Abstract

The recycling of end-of-life vessels has been identified as a key economic activity for sustainable development. A new engineering philosophy targeting sustainable development of maritime industries named 'designed for ship recycling' has been identified, formulated and presented. A new model for ship lifecycle has been proposed by adding few stages to the traditional lifecycle after analyzing their critical role in accomplishing clean and safe end of life dismantling of ships. Recently Bangladesh is dominating global ship breaking. The economic benefits of ship breaking& recycling through job creation and fulfilling the domestic demand for recycled steel and others things must be considered. Evolution of the industry toward a sustainable system can be aided through reasonable and enforceable legislative and judicial action that takes a balanced approach, but does not diminish the value of coastal conservation. 2009 Hong Kong International Convention on the Safe and Environmentally Sound Recycling of Ships' establishes control and enforcement instruments related to ship recycling. The object of this paper is to discuss the current situation of ship breaking & recycling in Bangladesh and give some proposals to overcome the detrimental effects on environment and human life due to ship recycling.

Key words : Standard Ship Breaking, Sustainable Recycling, Competitiveness and Profitability ,Environmental consequence.

Acknowledgement

I am starting by the name of Almighty Allah, the most gracious and most merciful. I am always blessed by the benediction of Almighty at every phase of my life. All praises be to Him. Though this little space is not enough to praise even the little most part of His kind. I express my immense gratitude to Him for enabling me successfully to complete my thesis work.

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Introduction :

Everything has conclusion. The ship sailing on seven seas or coastal regions need to be scrapped and dismantled for the safety of the environment. Again, the environment can be infected due to dismantling the scrap ship in improper way. Bangladesh is one of the leading countries for the context of ship breaking. So, it is a concerned issue for the government to avoid environment pollution by taking necessary steps. Different national and international bodies are concerned of the safe and sustainable ship recycling by making some rules and regulations on this matter. National regulations for ship recycling ,2011 and Hong Kong international convention for the safe and sustainable ship recycling, 2009 gave a pathway to make this industry green and sustainable. The study focuses on possible way to make green ship recycling practice with the adaptation of national and international regulations.

1.1 Background of The Study:

Initially, the ship breaking activities carried out at industrialized countries such as United Kingdom, United states of America and Japan. The ships being dismantled were damaged at second world war. Gradually the industry shifted to Spain, Turkey due to labor safety rules and environment protection laws. In 1970, the industry started shifting towards Asian countries like China, Taiwan, South Korea. Even in the middle of 1980, these three countries did one-third ship breaking business in the world. Due to the demand of scrap steel, China and Taiwan took the chance of the world ship breaking industry.

Economy grew up and the labor cost increased. These affected the ship breaking industry and shifted to the highly populated countries. Luckily Bangladesh is having the facilitation to have geographical position. Bangladesh along with India and Pakistan took the position of world ship breaking leading countries. The industry flourished in the Indian sub- continent in the last three and half decades. The labor cost in India, Pakistan and Bangladesh is less comparing to other developing countries. It helps the stake holders to go forward for ship breaking in these coastal regions.

Many studies have been completed on the prospects and challenges of ship recycling industry in Bangladesh. The ship recycling industry gradually moved from developed countries to developing countries. This industry started its journey at early 1960. In 1960, after a severe cyclone, the Greek ship MV ALPINE was stranded on the shores of Sitakunda, Chattogram. It could not be re-floated and so remained there for several years. In 1965, Chittagong Steel House bought the ship and took years to scrap the vessel. The work made a pathway to this industry in Bangladesh.

During Bangladesh liberation war, a Pakistani ship AL ABBAS was attacked by bombing. Later, the ship was brought to the Faujdarhat seashore. A local company, Karnafully Metal Works Ltd bought it for dismantling in 1974 and started unofficial introduction to ship breaking in the country.

Fig: Chittagong Ship breaking yard (Stephane M. Grueso and Javier Gomez Serrano, 2008)

The industry grew steadily through the 1980. The country stood at 2nd position in the world by tonnage scrapped in 1990. In 2008, there were 26 ship breaking yards in the Bangladesh and gradually the number was increased due to profitability in this industry. From 2004 to 2008, the area was the largest ship-breaking yard in the world. However, by 2012 it had dropped from half to a fifth of worldwide ship breaking.

Day by day the industry is going to be flourished with the patriation of the government. The stakeholders are getting encouraged to invest more in this side. The main reason behind this progress of this industry was low cost of labor comparing to other developing nation. Before 2006, the government didn't give emphasis on the environment pollution due to this activity at beach area. Different frame works on the protection of environment have been carried out at both national and international level and praised by the department of environment, Bangladesh. Later, Ministry of Industry proposed some guidelines to minimize the loss of the environment. On the other hand, due to ship recycling process at substandard way took many lives and caused human injury. The people working in ship breaking are unskilled and not getting proper training prior to starting this task. So it's a great demand for the favor of labor and considering the protection of environment, the possible way to green ship recycling practice must be introduced in Bangladesh. This study focuses on the possible way to do safe and sustainable recycling practice with the aid of national and international guidelines.

1.2 Statement of Research Problem:

The main underlying problems of green ship recycling are safety issues as well as environmental hazard. Standard of the labor skill needs to be evaluated with this risky job in maritime industry such as ship breaking. There is no program of training for personal safety and work safety for the workers which lead this work as poor practice.

Poor practice of present shipbreaking industry occurs huge environmental pollution in the coastal area of Bangladesh. For example, ship's hull is cut generally from forward to aft end slice by slice. While slicing the ship, little care is taken about the contained inside the double bottom or pipe. This tends to release bilge, ballast water into the coastal zone. Sometimes, the slice is pulled near to the yard which causes heavy pollution of sea water and beach soil by poisonous paint.

The ship recycling industries of Bangladesh has adopted a limited concern for the environmental protection. Sound management of asbestos, PCBs, ODS, heavy metals etc. is virtually nonexistent. Due to lack of appropriate procedure and trained worker, asbestos containing material causes atmospheric pollution by forming carcinogenic powder. Practice of stripping the electrical cables off their insulation by burning is another source of environmental pollution as it produces highly toxic gases such as dioxins, polychromatic hydrocarbons, etc. Disassembling of air conditioning and refrigeration systems can also result in the release of chloro-floro carbon series chemicals that are hazardous to the ozone layer. Some shipboard fire extinguishing systems is also the source of such gases. Engine, pumps, compressors, motors etc. which contain oils, oily substance are stored in open space and thus soil is contaminated due to mixing of oil with soil. Considering all these facts, a distinct and well-balanced policy is necessary for sustainable ship breaking activities.

In recent years Bangladesh has focused mainly on the economic advantages of ship breaking yard but didn't notice its impact on environment. Although, the basic construction material of ocean going ships is harmless structural and non-structural steel, but ship dismantling activities may generate lots of other materials like non-ferrous metallic materials, glass and wood, polymeric and composite materials, sludge water, oil, undifferentiated materials as well as dangerous solid substances such as mineral wool like asbestos. So, for a risk free, environmental friendly, energy conserving and economical ship recycling process comprehensive knowledge of the materials, regarding quality, quantity and location onboard is very important.

Poor practice of present shipbreaking industry generates huge environmental pollution in the coastal area of Bangladesh. For example, cutting operation is generally advanced from forward to aft end slice by slice. While slicing the ship, little care is taken about the contained inside the double bottom or pipe. This action paves the way to release bilge, ballast water into the sea. Sometimes, the slice is pulled near to the yard for further cutting. During pulling/dragging, poisonous paint such as Tribtylin (TBT) causes heavy pollution of sea water and beach soil.

The ship recycling industries of Bangladesh has adopted a limited concern for the

environmental protection. Sound management of asbestos, PCBs, ODS, heavy metals etc. is virtually nonexistent. Due to lack of appropriate procedure and trained worker, asbestos containing material causes atmospheric pollution by forming carcinogenic powder. Practice of stripping the electrical cables off their insulation by burning is another source of environmental pollution as it produces highly toxic gases such as dioxins, polychromatic hydrocarbons, etc. Disassembling of air conditioning and refrigeration systems can also result in the release of chloro-floro carbon series chemicals that are hazardous to the ozone layer. Some shipboard fire extinguishing systems is also the source of such gases. Engine, pumps, compressors, motors etc. which contain oils, oily substance are stored in open space and thus soil is contaminated due to mixing of oil with soil. Considering all these facts, a distinct and well-balanced policy is necessary for sustainable ship breaking activities.

1.3 Objective of The Study

The goal of the study is to express an overview of the present ship breaking activities and find out the possible pathway to mitigate the drawback of this industry for the purpose of safe and sustainable ship recycling. This will help to find out the possible method from the substandard ship recycling to the standard recycling practice. An assessment about strength, weakness, opportunity, and threat of the industries in global perspective has been expressed and recommendations for sustainable development have been outlined. Thus, underlying problems to way forward can be overcome with the adaptation of national and international regulations. The challenges of this industry will be turned into opportunity.

objective of the studies are:

- Highlight the adverse effects of Substandard ship breaking.
- To get a clear picture of ship breaking industry.
- Enhance the development of safe and environmentally sound ship recycling.
- To review the existing policies and national & international regulations to manage the ship breaking industries in Bangladesh.
- To find out the best possible way to mitigate the setbacks of substandard practice to sustainable recycling.
- To draw out potential measures for hazard analysis and waste recovery.
- Addressing and implementation of the Hong Kong convention.

1.4 Significance of The Study:

The significance of the study is huge. It will pave the way to hassle-free practice which will keep the environment safe from pollutants and give a sound life to the workers. The study focuses on the standard ship breaking which will cover the complete procedure of ship breaking with the guidelines of national and international regulations. As Ministry of Industry declared it as industry, the government apex court ordered a regulation on ship breaking and recycling in 2012. The national act for ship breaking and recycling has partly fulfilled the demand of environmentalist, but the issue of workers safety has been ignored at a great context. The standard design, preplanning, co-operational management, and enforcement of laws may create a great solution to this flourished industry.

This method will reduce the amount of waste and keep the waste materials from shipbreaking out of the beaches, reducing its impact on the environment. The accident and hazards can be minimized at a great context by implementing proper method. That' why we can say that the dignity of green ship recycling is remarkable and will make the path to run forward maintaining all the aspects at national and international level.

1.5 Scope of The Study:

The scope of this study covered time boundary, space boundary and content boundary of the research with rational justification.

In time boundary, this study covered the period from 2006 to 2020. This period was considered ideal as it is the best time for the country to develop the concept of ship breaking industry. In 2006 ship breaking industry gained recognition under the ministry of industry. The stake holders related to ship breaking industry faced some challenges due to the awareness of environmentalist. Even in 2010 the ship breaking industry was stopped for time being.

For this study, in space boundary the attention is on the skill and knowledge of the labors and others related to ship breaking industry. It also focuses on the management and supervision activities while ship dismantling is being carried out. Ship breaking industries in Bangladesh is concentrated in Bhatiary to Barwalia Upazilla (an Administrative unit of Bangladesh) of Sitakunda in Chittagong district. The industry is situated at the shore of Bay of Bengal, at the western side of Dhaka-Chittagong Highway. The favorable geographical location (22°37'99" N latitude and 91°33'05" E longitude) and curved shape of the Bay of Bengal has fostered the establishment and flourishing of ship breaking activities.

