing ships
Shipbuilders	
Influences	<ol style="list-style-type: none"> To draw up the Inventory of Hazardous Materials for new ships To be expected to increase requirements on the Inventory of Hazardous Materials by European owners who are going to be regulated by the European Ship Recycling Regulation
Problems	<ol style="list-style-type: none"> To have difficulties to inspect a number of equipments for initial survey for new ship Lack of interest in improvement of ship recycling
Countermeasures	<ol style="list-style-type: none"> To ask ship equipment manufacturers to provide them with necessary and useful information on hazardous materials in the equipment To reduce or replace hazardous materials To make the ship easy to dismantle. To have computing systems to input information on the hazardous materials
Ship inspection agency	
Influences	<ol style="list-style-type: none"> To certify and verify the Inventory of Hazardous Materials
Problems	<ol style="list-style-type: none"> Lack of inspectors who can survey the ships Lack of experience to draw up the Inventory of Hazardous Materials
Countermeasures	<ol style="list-style-type: none"> To train new inspectors for future increasing requirements of the Inventory of Hazardous Materials To prepare qualifying requirements to select inspectors for the inventory of Hazardous materials
Government	
Influences	<ol style="list-style-type: none"> To realize the importance to deal with international ship recycling issues
Problems	<ol style="list-style-type: none"> Weak domestic ship recycling regulation Lack of recognition Lack of supporting ship recycling industry Lack of financial support to support ship recycling related activities
Countermeasures	<ol style="list-style-type: none"> To embrace international regulations into domestic law To enact single ship recycling regulation separating from other marine environmental regulations

The figure below shows how the Korean ship recycling industry has to be changed under the national ship recycling strategy based on international ship recycling regulations. All the ship-related industries are required to cooperate with one another by sharing opinions and information for better ship recycling. In order to do it, it is recommended to follow the European steps to draw up the Green Paper to realize the importance of handling the ship recycling issues and set the strategies to encompass all the ship industries to support and offer a holistic approach.

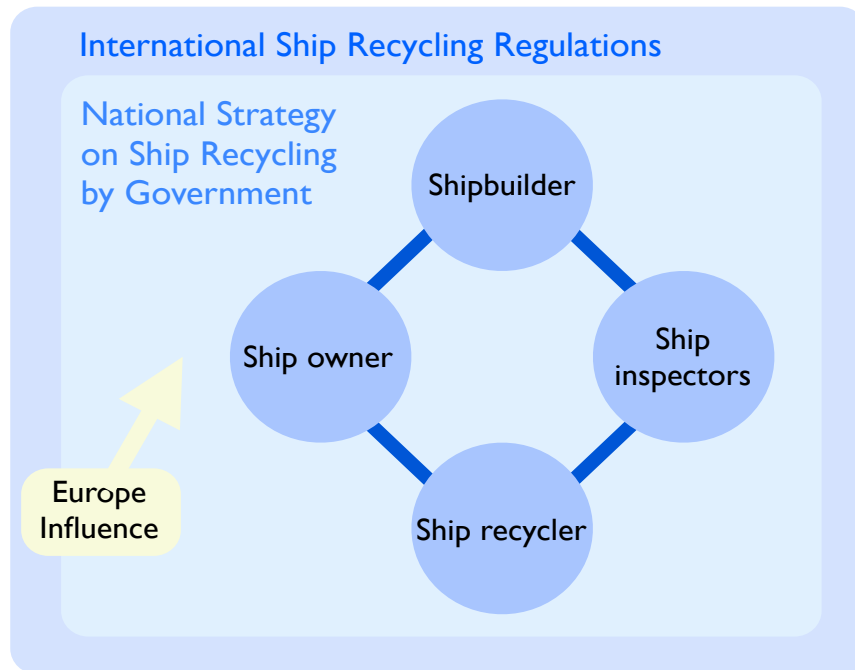


Figure 7-2 Recommendation of future Korean ship recycling industry

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Interviews and personal communications

Daeyang Ship Recycling Facility	A personal meeting planned
Department of Coast Guard Studies, Korea Maritime University	A personal meeting planned and e-mail communication
Korea Coast Guard	A personal meeting planned and e-mail communication
Korea Register of Shipping	Personal meetings planned and e-mail communication
Korea Ship Equipment Research Institution	Personal meetings planned and e-mail communication
Shinhan Ship Recycling Facility	A personal meeting planned
The Korea Shipbuilder Association	A personal meeting planned
The Korea Shipping Association	Communication over the phone

* Further details are available upon request.