In the content boundary, the attention is on the Ministry of industry, department of environment, orders by Apex court, International Maritime Organization regarding sustainable ship recycling.

1.6 Research Methodology:

This is basically a qualitative type of thesis. The study is conducted on the base of secondary sources of data. Secondary data were collected and analyzed included different journal articles, newspapers, magazines, books, Department of Environment data, NGO shipping platform, TV reports and documentaries related to ship breaking and sea water pollution.

To identify the existing working condition, physical infrastructure and management practice have been observed to understand real life scenario. Since a good database on such industry was not available, data was collected from TV reports, journals regarding ship breaking to recycling activities, seminars arranged by Ministry of industry & Department of environment related to environment awareness and challenges to purchaser in ship breaking.

Chapter-2: Literature Review

2.1 Conceptual Discourse

When commodities cease to be fit for their purpose, it is natural to disappear of them. It regards to the ship. Everything has an end for its own purpose. The ships sailing on seven seas or local bay are being dismantled as making the end of the vessel. But some ships came to end of its service life being a museum or others. Behind ship scrapping there is having some reasons. In the world there are having 50000 ships sailing on the seas. The number can be very due to building of new ships and scrapping of old ships. The ship broker pays value for a scrap ship considering revenue, cost, and profit. A chart for sample ship in the context of revenue, costs and profit is given below: -

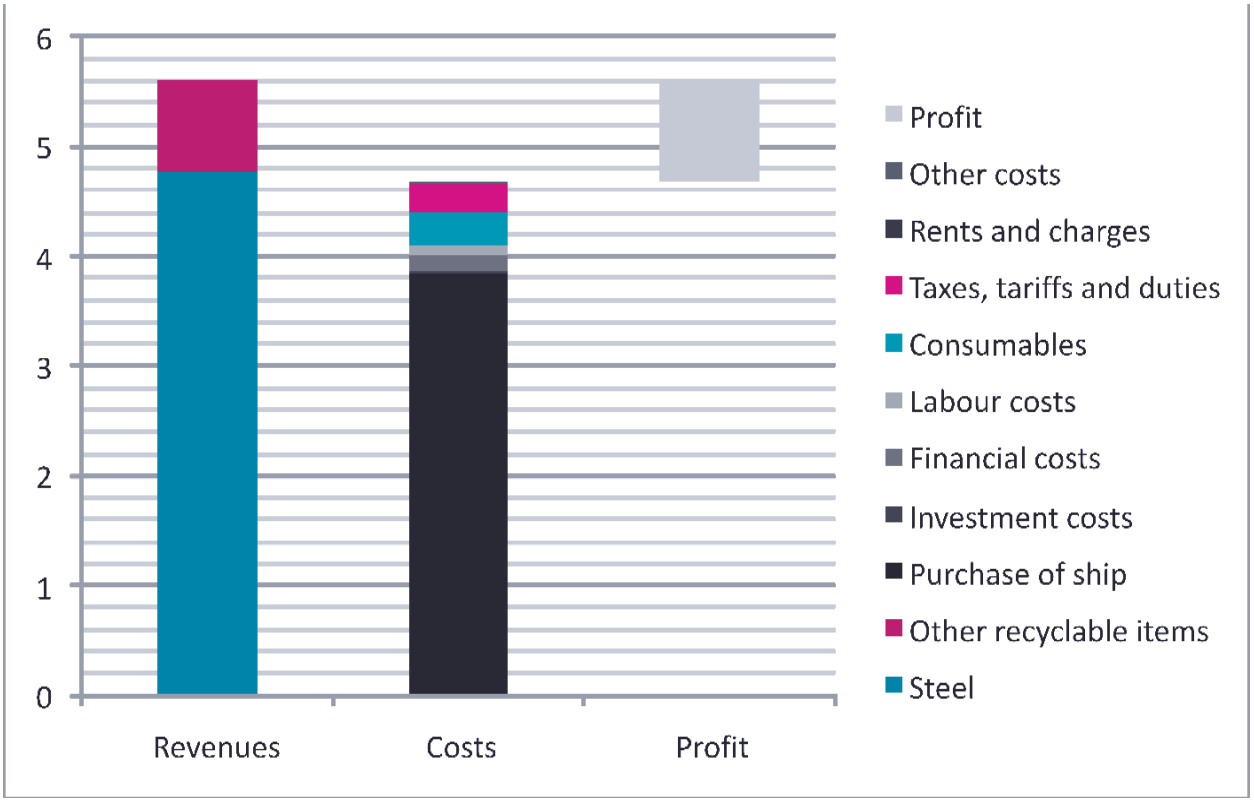

Figure: Revenue, costs, and profits for a sample ship in Bangladesh, mid 2010.

The ship owners decide to send the ship to scrap when the operating costs exceed the revenue. So, freight rate in the world market is having the greatest consequences in making the decision to scrap the vessels. The lifetime of the ship is normally 25 to 30 years. But it also varies due to the freight rate in the world shipping market. In 2007, the report declared that the ships got the service time for 32.5 years for the excellent freight rate. The regulations on the moto of safer and environment friendly shipping cause some ships of certain design to be scrapped. Such as the single hull tanker ships have been sent for scrapping within 2015 due to the ongoing phase out of single hull tankers. Rather old design ship costs more in operating which lose the attention of ship owner and are scrapped at suitable time.

In 1999 Mr. Ataur Rahman and A Z M Tabarukullah wrote a report entitled 'Ship Breaking Industry of Bangladesh'. In this report they mentioned that there was no arrangement for the safety of labour. No lifting process was available here in shipbreaking yards to load and move the iron pieces. The whole risky works were done by the unskilled labour of the industry. Besides, there was no system to provide anything for eye protection, uniform, glove and boots. It was also mentioned in the report that without making the ship gas free, the ships were beached to be scrapped. As a result it becomes a great cause for the sea pollution and a threat to the local environment.

A dissertation published by Capt Kazi ABM Shameem in 2012 named The Role of the shipbreaking industry in Bangladesh and its future with special emphasis on capacity building through Education and Training. He focuses on the influencing factors for driving and holding its position in south Asia particularly in Bangladesh. The shipping & demolition market dynamics analyzed with future trend of the industry. It also focuses on the occupational health and safety issues involve in this industry and how this has been

addressed by the government of Bangladesh. The transition from past practices towards green recycling is demonstrated by examining the drastic actions taken by the competent authority and find out the formation of new rule and its application with Education and Training of workers for the development of ship breaking industries.

A report published by Panini & Mustakim named Impacts of Ship Breaking Industries on Environment and Socio-economic Condition of Bangladesh. The main objective of this paper was to identify the environmental and socio economic impacts of ship breaking industries of this region and to develop an environment friendly plan for a sustainable ship breaking industry for this region. In this study not only the secondary data sources but also the primary data sources through focus group questionnaire survey and laboratory test have been conducted for data collection and analysis. A comparative analysis about the legislative measures has been developed also among Bangladesh and India in accordance with Hong Kong Convention. The socio economic conditions of the workers and the yard are found not satisfactorily and the laboratory result of the soil and water of the yard also supported these findings. But surprisingly majority of the workers and people related to this industry believe beyond all these bad impacts, this industry will flourish and their economic situation will improve.

Another report published by YPSA in 2005 named "Ship Breaking Activities and its Impact on the Coastal Zone of Chittagong, Bangladesh: Towards Sustainable Management" presents national & global status, history, hazardous & toxic substances involved with ship breaking activities, impacts on aquatic biodiversity, human health & other resources. The report publicize that the ship breaking activities contaminate the coastal soil and sea water environment and thus impair ecological settings. The problem is mainly associated with the discharge of ammonia, burned oil spillage, floatable grease balls and metal rust (iron) and various other disposable refuse materials together with high turbidityof sea water.

Another report published by Proffesor Shahadat and Sharifuzzaman ,2016" **Environmental impact of ship recycling industry in Bangladesh** .This report comprises two Parts: Part 1 describes the purpose and approach taken to assessing the environmental conditions of the ship recycling area at Sitakunda, Chittagong, Bangladesh in order to provide a baseline understanding of the environmental factors affecting this area. Part 2 describes in some more detail an assessment of the environmental impact of ship recycling in the form of an Environmental Impact Analysis.

In recent years ship breaking industry shifted to the Asian countries while disappearing this activity in western countries. The stringent labor safety rules and strict environment policy led the movement to south Asian countries like Bangladesh, Pakistan, India etc. there are having four reasons for the movement of shipping industry to the Asian countries. Firstly, the strict regulations of labor safety and compliance of hard environment protection laws lose the attention of the stakeholders of industrialized countries for scrapping the old vessels. Secondly the availability of the labours in low cost makes the ship broker profitable which make sense to choose the vessel scraped here. Thirdly the shores of these countries found idle

for scraping the vessel and high tides make it possible to drive the ships straight up on the beaches. Thus, avoiding the need of docks. Finally, the national demand for scrap steel for re-rolling or reusing the materials found on board ship increase the attention of ship broker for breaking ship confidently.

The ship breaking activities should be in sound and environment friendly manner but the reality in Asian countries is far away from it. Gradually, the size of shipping industry has advanced over the years in the whole world as well as in Bangladesh. The international and local NGOs have raised issues concerning the management of dangerous materials and work accidents since the 1990s. The IMO keeps overall accountabilities in the coordination of ship recycling problems and observance throughout ship coming up with, building and operation.

ILO conventions influence operating conditions and employee rights. Sawyer (2002) declared that ship breaking countries are underneath an obligation to ensure standards for employees in the yard like the right to create trade unions, routine health problems, etc.

The main underlying problems regarding ship breaking is on management of the hazardous materials contained in end-of-life vessels. The vessel sent for scrapping in the yard carry hazardous materials which are dangerous to human health as well as environment. Building of ships 25 to 30 years ago, many hazardous materials installed on board ship may be banned to some regulations in this modern era and carried on ship to scrapping. Among other things, the following hazardous materials may be found in a ship:

Asbestos – used for insulation and surfacing material which may cause a chronic inflammatory condition called asbestosis.

Polychlorinated biphenyls (PCBs) - found in for instance paint, cable insulation and transformers.

Lead - found in batteries, paints, and cables. It may affect the nervous system and impair muscle coordination.

Radioactive material - present on board a ship in liquid level indicators, smoke detectors or emergency signs and may cause severe types of cancer and/or damage to genetic material endangering future generations.

Ballast tank sediments - constitute a large number of organisms including viruses and bacteria that may be a threat to both human health and to the environment. The discharge of ballast water sediments has previously been connected to the outbreak of cholera epidemics (Peru, 1991).

Ozone-depleting substances - are being phased out for uses onboard, particularly for refrigeration and fire extinguishing. However, ODS used as blowing agents within the formation of foam for insulation are structurally embedded in many ships, and therefore the waste, which must be designated as hazardous, is voluminous.

Polyvinyl Chloride (PVC) - Among other pollutants exposed when breaking a ship, Sulfuric acid, Radioactive materials, Paint and preservative coatings, Bilge water, Polychlorinated

Biphenyl Compounds (PCBs) are noteworthy most of which causes respiratory problems and nervous attack.

Paints and other coatings - often contain high levels of lead, TBT, and frequently chromates, cadmium, and PCBs When plates are cut and re-rolled, these chemicals are released into the atmosphere and cause a great threat to environment.

TBT (Tributyltin) - An organometallic substance that may have effects at very low concentrations – sub-nanogram quantities per liter and considered to be one among the serious toxic compounds in the aquatic environment.

Chromium - contained in some chrome-based chemicals (chromates) which can cause eczema and respiratory disease in people exposed to dusts and fumes, including cancer of the lung.

Bilge oil -The machineries produce bilges which are the results of oil leakage. Each scrapped ship holds near about 2 to 3 tons bilge oil.

Ballast water - Ballast water discharges by ships can have a negative impact on the marine environment. The discharge of ballast water and sediments by ships is governed globally under the Ballast Water Management Convention since its entry into force in September 2017.

A chart of environment pollution related to the ipact of ship breaking comparing to other reasons is given below:-

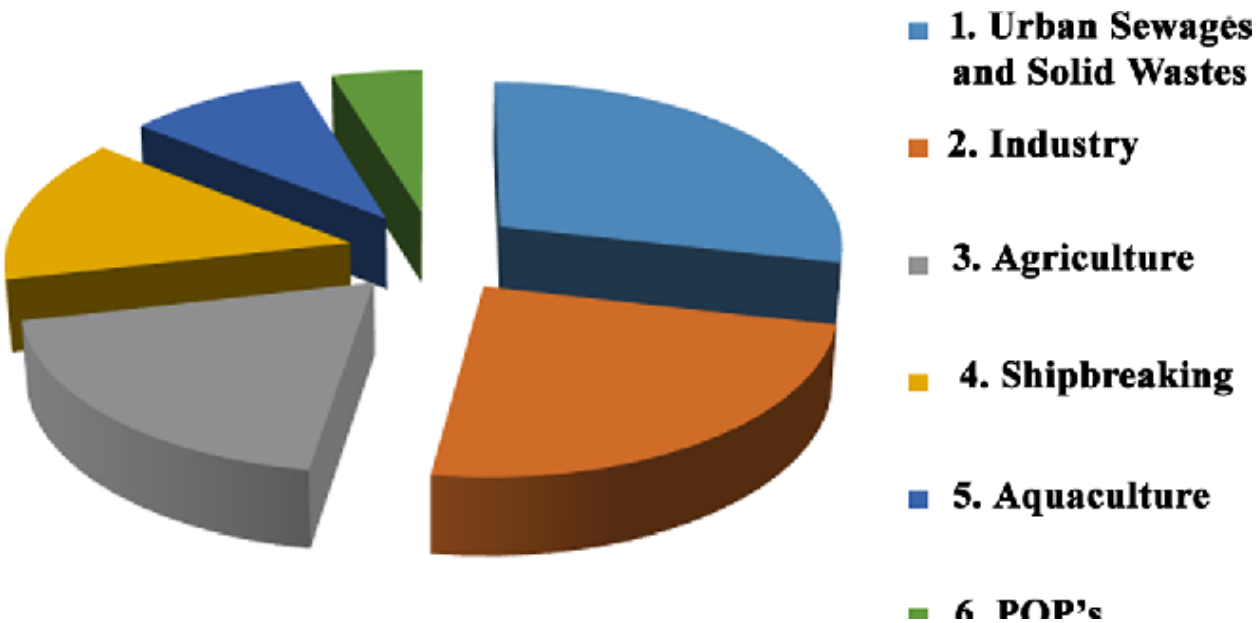

Figure: The impact of various activities on the environment.

So it has been clearly observed that the hazardous materials released at the time of ship breaking are causing huge impact on the environment as well as the animal diversity. Ecological biosystem can be changed due to the prolong substandard ship breaking activities in coastal areas. For the betterment of environment as well as animal biodiversity, Ship recycling must be done in friendly manner with the compliance of national and international regulations.

2.2 Review of Existing Literature:

It is almost 15 years that Ship breaking industry has completed its journey as recognized industry. It plays a vital role in the national economy in Bangladesh. Many studies have been completed on this and published on respective journals. All these studies have given an analytic pathway to way forward.

A dissertation published by Capt. Kazi ABM Shameem in 2012 named The Role of the shipbreaking industry in Bangladesh and its future with special emphasis on capacity building through Education and Training. He focuses on the influencing factors for driving and holding its position in south Asia particularly in Bangladesh. The shipping & demolition market dynamics analyzed with future trend of the industry. It also focuses on the occupational health and safety issues involve in this industry and how this has been addressed by the government of Bangladesh. The transition from past practices towards green recycling is demonstrated by examining the drastic actions taken by the competent authority and find out the formation of new rule and its application with Education and Training of workers for the development of ship breaking industries.

Pollution is that the introduction of contaminants into the natural atmosphere that cause adverse modification. Environmental degradation and depletion of resources are alarmingly increasing in developing countries because of lack effective legislations, non-compliance of international standards in ship breaking method. It is manifested chiefly by pollution, deforestation, destruction of wetlands, depletion of soil nutrients, etc. Super tankers and large load ships are the backbone of our global consumer society. Hundreds of meters long, ferrying countless plenty of product across the world, the perpendicular size of these immense vessels is awe exalting. Even once these ships don't seem to be seaworthy anymore, and repairs don't seem to be inexpensively viable, the raw material it is constructed from has a greater value for other purposes. Construction of one such behemoth may be a fascinating effort of engineering, however, the destruction and final resting place of these steel giants is even a lot of intriguing.

Ship breaking is that the method that dismantles an obsolete vessel's structure for scrapping or disposal. Conducted at a pier or dry dock or dismantling ship, it includes a wide range of activities, from removing all gears and equipment to scaling down the

ship's infrastructure (OSHA, 2001).Ship breaking though is hard-to-please however an awfully risky method so. It involves pollution, environmental hazards, and health problems. Ship breaking was recognized as an extremely mechanized task until the 1960s in the industrialized countries just like the United States, United Kingdom, Germany and Italy, but as the costs of upholding environmental health and safety standards increased the activity moved towards the poor Asiatic states from the early 1980s. The industry since then took a distinct approach where the ship owners to maximize profits sent their vessels to the scrap

Yards of poor South Asian countries like India, Bangladesh and Pakistan wherever payment, health and safety requirements are smallest and employees are desperate for work. Ship breaking activities in Bangladesh is concentrated on the port city Chittagong on the Bay of Bengal. Ship breaking activities are being practiced within the coastal areas and have gained importance within the macro and micro- economy of poverty stricken Bangladesh.

Though ship breaking has earned a decent reputation for being a profitable industry in developing countries there are variety of environmental and human health hazards. counting on their size and performance, scrapped ships have an unladened weight of between 5,000 and 40,000 tons (the average being 13000+), 95% of which is steel, coated with between 10 and 100 heaps of paint containing lead, cadmium, organotins, arsenic, zinc and chromium. Ships also contain a good range of other hazardous wastes, sealants containing PCBs, up to 7.5 tons of varied kinds of asbestos and; several thousands liters of oil (engine oil, bilge oil, hydraulic and lubricants oils and grease). Tankers additionally hold up to 1,000 cubic meters of residual oil. Most of those materials are defined as hazardous waste under the Basel Convention. In Bangladesh, ships containing these materials are being split by hand, on open beaches, with no consideration given to safe and environmentally friendly waste management practices. Ships don't seem to be properly cleaned before beaching. Generally, an eyewash test is allotted to certify that a ship is free from dangerous chemical and fumes.Ship breaking activities could be a threat to both the terrestrial and marine environment as well as to public health. It's sort of a mini version of a city that discharges all kinds of pollutants a metropolis can generate like liquid, metal, gaseous and solid, pollutants. However, these ships contain hazardous substances such as asbestos, lead paint and polychlorinated biphenyls (PCB). During scrapping, by manual and basic methods, these toxic substances are released into the atmosphere. This phenomenon produces a robust and considerable contamination of the surrounding environment and lethal diseases into the workers. These activities exemplify both the potentialities and also the dangers of an increasingly globalizing economy.

The purpose of the study is to collect data and do an environmental assessment to create social awareness among the people who are directly or indirectly involve in ship breaking activities.

Else, the objective of this study is to focus on the hazardous effect of oil and chemical

pollution from ship breaking industries. More objective of the studies are:

Highlight the adverse effects of ship breaking pollution on environment & biodiversity.

To draw out potential measures for hazard analysis and waste recovery.

To get a clear picture of ship breaking industry.

Enhance the development of safe and environmentally sound ship recycling.

To review the existing policies and national & international regulations to manage theship breaking industries in Bangladesh.

To find out the best possible way to mitigate the setbacks of environmental pollution due toship breaking.

Addressing and implementation of the Basel convention.

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A dissertation published by Md. ASHABUR Rahman, Mansura Akhter & Wahidul Sheikh named A National and International Regulatory Framework for Establishing Sustainable Ship Breaking Industry in Bangladesh. The main objective of the paper to show the concept to be sustainable industry by implementation national and international regulations. They reported the consequences of substandard ship breaking by sequence from 1990 to 2010. The marine environment protection and the labor safety issues have been addressed for the compliance of national and international laws.

In 1999 Mr. Ataur Rahman and A Z M Tabarukullah wrote a report entitled 'Ship Breaking Industry of Bangladesh'. In this report they mentioned that there was no arrangement for the safety of labour. No lifting process was available here in shipbreaking yards to load and move the iron pieces. The whole risky works were done by the unskilled labour of the industry. Besides, there was no system to provide anything for eye protection, uniform, glove, and boots. It was also mentioned in the report that without making the ship gas free, the ships were beached to be scrapped. As a result, it becomes a great cause for the sea pollution and a threat to the local environment.

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activities, impacts on aquatic biodiversity, human health & other resources. The report publicizes that the ship breaking activities contaminate the coastal soil and sea water environment and thus impair ecological settings. The problem is mainly associated with the discharge of ammonia, burned oil spillage, floatable grease balls and metal rust (iron) and various other disposable refuse materials together with high turbidity of sea water.

2.3 Theoretical Framework:

The ship breaking industry is a massive concept as it is related to huge manpower and big invest. At one side this industry created employment of the people, on the other side it plays a vital role to the national economy. As the industry related to environment, national and international NGOs focused on the effect of environment due to substandard ship breaking. The ship recycling industry is subjected to national and international regulations for the purpose of workers safety as well as maritime environment protection.

International Maritime Organization is mainly concerned of shipping and environment protection. Marine environment protection committee (formed under article no 37 in IMO convention) at its fifty-three session delivered a guideline for safe ship recycling which was actually focused on gas free hot work while ship breaking operation is carried out.