Appendix 1 International demolition of ships of 300 GT and over by types

Year	Tankers		Bulk Carriers		Container Ships		General Cargo Ships		Passenger Ships		Total	
	No.	1,000DWT	No.	1,000DWT	No.	1,000DWT	No.	1,000DWT	No.	1,000DWT	No.	1,000DWT
1985	307	27413	309	12400	25	324	146	7386	26	63	1713	47586
1986	243	13159	384	15733	32	541	888	6654	29	77	1576	36164
1987	153	7422	192	9531	23	369	698	4604	28	80	1094	22005
1988	129	3692	80	2636	8	52	564	3468	31	60	812	9908
1989	99	3768	33	1012	9	121	342	1609	29	79	512	6589
1990	64	1199	43	2122	4	37	351	1909	17	38	479	5305
1991	71	3488	69	2989	2	28	284	1842	19	42	445	8389
1992	155	10718	106	6415	8	98	322	2513	12	31	603	19775
1993	157	12110	78	4734	9	153	290	2230	13	31	547	19258
1994	151	14267	116	7740	4	51	317	2529	15	32	603	24619
1995	117	9997	68	3892	8	177	280	2077	18	32	491	16175
1996	120	7878	164	10205	20	403	314	2485	22	73	640	21043
1997	107	3729	156	7332	22	426	367	3436	23	63	675	14986
1998	108	6019	276	13845	59	1599	420	3676	20	63	883	25202
1999	129	14028	224	10631	46	892	353	3252	12	22	764	28825
2000	178	16237	133	5272	11	206	370	3396	17	39	709	25150
2001	146	14036	181	7757	28	485	380	4140	34	76	769	26494
2002	214	20874	161	7483	42	908	277	3308	18	31	712	32605
2003	336	20736	154	6640	49	1011	518	4114	75	174	1132	32675
2004	253	10199	58	2071	15	221	326	1767	80	170	732	14429
2005	199	7218	49	1736	6	47	185	1087	57	145	496	10233
2006	152	3948	64	2814	19	457	208	1243	50	73	493	8535
2007	180	4668	35	921	24	442	191	1140	32	51	462	7223
2008	202	5515	76	3340	38	980	283	1535	55	83	654	11453
2009	213	8882	286	11781	194	5666	548	6171	34	77	1275	32576
2010	369	14580	148	6425	99	2587	656	5045	72	157	1344	28794

Source: ISL, Shipping Statistics and Market Review

Appendix 2 Controls of Hazardous materials listed in Appendix 1 of the Hong Kong Convention

Hazardous Material	Definitions	Control measures
Asbestos	Materials containing asbestos	For all ships, new installation of materials which contain asbestos shall be prohibited.
Ozone-depleting substances	<p>Ozone-depleting substances means controlled substances defined in paragraph 4 of article 1 of the Montreal Protocol on Substances that Deplete the Ozone Layer, 1987, listed in Annexes A,B,C or E to the said Protocol in force at the time of application or interpretation of this Annex.</p> <p>Ozone-depleting substances that may be found on board ship include, but are not limited to:</p> <p>Halon 1211 Bromochlorodifluoromethane Halon 1301 Bromotrifluoromethane Halon 2402 1,2-Dibromo-1,1,2,2-tetrafluoroethane (also known as Halon 114B2) CFC-11 Trichlorofluoromethane CFC-12 Dichlorodifluoromethane CFC-113 1,1,2-Trichloro-1,2,2-trifluoroethane CFC-114 1,2-Dichloro-1,1,2,2-tetrafluoroethane CFC-115 Chloropentafluoroethane</p>	New installations which contain ozone-depleting substances shall be prohibited on all ships, except that new installations containing hydrochlorofluorocarbons (HCFCs) are permitted until 1 January 2020.
Polychlorinated biphenyls (PCB)	“Polychlorinated biphenyls” means aromatic compounds formed in such a manner that the hydrogen atoms on the biphenyl molecule (two benzene rings bonded together by a single carbon-carbon bond) may be replaced by up to ten chlorine atoms	For all ships, new installation of materials which contain Polychlorinated biphenyls shall be prohibited.
Anti-fouling compounds and systems	Anti-fouling compounds and systems regulated under Annex I to the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (AFS Convention) in force at the time of application or interpretation of this Annex.	<p>1. No ship may apply anti-fouling systems containing organotin compounds as a biocide or any other anti-fouling system whose application or use is prohibited by the AFS Convention.</p> <p>2. No new ships or new installations on ships shall apply or employ anti-fouling compounds or systems in a manner inconsistent with the AFS Convention.</p>

Appendix 3 Minimum list of items for the inventory of hazardous materials listed in Appendix 2 of the Hong Kong Convention

Any Hazardous Materials listed in Appendix 1
Cadmium and Cadmium Compounds
Hexavalent Chromium and Hexavalent Chromium Compounds
Lead and Lead Compounds
Mercury and mercury Compounds
Polybrominated Biphenyl (PBBs)
Polybrominated Diphenyl Ethers (PBDEs)
Polychlorinated Naphthalenes (more than 3 chlorine atoms)
Radioactive Substances
Certain Shortchain Chlorinated Paraffins (Alkanes, C10-C13, chloro)