The international convention for the protection of pollution by ships is known as MARPOL. Bangladesh is a signatory state of this convention as the country accessed the convention. Every signatory state is responsible to implement the regulations addressed in this convention by enacting at domestic laws. As ship breaking & recycling is related to coastal zone, there is a chance of marine environment pollution. So green ship recycling is mandatory to uphold this convention.

United nations conventions on the law of the sea known as UNCLOS addressed the importance of maritime zone. UNCLOS clearly described the guidelines to protect marine environment from different activities such as drilling, dredging, waste disposal. It will give the rights of individual states to monitor on their own respective coastal zone. By the jurisdictional power of coastal state, UNCLOS gives the guidelines for adopting environment friendly ship recycling process.

Basel convention on the management of transboundary movement of unsafe waste and their disposal says the first international legal document of the Regulation of ship breaking business. Choksi (2001) declared that the most purpose of the meeting is to make sure that parties take responsibility for his or her unsafe waste, establish their territory, minimize the generation and transboundary movement of hazardous waste, and make sure that they are doing not export the hazards and harm to human health and the setting, to different countries.

The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships,2009 addresses all the matters regarding Shipbreaking including the ships sold for

scrapping and environmental conditions for ship recycling facilities. It provides the guidelines in shaping up the shipbreaking and recycling industry throughout the world. According to Article 5 of the Convention, every ship must maintain the survey and certification requirements suggested by the flag State. The ship breaking state will ensure that ship-recycling facilities are being conducted in accordance with the regulations of this Convention. Health safety, as well as sound and safe environment in shipbreaking industries, are enclosed in Regulations 19 to 23 of the Convention. So, the Hong Kong convention is the main baseline for ensuring sustainable ship recycling.

European union adopted a regulation on ship recycling for the control of shipment of wastes in or out of the European community. It meets the requirement to all ships entering EU ports have an Inventory of Hazardous Materials (IHM) onboard ("European Laws and Guidelines" n.d.). The Regulation is mainly based on the Basel Convention. It is not mandatory for any warships, naval support or other ships owned by a state. European union member state will ensure of having inventory of hazardous material of EU flagged ship and thus giving clearance to the ship being recycled. Although the international community and the EU have made good progress in creating a proper legislative framework for ship recycling. This regulation paves the standard pathway in compliance with Hong Kong convention for sustainable ship recycling practice.

The International Labor Organization (ILO) delivered guidelines aiming to ensure proper safety and health of the workers in shipbreaking industries. These guidelines cover the areas described at IMO Convention, the Basel Convention, the London Convention, and the International Chamber of Shipping (ICS). It described the procedure to maintain the safety of the workers and suggested to do risk assessment prior to doing risky job such as ship breaking. The procedure of having leadership and teamwork paves the way to minimize risk at ship breaking activities.

The process of breaking in Chittagong involves initially physical beaching of the vessel to the specific yard and this is generally done during maximum high water time, which is about 50-100 meters (depending how efficiently is beached) from the main yard. In the next high water the vessel is further pulled towards the yard with the help of mechanized winches and the same continues as the vessel is lightened by removing of stores, machineries and all other removable items.

The ship must be placed in this exact position and above all come to ground as high up on the beach as possible to facilitate dismantling operations. Beaching has a crucial impact on the final cost; the time needed for dismantling can be doubled, if the beaching operation is not successful.

Primary cutting is done during the intertidal zone at the beaching yard with big chunks of section about 20-50 MT each, which are pulled on to the shore yard for additional cutting known as secondary cutting area. The customized cutting, resizing the plates into truckable size, sorting, segregating, loading, delivery is done in the secondary cutting area. On an average, a 10,000 LDT size ship takes around three months to complete the whole process.

During the dismantling, cutters and their helpers start cutting the vessel into parts. The breaking operation is undertaken based on the structural design of the vessel. The larger parts are dragged to the dry part of the shore with the help of motorized pulley. A large number of workers are also engaged in this operation. Though the motor does the main job, workers need to help the pulley driver in dragging the part to the dry area of the shore.
Another group of cutters, helpers and workers start cutting the dragged parts of the ship into truckable parts as per order of the purchasers. Heavy equipment like boilers, motors, capstan stocking etc. are carried to stack yards by moving crane. The unskilled workers carry metal plates, metal bars or pipes on their heads or shoulders, start walking in synchronized steps with the rhythm of the singers call up to a definite destination and then pile up metal plates in stack yards or load them on trucks. The supervisors control the group of workers; the on-looker guides them and helps them in pilling up the heavy metal plates in stacks.

The ship is cut down into different pieces and winched to the shore at high tide and further large portion is cut into suitable pieces on the beach for easier loading and transportations. The valuable components (e.g. small motors and pumps, generator, navigation equipments, life saving equipments, furniture, electrical cables, utensils etc.) are dismantled and sold to second hand market situated on both sides of the Dhaka-Chittagong highway. It needs 5-6 months to dismantle a typical cargo ship.

In the People's Republic of Bangladesh, the principles and regulations associated with ship breaking industries contemplate surroundings and labor relations. Saraf et al. (2010) expressed that the array of state departments attached ship breaking problems in the People's Republic of Bangladesh is the department of surroundings (DoE) at the side of the department of review for Factories and institutions and therefore the Explosive Department. The acts, Laws and Rules that play significant roles during this method are the surroundings Conservation Act 1995, the Environmental Law, 1995 and Marine Fisheries Ordinance 1983, etc. Recently, a draft has been issued named 'Rules on Ship Breaking and unsafe Waste Management underneath the People's Republic of Bangladesh surroundings Conservation Act 1995; and in 2011 Ministry of Development discharged Ship Breaking and utilization Rules' that additionally introduced construction and Ship utilization Board (SBSRB) to issue certifications principally. The department of surroundings is meant to play a critical role in dominant environmental pollution from ship breaking activities that are just succeeded thanks to a lack of workforce and reasonable rules. However, a bill titled Bangladesh Ship utilization Bill, 2018, was passed within the parliament, keeping a provision of a more durable penalty for violations of the law, and attending to provides an additional boost to the country's potential ship utilization trade. Within the bill, it is expressed that a zone is going to be established in the urban center for the ship-recycling business underneath Section four of the draft law.

Therefore, the trade house owners can need to establish yards and conduct their activities among the zones. The law makes it necessary to issue life assurance for each employee and worker by the house owners. The industries will need to abide by the relevant international rules and conventions. It additionally aforementioned if anyone establishes a yard while not permission, the penalty for such offence is most biennial jail or minimum BDT ten animal product fine or most BDT thirty animal product fine or each. The death for commerce ships while not a no-objection certificate (NOC) is two years' jail or a penalty of minimum BDT ten animal products beautiful to most BDT thirty animal products. If anybody brings a ship

toward land and recycles that while not an operative certificate, then the penalty is additionally most two years' jail or a fine of minimum BDT ten animal product to most BDT thirty animal products. The death for availing the ability through fake certificate is almost five years' jail or a fine of minimum BDT five animal products or most BDT twenty animal products. Within the case of putting in place yards outside the zone, the penalty is two years' jail or a fine of minimum BDT ten animal product or most BDT thirty animal product. Underneath the new law, 13 members board is going to be deep-seated to superintend the activities of the ship utilization industries with an extra secretary of the Ministry of Industries as its chairman. Thus, regulative framework assists to have a better and sustainable recycling practice in Bangladesh.

2.4 Examples of Other Countries:

The ship breaking practices carried out in a rudimentary manner cannot be expressed as green ship recycling. The methods followed at south Asian countries for ship breaking is beaching method. The vessel being scrapped sailed onshore utilizing tidal range and then broken apart mostly manually.

The Ship breaking sites in India are situated mostly at Sewri in Mumbai, Maharashtra, Kolkata in West Bengal and Alang in Gujarat. Alang is the most popular site for ship dismantling business in India which is 56 Km away from Bhavnagar city in Gujarat. Due to the idle shore and high tidal region, Ship breaking industry got popularity here. Ships dismantled in the yard at open beach in India except a few dry dock-breaking options in Kolkata. When ships are brought at outer anchorage near the ship breaking yard, the responsibility of the ship braking yard started. The custom department and explosive department examine the ship and issue a clearance certificate for cutting operation. It covers various safety precautions as mentioned under various statutes such as Factories Act, the Explosives Act, the Gas Cylinder Rules, the Static and Mobile Pressure Vessels Rules. After beaching on the yard, the ship breaking activities carried out from forward to stern side. The whole cutting operation is being monitored by Gujarat maritime board. Before starting the cutting operation, all fittings and equipment such as furniture, refrigerators, cables, communication system, fire-extinguishers, lifting tackles, etc. are taken out from the ship. These things are being sold at local market and reused at national coastal vessel or domestic purpose. All the outer pipelines are detached from ship except some pipelines of fuel which are kept remaining for drain off. The ship is laced appropriately through holes by wire ropes and connected to the shore-based winches. The ship being cut slice by slice and taken to the shore by means of crane. The pieces are cut further into reasonable small pieces and sent to re-rolling mills. Other equipment like compressors, Diesel Generator (D.G.) sets, evaporation pumps, etc. are brought to shore and used in industries or coastal vessel. It is published at one report that 99% of total LDT of a typical ship can be recycled.

Still waste management in ship breaking industry is not up to the standard as described in European Union Ship Recycling Regulation and Hong Kong Convention for The Safe and Sustainable Ship Recycling Practice. For gaining environment friendly ship recycling practice, the guidelines by Hong Kong convention must be followed. In India there is having a bit practice to manage the hazardous materials in proper manner. But comparing to Bangladesh and Pakistan, Indian has developed its waste management system in ship breaking industry. Pakistan government is encouraging the stake holders by reducing taxes,

vats to promote ship dismantling business. But at the same time, they are giving less emphasis on waste management. Landfill is the only chosen option for south Asian countries for protecting the environment from hazardous substances. Still bilge water, ballast sediments, oily waters are not handled in proper manner in those countries.

Other ship breaking country specially China and Turkey are having ship recycling facilities better than south Asian countries. At some places, they follow the dock yard ship breaking method instead of beaching method. Comparing to beaching method, dock yard ship breaking is maintaining some mannerism to sustainable ship recycling practice which is in favor of workers safety and environment protection. Among the ship breaking leading countries, Turkey is on the top position for sustainable practice. The ship breaking zones are owned by the government and leased to the private companies. Most yards are located at Aliaga which is 50 Km north of Izmir on the Aegean coast. Turkish ship recycling yards are landing method. In 2002, Greenpeace reported poor conditions of the workers and no initiatives in the place to prevent environmental contamination. After that Government of Turkey introduced new procedures and regulations for maintaining Inventory of Hazardous Material (IHM) and management of hazardous wastes. The practices reached at one step forward with the co-operation of European countries for the dismantling of naval ships. The process of Aliaga yard to enlist in EU list of approved ship recycling facilities paves the pathway to sustainable and environment friendly recycling practice. In 2018 two yards were approved by European Union council and included in EU list. In 2019 Greenpeace reported the outstanding achievement of Aliaga yards with the patronization of Istanbul commission on health and safety and the Turkish government.

European Union Ship Recycling Regulation speeds up the ratification of Hong Kong convention for expected practice. European Council approve some yard for ship recycling facilities meeting with the safety and environmental requirements. There are having 18 EU approved ship recycling facilities including two yards in United KINGDOM, three yards in Belgium, two yards in Italy which are in compliance with EU SRR. SO, these yards are having the best practices ever on the concept of green ship recycling.

Figure: EU approved lists of ship recycling facilities (3rd Edition ,Oct 2022 / Jim Health)

Chapter-3 Green Ship Recycling in Bangladesh: An Analysis

3.1 Overview of Green Ship Recycling in Bangladesh:

Bangladesh is one of the top ships breaking leading countries in the world. It is published in a report that about 47.2% of old ships are being dismantled in Bangladesh (NGO platform). The demand of scrap steel from ships increased the ship breaking activities in the country. There are having about 350 re-rolling mills but do not have natural resources for raw material. All of them depend on scrap steel which can be gained from dismantling of ships. In Bangladesh, there are having about 150 ship breaking yards (50-60 yards are active). Around 750 ships above 500 GRT are being sent for scrapping in a year in the world. Among them, Bangladesh is taking part to dismantle about 230 ships in each year. A statistics of Bangladesh ship breaking for the context of number of ships is given below: -

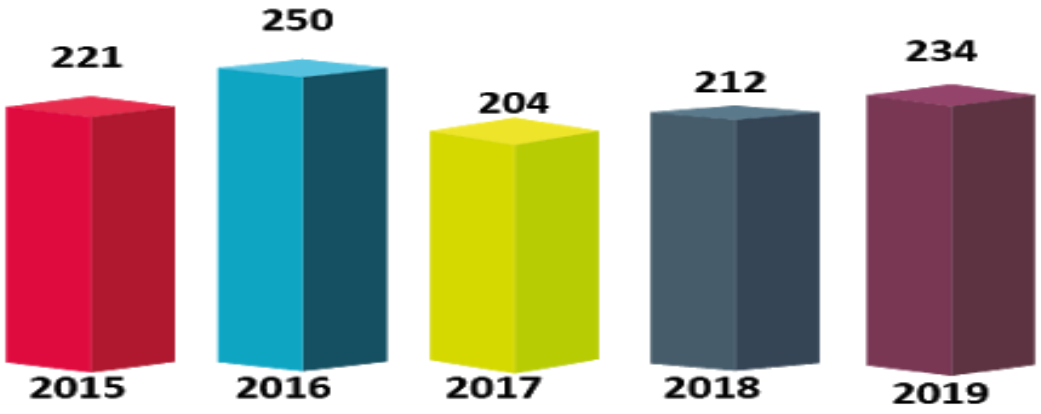

Figure: Number of ships dismantled in a year in Bangladesh. (Source: ministry of industries; administrive data)

Bangladesh is paying the highest values for scrap ships. The ship owners want to be benefitted at the end of the ship's life. This is also another reason for dismantling huge number of ships in Bangladesh. A table estimating the value of scrap ship per LDT is given below: -

Types of Ship	Bangladesh (US $ per LDT)	Pakistan (US $ per LDT)	India (US $ per LDT)	Turkey (US $ per LDT)
Tanker	475	465	455	260
Bulk Carrier	465	455	445	255
Container	470	470	465	265

Figure: Value of Scrap Ship in 2021 (US$ per LDT)

It is seen in the table that Bangladesh is paying 475 US $ for tanker ship, 465 US$ for bulk carrier and 470 US$ for container per LDT which are the maximum in ship breaking leading countries.

The stake holders have concentrated mainly on the economic advantages of ship breaking yard but didn't notice its impact on environment. Ship recycling offers a far better way of dismantling of old vessels, with practically a part of the hull and machine complex being reused or recycled as scrap metal mostly to be sold to interested industries. This activity began in 1969 and since then it's earned a decent status for being profitable but at a good environmental cost. Different types of disposable materials and rubbish are disposed and spilled from scrapped ships in an exceedingly way that they often get mixed with the beach soil and sea water around. This way of disposal encompasses a negative impact on our coastal environment and marine biodiversity. The industry creates direct and indirect jobs for a few of the poorest and most marginalized segments of the local population. For that reason, voice of local people against this severe pollution is often absent.

The Ship Breaking and Recycling Rules ,2011" herein after referred to as" Rule'' has been formulated in pursuance of the Hon'ble High Court Division of Supreme Court, in written petition No. 7260 of 2008 dated 07thMarch 2011 taking into consideration the directions contained in the Order and also under the power of Act 13 , 87 of The Factories Act ,1965 . Unless the context otherwise requires, the other terms used in the rule shall have the meaning assigned to them under the Acts such as

- Bangladesh Ship Recycling Act 2016
- Ship Breaking and Ship Recycling Rules 2011
- Bangladesh Environment Conservation Act 1995
- Labor Act 2006
- ILO Guidelines safety and Health in Ship Breaking
- The Hong Kong International Convention for safe and environmentally sound recycling of ships ,2009
- Basel Convention 1989,

The first and main formation of this rule is the development of a monitoring and regulatory authority named Ship Building and Ship Recycling Board (SBSRB).

The Ship Breaking and Ship Recycling Rules 2011 have been developed for safe and environmentally sound ship recycling in Bangladesh. The Ship Building and Ship Recycling Board (SBSRB) is established by these rules and, when in place, it will be the Government one stop service provider under the Ministry of Industries. It will provide integrated service for ship breaking, recycling and other related activities. Under these rules:
To import a ship for breaking and recycling the yard owner has to obtain the NOC (No Objection Certificate) from SBSRB by submitting a yard environment clearance certificate,

ship's details of particulars, MOU with buyer and the Inventory of Hazardous Materials on board. To open the letter of credit from any scheduled bank it will require the NOC from SBSRB. In cooperation with the SBSRB the Department of Environment simultaneously examines the ship for Hazardous Waste and material excluding in-built hazardous and toxic materials and they may issue an environment clearance certificate for that particular ship. Similarly, the SBSRB and the Department of Explosives issues the certificates for 'Gas free for man entry' and 'Gas free for hot work', which means that the ship can be cut by torches.
Ship recycling is the process of dismantling a vessel's structure or disposal conducted at a recycling facility for dismantling a ship. It includes a wide range of activities, from removing all gears and equipment to cutting down and recycling the ship's infrastructure. Before providing demolition or cutting permission, the yard owner has to submit a Ship Recycling Plan (SRP) and copy of the permit for Ship Recycling Facility Plan (SRFP). The SBSRB is the authority designated to ensure compliance with all ship breaking rules and regulations. It also oversees hazardous waste/materials generation and its disposal. Non-compliance of rules will result in the cancellation of the permit. The ship recycler can get a new permit only after a full re-inspection of corrective measures. The SBSRB in future will conduct its monitoring activities half yearly. It may conduct more inspections when accidents take place.

Bangladesh Ship Recycling Act 2016 is aimed at setting up the industry in a certain area considering environmental impacts as well as regulating the activities of the fast growing industry. The government will set up one or more zones for the industry. The entrepreneurs will set up yards in the designated zone. Penalties will be imposed for setting up yards outside the zone. Bangladesh Ship Recycling Board is formed, headed by a Chairman and a full time Director General, as a regulatory authority. The Board will facilitate a 'One-Stop Service' for discharging the day-today administrative tasks with regard to the ship recycling activities, for example issuance of No Objection Certificate, Inspection Order, Beaching permission, Cutting permission, etc.

The "Ship Building and Ship Recycling Board" (SBSRB) is the ONE STOP SERVICE provider under The Ministry of Industries .The Board is headed by Chairman appointed by the Government under Board of council which will govern and administer the Board .Chairman of the Board of council will be the Minister of Ministry of Industries with members Secretary of Ministry of Industries , Secretary of Ministry of Commerce ,Secretary of Ministry of Environment and Forestry ,Secretary of Ministry of Shipping ,Secretary of labor & employment ,DG Shipping ,DG DOE ,DG Fire brigade and Authorized Representative from Bangladesh Naval Head quarter .The Board will operate on having expertise on the various department i.e. Department of Environment , Directorate of Shipping ,Department of Explosives, Chief Inspector of Factories & Establishment , Collector of Customs , Bangladesh Navy, Directorate of Labour and Employment, Ministry of Commerce , Mercantile Marine Department and Directorate of Health service .

Abnormal (i.e. too high or too low levels) changes in physicochemical parameter(s) of water not only affect aquatic life forms (such as fish, invertebrates, bacteria and plants) but also the surrounding ecosystem. As such water quality is an important part of environmental monitoring. Table 3 shows summary data from laboratory analysis from field studies (M Shahadat,2016**)** carried out for this report and data supplied by DoE compared with previous literature reports and Bangladesh Environmental Conservation Rules (ECR1997). Among the important water quality parameters, the data for temperature (31°C), pH (~7.5–8.0), DO (5.0–10.0 mg/l) and BOD (5.72 mg/l), obtained, were found to

be within the acceptable standard of ECR1997. But COD levels in the waters of ship recycling yards, as revealed by current (258–366 mg/l) and previous (178–338 mg/l) studies, were higher than the ECR1997 standard (200 mg/l). An escalated COD concentration is most likely due to the presence of high amount of oil & grease (81.0 mg/l; field study result). Zhang et al. (2014) found that COD concentration in water was decreased with the decrease of oil concentration, and thus COD is reported to be positively correlated with oil concentration. From the field study values (i.e. 2.30 mg/l), levels of TDS in other studies (7,966–17,740 mg/l) were much higher compared to the ECR 1997 standard of 2100 mg/l. In this case, ECR standard has limitations as it is only applicable to estuarine environment, but not to coastal and marine waters. Moreover, precipitation in the months of July-September is reported to lower the salinity levels of entire coastal Bangladesh to zero and thus influencing the TDS levels as observed in field study results. The dissolved solids concentration, commonly called the water's salinity, is classified as fresh: 0– 1,000 mg/l; slightly saline: 1,000–3,000 mg/l; moderately saline: 3,000–10,000 mg/l; very saline: 10,000–35,000 mg/l; and briny: >35,000 mg/l (Heath 1983).

Iron (Fe) levels in the water of ship recycling yards were lower (0.08 ppm or mg/l; field study result) than the ECR standard (2.0 mg/l), although previous studies recorded much higher concentrations, e.g. 36.02–41.26 mg/l (Islam and Hossain 1986), 0.33–160.5 mg/l (Hasan et al. 2013a95) and 19.02–33.40 mg/l (Islam et al. 2013), respectively.

Metal (mg/l)	**Ship recycling area**		***Standard level**
	Hasan et al. (2013a)	Islam et al. (2013)	
Cd	0.003–0.004	0.024–0.037	0.005
Hg	0.82–2.44	–	<0.01
Pb	0.01–0.35	0.02–0.04	0.21
Co	–	0.02–0.08	0.05
Cr	0.01–0.21	0.05–0.35	1.1
Cu	0.01–0.93	0.02–0.15	<0.008
Al	0.02–84.25	–	–

According to the current field and previous study results, heavy metals such as cadmium (Cd), mercury (Hg) and lead (Pb) in the water of ship recycling yards were also below the standards of ECR (1997). However, Hasan et al. (2013a[95]) reported elevated levels of Hg (0.82–2.44 mg/l) that exceeded ECR standard (0.01 mg/l), (Table 4).The analysis results (by DoE, field study and previous reports) of other metals such as As (except 0.010–0.951 mg/l by Islam et al. 2013; ECR standard 0.2 mg/l), Cr, Cu, Mn, Ni and Zn in water were below the ECR standard

Moreover physical, chemical & biological characteristics of the area are relentlessly degraded. However, the extraction processes required itself represent a relentless threat to the environment and human health. Further, the methods adopted within the extraction and demolition processes are sometimes beyond environmentally safe procedures. The higher

concentration of trace metal and toxic substances within the environment of the ship breaking yard areas of Sitakunda hampered marine ecology and coastal ecology. The previously mentioned toxic substances impaired primary productivity by killing off the phytoplankton and zooplankton of the intertidal zones. In turn, the fish resources degraded severely owing to the scarcity of food. Deforestation, polluted water and toxic soil destroyed and degraded the habitat, and thus threatened the expansion of biodiversity within the area.
The process of breaking in Chittagong involves initially physical beaching of the vessel to the specific yard and this is generally done during maximum highwater time, which is about 50-100 meters (depending how efficiently is beached) from the main yard. In the next highwater the vessel is further pulled towards the yard with the help of mechanized winches and the same continues as the vessel is lightened by removing of stores, machineries and all other removable items. The ship must be placed in this exact position and above all come to ground as high up on the beach as possible to facilitate dismantling operations. The operations for dismantling ships are in unsafe way. It is reported that about hundred workers died, and huge number of workers got injured during ship breaking activities. So unsafe and substandard ship breaking turn the nation to the bad practice in ship breaking industry. The hazardous materials are not maintained for recycling purpose in a proper way. Asbestos, oily water, bilge water, ballast sediments etc. are often mixed with the coastal areas.

Among all the ship breaking yards, two or three yards maintain standard ship breaking and recycling guidelines. It is reported at ATN news that PHP Ship Breaking and Recycling Industry is doing their activity in compliance with Hong Kong Convention. Recently this yard has been awarded with ISO certification and applied for EU approved ship recycling facilities. Ministry of industry, Bangladesh aimed to facilitate all ship breaking yards into the standard ship breaking yard by February,2023. About 20-30 cores BD Tk is needed for each ship breaking yard to arrange an environment friendly ship breaking and recycling practice.

The fishery resources of the realm seems to be affected by the ship breaking activities as revealed by increased fishing efforts, reduced species diversity, increased amount of trash fish(Siddiquee,2004). Notably as compared of past 15 years, species diversity in Set Bag Net (SBN) catch is reduced significantly. To assess the concept, a comparison was made between data on species composition of SBN by Alam *et.al.* (1989) and therefore the data gathered from that area during the currnet investigation (Hossain & Islam, 2004) through random sampling together with interview with local fishermen. From the comparison, it absolutely was revealed that the subsequent fish species were't available in the catch. To form concrete assessment about the status of threatened, endangered and extinct species of that area, it needs further research.

Table: The fish species not found in SBN catches of ship breaking area during present investigation 2004) in comparison to study by Alam *et.al*.(1989)

Scientific name of fish species	Local name	Scientific name of fishspecies	Local name
Osteogeniosus staenocephalus	Aspisoa katamach	*Sphyraena obtusata*	Khika mach
Scolopsis vosmere	Nemipscol mach	*Carangoides malabaricus*	Lohamuri mach

Eleotris fusca	Dora bailla	*Carangoides melampygus*	Bungda muri
Uranoscopus guttatus	Foton mach	*Sauridia elongata*	Tiktiki mach
Dendrophysa russelli	Kala poa	*Anodontostoma chacunda*	Koiputi mach
Bahaba chaptis	Chapti mach	*Pricanthus macracavthus*	Prica mach
Pomadasys opercularis	Grunti mach	*Pricanthus tayenus*	Prica mach
Polynemus sextarius	Kala tailla	*Cynoglossus macrolepidotus*	Lamba kukur jib
Gobuis sadanandio	Nandi bailla	*Arius thalassinus*	Kata mach
Gobuis melanosoma	Kalthu Bailla	*Apocryptes serperaster*	Dosa chau mach
Sphyraena forstegi	Khika mach	-	-

Persistent toxic metals that settle down on the sediment from various sources are a threat to the existence of all organisms and to biodiversity. Through bioaccumulation such metals enter within the organic phenomenon and bio-magnified. Concentration of some metals exceeding the tolerance limit could be a threat to the fisheries, found in an exceedingly more recent investigation within the fishes from ship breaking area. A study administered in the area (Fauzdarhat-Kumira) in 1992-1993 included a quantitative investigation of trace metals in water and in edible crab *Scylla serrata* (Rahman,1994). This work concluded that the concentration of a number of the metals investigated (Zn and Cu) occasionally exceeded international limits for human exposure.

There is limited study or report on air quality indicators such as suspended particulate matter (SPM), sulphur oxide (SOx), nitrogen oxide (NOx), including metals and sound level in the area within and

around Sitakunda. However, it is likely that the ambient air of ship breaking yards may be affected by heavy metals due to dismantling ships and torch cutting of scrap metal. This needs to be determined. General air pollution from other sources has not been quantified for example by vehicular traffic, combustion sources and other local industry.

Suspended particulate matter (SPM), sulphur oxide (SOx) and nitrogen oxide (NOx) are considered to be the main issue pertaining to air pollution problems, but their levels (SPM: 138–163 $\mu g/m^3$; SOx: 4.1–7.6 $\mu g/m^3$; NOx: 7.3–14.4 $\mu g/m^3$) in the air of ship recycling area are inside the permissible limits (SPM: 500 $\mu g/m^3$; NOx: 100 $\mu g/m^3$) of Bangladesh Environmental Conservation Rules (ECR, 1997) applicable to industrial and sites with mixed type of activities. The ambient sound levels (62–72 dBa) in the ship recycling yards are also found within the standard range (70–75 dBa; ECR, 1997)

3.2 Factors Affecting Green Ship Recycling in Bangladesh:

Bangladesh is improving in ship breaking activities, yet to develop in some contexts. Factors affecting green ship recycling are the main challenges for Bangladesh ship breaking industry. For having developed industry in ship breaking, there is no alternate to Hong Kong convention guidelines. Work plan, allocation of human resources and position of tools & equipment must be mandatory in friendly manner for the context of productivity as well as maintaining safety and health provisions.

Lack of co-ordination and monitoring, the whole ship breaking and recycling activities are being carried out in a rudimentary manner. Strict and well-designed cutting plan can minimize the risks while dismantling the ship. There should be strict monitoring system. Workers and the management authority will co-operate each other on daily basis for carrying out the job. The common scenario of ship breaking yard are mismanagement and lack of co-ordination.

The basic construction of ocean-going vessel is unknown to unskilled labors. Lack of expertise, the workers failed to make cutting plan in a safe way. It is reported by NGO platform that labors have fallen during cutting operation at ship's side. Even they are doing their gas cutting job in the cargo tank without gas freeing in the tank. So, it's vital to arrange a minimum training for the workers to do risky job such as ship breaking. Through proper training and basic knowledge ship breaking will be on the way to forward.

Lack of health awareness is common problem among the workers. They don't wear proper safety clothing such as goggles, gloves, safety shoes or PPE in case of handling dangerous chemical. It is reported that there is having hearing problem due to working at high decibels of sound. Eye irritating, skin problem, breathing problem are the common issues here. Without having proper PPE, they are handling asbestos, dangerous paints like Tributyltin, chemicals like corrosion remover, scale remover which led them to lifetime disease. So, awareness of health for the workers must be increased to avoid such an unexpected situation.

Security is the main factor for establishing social livings. Most of the workers don't have any contract or employment agreement with the owner of ship breaking yard. According to World Bank, any nation reaching to get recognition as developed country, 2.5% of national budget

must be for social security. In the Bangladeshi ship breaking yards, the owners or government didn't estimate any handsome money for the purpose of social security of the workers. To minimize the vulnerable living condition of the workers, it is urgent to work in this context.

Inventory of hazardous materials prior to cutting operations is ignored often by the ship breaking yard management. It is a common scenario in maximum ship breaking yards in Bangladesh. If inventory can be done, the waste management of hazardous materials will be monitored by the yard authority accurately. This will pave the way to safe recycling practice in Bangladesh.

In Bangladesh the shipbreaking trade was born out of a severe cyclone in 1960 that killed thousands of individuals and a Greek ship "M D Alpine" was driven ashore by the devastating recurrent event and will not be refloated and was confined to Fauzdarhat coastline of Sitakunda Upazilla (Fig.3). The ship remained there for an extended time. In 1964 Chittagong Steel House bought the vessel and scrapped it. It took years to scrap the vessel, however the work gave birth to the industry in Bangladesh.

During the liberation War in 1971, a Pakistani ship "Al Abbas" was broken by bombing. Later on, this was salvaged by a Soviet salvation team from Chittagong port and brought to the Fauzdarhat seashore. In 1974 the Karnafully Metal Works Ltd bought this as scrap that is taken into account as introduction of commercial ship breaking in Bangladesh.

Following these tentative beginnings, the shipbreaking sector experienced a boom in the 1980s. As developed countries like United Kingdom, Spain, Scandinavian countries, Brazil, Taiwan, and South Korea wanted to get rid of an industry, that was not in compliance with the new environmental protection standards, Bangladeshi industrialists took the opportunities allured by vast profit. Businessmen concerned in the industry imported more and more ships and Bangladesh bit by bit began to play a significant role. As a result, at interval of short period Bangladesh established monopoly within the international market of big ship scrapping. Statistics (DNV, 1999) shows that about 52% of big ships are dismantled in Bangladesh.

Ship breakers in Bangladesh, think 1980s as the golden age. At that time, though there was already a substantial body of legislation, notably in respect of trade, the owners of the shipbreaking yards tookadvantage of the laisser-faire climate (FIDH, 2002)

The nature of this site additionally offered many advantages making it particularly suitable for ship breaking:

- A long, flat uniform intertidal coast zone,
- An extended beach with tidal difference of 6 meters,
- Protection by the Bay of geographic region
- Stable atmospheric conditions
- Low labour costs
- Some existing infrastructure (connected to the capital Dhaka by road and

railway)

- Moderate enforcement of laws
- Low level of environmental awareness
- Huge demand of iron and steel in native market
- Nearby location of rolling mills-essential outlet for the steel of the demolished ships.

At present there are 125+ ship breaking yards in this area and the space extend from over 14 kms along Fauzdarhat to Kumira Coast (YPSA, 2005). Every year 60-65 ships are either being dismantled or awaiting dismantling process (SHED, 2002). Once about 150 companies were engaged in ship scrapping activities (Rahman, 1994). At that time, more than sixty shipbreaking yards were tearing tankers and container ships apart, however paying no taxes or levies. Nor was there any oversight of the yards. The new industrial sector was additionally preyed upon by shady businessmen who bought ships for millions of taka using government (subject to corruption) loans and then disappeared with the loans. As time went on the banks began to be more careful and the government obligatory tax onthe trade.

Landfill, high temperature incineration facility, oily water separator, garbage handling zone can be installed for safe ship breaking and recycling practice. For the lack of these facilities, bilge water, ballast sediments, oily rags, asbestos and other hazardous materials are kept in a rudimentary manner on the beach or yard. For the target of green ship recycling facilities, ship breaking yard authority need to concentrate on these issues.

Recently Bangladesh has concentrated mainly on the economic advantages of ship breaking yard but didn't notice its impact on environment. Ship recycling offers a far better way of dismantling of old vessels, with practically every a part of the hull and machine complex being reused or recycled as scrap metal mostly to be sold to interested industries. This activity began in 1969 and since then it's earned a decent status for being profitable but at a good environmental cost.

About 52% of giant ships of the world are dismantled in Bangladesh [4]. Different types of disposable materials and rubbish are disposed and spilled from scrapped ships in an exceedingly way that they often get mixed with the beach soil and sea water around. This way of disposal encompasses a negative impact on our coastal environment and marine biodiversity. The industry creates direct and indirect jobs for a few of the poorest and most marginalized segments of the local population.

For that reason, voice of local people against this severe pollution is often absent. Moreover physical, chemical & biological characteristics of the area are relentlessly degraded. However, the extraction processes required itself represent a relentless threat to the environment and human health. Further, the methods adopted within the extraction and demolition processes are sometimes beyond environmentally safe procedures.

The higher concentration of trace metal and toxic substances within the environmentof the

ship breaking yard areas of Sitakunda hampered marine ecology and coastal ecology. The previously mentioned toxic substances impaired primary productivity by killing off the phytoplankton and zooplankton of the intertidal zones. In turn, the fish resources degraded severely owing to the scarcity of food. Deforestation, polluted water and toxic soil destroyed and degraded the habitat, and thus threatened the expansion of biodiversity within the study area.

Figure: Threats from irresponsible ship recycling (source: world Bank)

Compliance of national and international regulations can help the ship breaking activities to turn into safe and environment friendly ship breaking practice. The government, the ship breaking yard owners, NGOs can be co-operative to each other for aiming best recycling practice as well as increasing national economy.

3.3 Impact of Green Ship Recycling in Bangladesh:

The ship recycling industry plays a great role in the national economy of Bangladesh. On average the industry generated about BD taka 52-55 billion per year (Sujauddin et al.) The industry pays customs duties, income taxes, value added taxes which is a great source of revenue for Bangladesh government. Also pay fees and charges as required under the current regulatory and compliance frameworks. A chart of fees paying by the ship breaking yard authority for the purpose of ship breaking activity is given below: -

Table: Beaching and cutting permission costs.

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

Source: Sujauddin et.al 2018

So, it has been observed that the ship breaking industry is making direct contribution on the national economy through paying fees, taxes and other costs. On the other hand, the ship breaking industry creates the chance of employment of skill, semi-skilled workers. The port published by NGO platform that 1,00,000 workers are directly involved with the ship breaking industry. A study published by Sujauddin (academic researcher) that the industry provided between 25,000 and 40,000 full-time equivalent jobs on the aspects of management and administration roles. The jobs are divided into some sections such as technical, supporting and management based. These people are directly work at ship breaking industry. About 350 re-rolling mills use the scrap steel from ship breaking industry. The workers involved with these mills are indirectly related to shipping industry. More 2,00,000 peoples who are those related with recycling process of non- ferrous material and others as well as re-rolling mills. So, this is an great achievement of ship breaking and recycling industry for a densely populated country like Bangladesh.

The ship breaking industry in Bangladesh is contributing to growth and development of other economic activities. A report published that about 70% raw material of steel manufacturing company and steel re-rolling mills directly depend on scrap steel from ship breaking (Sujauddin at el 2010). Even some re-rolling mills are related with ship dismantling business. PHP family, KSRM group, AKS steel etc. are enlisted in top ship breaking leading companies in Bangladesh. Besides that, ship machineries, lubricating oil, general paints, non-ferrous materials are re-used in coastal ship building or other domestic purposes. This also adds economic value. A statistical figure estimating the values of scrap steel, non-ferrous metal, hardware, machines, fitting etc. in ship dismantling in a year given below: -

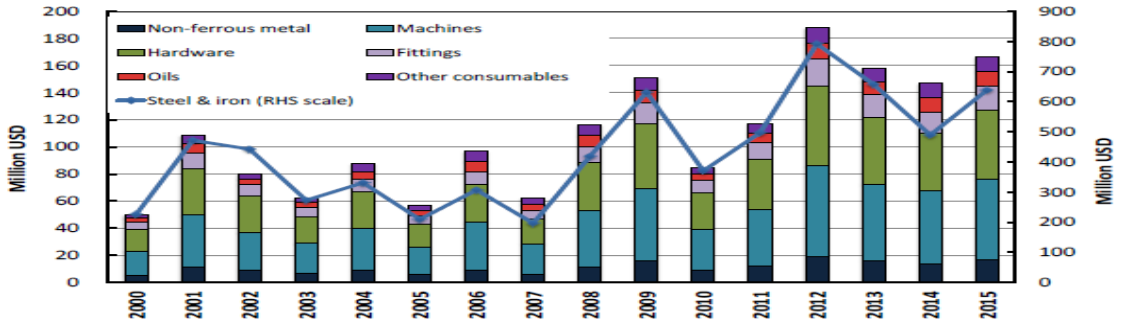

Figure 1 Estimated weight, average weight (LDT), and number of ship recycling in Bangladesh (source: NGO platform 2015)

A paper published by Great Economist Mr. Munir Hossain ship breaking and recycling processes are making added value equal to BD Tk 735 per one taka. The government organizations, NGOs and other stakeholders can promote this industry for making national economy great with compliance of safe and sustainable guidelines.

The concept of green ship recycling will contribute a lot to blue economy. The blue economy aims to maneuver on the far side business as was expected and to contemplate economic development and ocean health as compatible propositions. According to U.N. agency and international organization Department of social science and Social Affairs (2017), the "blue economy" construct seeks to push economic process, social inclusion, and also the preservation or improvement of livelihoods whereas at identical time guaranteeing environmental property of the oceans and coastal areas. So we must give emphasis on green ship recycling practice.

3.4 Challenges Militating Against Green Ship Recycling in Bangladesh:

The term green ship recycling means the practice of dismantling ship in such a safer way that reduces the amount of waste and also keeps the waste materials out of the beaches, minimizing its impact on the environment. The regulatory framework at national and international levels can pave the way to accomplish the green ship recycling practice. The governance of Bangladesh took a vision to make all the ship breaking yard safe and environment protective zones by 2023. Still the green ship recycling practice is a far cry. The industry is facing huge challenges for upgrading the practice in Bangladesh.
The lack age of knowledge and training of the workers is the main challenging issue in ship breaking yard. Two or three ship breaking yards are arranging training for the workers to avoid risk and accident in the workplace. PHP family ship breaking, and recycling industry is one of them. To keep a valuable contribution, the dignity of safe ship breaking practice is indeed. The workers must have basic ship breaking knowledge and the authority needs to arrange a training for carrying out such a risky job. Most of the workers doesn't have any academic education and rare to find workers crossing secondary school. A chart of the educational status of the workers involved in ship breaking industry is given below: -

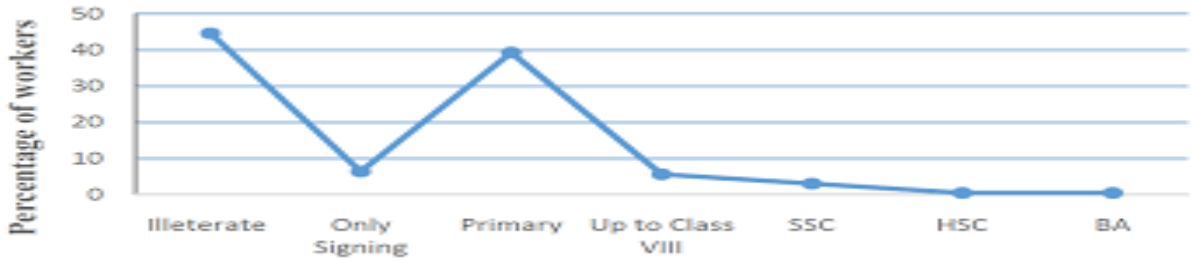

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Figure: Educational status of workers in ship breaking industry (source: sarraf et al.)

In 2008, the NGO Shipbreaking Platform and its associate organizations YPSA and FIDH published a report that about 27% workers in the ship breaking industry are below 18 years and 9% workers are below 14 years. It is clearly declared in ILO convention that each worker must be above 14 years. Bangladesh Shishu Adhikar Forum is working on these issues. The ship breaking yard authority can hire the children at less money than the adults. Skilled, trained and adult workers will bring prosperity. On the other hand, the workers have rights to lead their lives in a sound way. Labor Law Act 2006 has provisions on working conditions, health and safety, hours, leave, compensation for the industry workers. The compliance of national laws can improve the working condition.

Inventory of hazardous materials is still a negligence issue in the ship breaking industry. For the betterment of effective waste management, inventory of hazardous materials is important. Due to mismanagement of waste in ship dismantling, there is a chance of environment pollution as well as threat to human health. Proper landfill, high incineration facility, oily water separator, waste oil tank facility, ballast water treatment plant etc. must be installed to cope up the standard ship breaking requirements. The stakeholders blamed the governance for increasing taxes, value added taxes, fees which may discourage them to sustainable ship recycling.

Lack of expertise, co-operation, monitoring in the ship breaking industry, there is a probable chance of unsafe ship dismantling practices which can be a great threat to human health as well as environment. This is a bit challenge for proper ship dismantling business. Some underlying challenges for the concept of green ship recycling in Bangladesh is given below: -

- Compliance of national and international regulations.
- Lack of political support.
- Shortage & improper usage of government resources.
- Job insecurity of the workers.
- Employment relationship.
- Improper practice of waste management.

3.5 Prospect of Green Ship Recycling in Bangladesh:

There are having social, human health and environmental impacts of ship recycling. The economic activities include using labor, land, infrastructure, machinery, and various utilities and consumables−into steel and other recyclable and reusable commodities that are mostly sold in domestic markets through dismantling over 200 ships totaling about 2.2 million light displacement tones (LDTs) which is around 35 percent of the total ships scrapped in the world. The demand for steel scraps and reusable materials and products; proximity to critical infrastructure and a thriving industrial zone with many re-rolling mills extend the ship breaking business in Bangladesh.

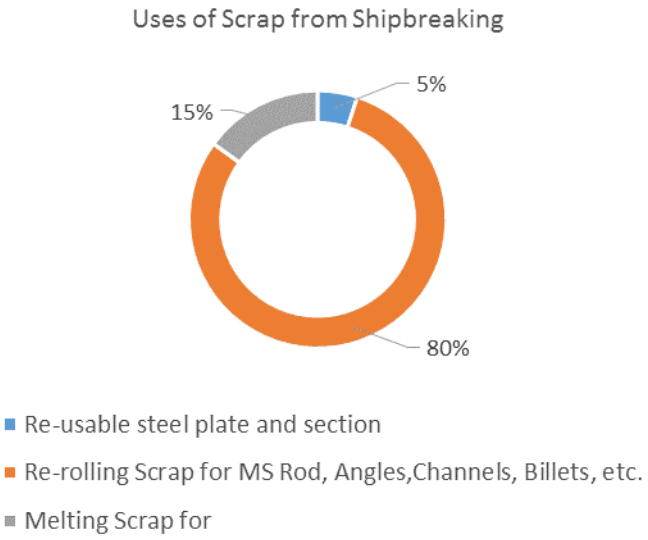

Figure: Uses of scrap from ship breaking

As such, steel scraps recovered from ship breaking covers third-fourth of raw materials in steel manufacturing in Bangladesh. The scrapping of ships is the main source of steel in Bangladesh which saves the industrial amount of money in foreign exchange reducing the need to import steel materials.

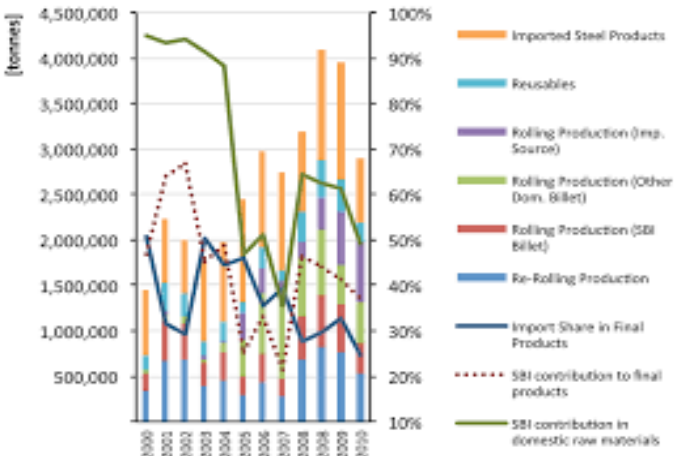

Figure: Scrap steel recovering from ship breaking to still manufacturing company (Source: NGO platform)

The ship breaking industry generate about Tk 55 billion per year and paying about 5 billion Tk as vat, taxes, fees which is the important source of government revenue. If green ship recycling practice is possible through proper guidance and by arranging training, the scrap ships buying from cash buyers can be escaped and will reduce the price.

The coastal area (Shitakundu to Kumira at Chattogram district) is having the great advantage for beaching the scrap at high tide. By implementing environment sustainable technology, the ship breaking zones may be turned into best practices.

The blue economy aims to maneuver on the far side business as was expected and to contemplate economic development. The activities related to marine and coastal setting differs from country to country. In Asian countries, scrapping of previously unusable ships maybe for the shipping industry to continue for the predictable amount, therefore conjointly for the continual freeing for the whole international community. This business has not solely met the growing wants of the article of furniture, home fittings of all categories, boilers, life-saving boats, generators so on, however conjointly generated employment opportunities. There are concerning 125 ship breaking yards with an annual turnover of concerning USD 4 billion. Ship utilization should be the fashionable business with all eco-friendly infrastructures and compliance of international convention. Ship breaking is inescapable for the international community and essential for many countries. Therefore, a way should be adopted, which can remodel scrapping to a new business. They need such a significant role, rather than a vital role, to play. Once scrapping is safe, dismantling is one amongst the most effective fitted industries to the Blue Economy.

Regarding the operational management, observation, and overall method of ship breaking industries in Bangladesh, there are issues from a plethora of stakeholders. Among government organizations principally Ministry of Industries, Ministry of Labor and Employment, Department of Customs, People's Republic of Bangladesh Navy, interior Water Transport Authority, city Port Authority, Radio Communication, and Wireless management Authority, Shipping Masters workplace, etc. are mentionable. Except for these importers, the breaking yard house owners, and Breakers, survey authorities, banks, and commercial firms, shipping agents, steel rerolling mill house owners, and traders conjointly play a significant role within the method (Hossain 2006). International issues like U.N. agency, ILO, UNEP, Greenpeace, organization Ship breaking platform, International Federation for Haman Rights, etc. work because the presser teams to make sure safer and inefficient ship use in worldwide particularly within the south Asian countries. Among native NGOs principally Young Power in social policy (YPSA) and the Bangladesh Environmental Lawyers Association (BELA) has been operating since the dawn of the ship breaking history in Bangladesh.

Chapter -4 Strategies Proffered to Mitigate Challenges Militating Against Green Ship Recycling in Bangladesh

4.1 Strategies Proffered to Mitigate Challenges Militating Against Green Ship Recycling in Bangladesh

Ship recycling practice in Bangladesh has been denounced by national and international bodies for unsafe working condition, wrong procedure of handling hazardous waste, child workers imposing on the yard etc. Some strategies are needed to apply to mitigate challenges militating against green ship recycling inn Bangladesh.

There must have Ship Recycling Facility Plan (SRFP) which will be adopted by the ship recycling company. Site inspections, operational procedures, waste management etc. will be included in SRFP and will provide information regarding the organizational structure, methodologies related to ship recycling and management policies of the Recycling Company. The decision will be in favor of protection of safety for the workers and environment. According to regulation no 22 of Hong Kong Convention, Ship Recycling Facility will ensure training program, job functions, sufficient workforce and the information described on handling and management of Hazardous Materials, personal protective equipment, emergency response and evacuation, safety and health training etc. Site specific permit, license, certification prior to starting ship recycling should be performed in compliance with laws and regulations.

SRFP describes the full procedure of ship recycling including reusable or recycling materials, hazardous materials, general wastes handling, disposal, land filling procedure which is not harmful to human health and the environment. SRFP covers plans and procedures for protecting worker health and safety, procedures to prevent explosions by ensuring that Safe-for-hot-work and Safe-for-entry conditions into any enclosed space. All pressure vessel such as oxygen bottle, acetylene bottle etc. need to be stored, handled in a safe way. The NGOs platform reported many accidents fallen from height or objects falling from heights. SRFP describes the procedure of using human floating device, procedure to avoid hazardous materials spillage which will ensure safe working condition according to international guidelines.

Emergency preparedness and response plan, medical first aid, improved health facility, training for preventing fire explosion & fire fighting, worker exposure, medical monitoring, sanitary & washing facility, standard & hygienic working condition, good employing procedure will be described in Ship Recycling Facility which will pave the pathway for standard ship breaking practice and reduce workers injury. But all the procedures will be in compliance with national rules as well as international regulations.

Green ship recycling concept will be appropriate whenever the environment protection will be emphasized with the safety of workers. The SRFP should demonstrate the plan & procedure for protecting the environment through treatment and disposal of Hazardous Materials generated from ship recycling operations pursuant to national laws and regulations. The Ship Recycling Facility will include the environmental monitoring program on the

following matters: -

- Inventory of Hazardous Material.
- Prohibition of release of Hazardous Materials to water.
- Control of emissions of Hazardous Materials to air.
- reducing noise/vibrations.
- use of dry dock, jetty/piers and/or recycling plots on land-sea interface.
- sampling and analysis of relevant environmental parameters.
- Storage, treatment, labeling, transportation and disposal of operational waste.

According to the guidelines of Hong Kong convention, identifying the location and quantity of asbestos and materials containing asbestos must be handled by the person who is trained and authorized by the government under the monitoring and management of the Competent person. The person working with asbestos must be prepared prior to starting his/her job. Work should be carried out in such a manner which will save the environment from contamination of asbestos with air. After separating the asbestos, it's needed to store them in a plastic container and high temperature incineration facility must be installed for burning asbestos.

The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (hereafter referred to as "the Convention") was adopted at a Diplomatic Conference held in Hong Kong, China, 11–15 May 2009, under the auspices of the IMO. The Convention deals with many matters that are generally described here but are not covered in detail. The main context for this note is the management of hazardous materials within the ship recycling industry. The note describes the main features of the Convention, providing a summary of the Whole Convention and its general implications for states, ship owners, and ship recyclers along with key issues including entry-into-force conditions.
The challenges facing one of the current ship recycling states (Bangladesh) are assessed, indicating some of the pressures and the gaps that may need to be filled to bring about ratification and implementation of the Convention. Some possible next steps are outlined along with the approach that might be taken by other IMO member states. The latter has particular significance, bearing in mind the interconnectedness of the Convention's entry-into force requirements.

This section outlines the main features of the Convention as set down in the text adopted at the Diplomatic Conference held in Hong Kong on 15 May 2009. The general structure of the Convention is that of enabling Articles containing requirements appropriate to ship recycling, together with standard mechanisms for the operation of international agreements, such as entry-into-force conditions. Detailed requirements are contained in the text of regulations that are in an Annex. The Annex itself is designated as an integral part of the Convention, meaning that the requirements of the Annex have the same force as those of the Articles to the Convention.

The essential requirements of the Convention are contained herein four Chapters, with detailed conditions to be observed and signposts to relevant guidance, the latter yet to be developed by the IMO. Ultimately these 61 regulations may be adapted over time, as
Experience indicates, through the IMO's negotiation mechanism. This process would require the Convention to have entered into force and some experience to have been gained in practice of the operation of the Convention.

Regulations 1 to 3 provide further definitions and scope. In particular, Regulation 3 refers to the "applicable standards" found in the material developed by the ILO and the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal, to be taken into account by Parties (i.e., the states that have ratified the Convention and are bound by its provisions) when taking measures to implement the requirements of the Annex.

Regulation 5 provides for new and existing ships to possess an Inventory of Hazardous Materials, materials that the ship contains in its structure and equipment, to be kept updated. Just before recycling, the inventory is to be supplemented with information about stores and operational wastes. Regulation 9 requires a Ship Recycling Plan to be prepared by the ship recycling facility and be "explicitly or tacitly approved by the Competent Authority authorizing the ship recycling facility," the chosen approval option (tacit or explicit) being decided at its ratification stage by the state concerned. The exact nature of the written notification procedures to other authorities and the ship owner depend on the tacit/explicit option selected. Regulations 10 to 14 deal with surveys and certification of ships by the Administration (Flag State) under the Convention.

Regulations 15 to 23 require a Party to the Convention to establish legislation, regulations, and standards that are necessary to ensure that ship recycling facilities are designed, constructed, and operated in a safe and environmentally sound manner in accordance with Convention regulations. An authorization process is required with inspection, monitoring and enforcement provisions, including powers of entry and sampling. Ship recycling facilities shall establish management systems, procedures,
and techniques that do not pose risks to the workers concerned or to neighbors and that, to the extent practicable, eliminate adverse effects on the environment, taking into account guidelines developed by the IMO.

Regulations 24 and 25 establish notification procedures concerning the intention to recycle a ship so that final surveys may be arranged and specify the information to be given to the ship recycling facility's competent authority by the facility. A Statement of Completion is issued by the facility to the competent authority when the ship has been recycled.

In recognizing the need for improving the process and further, to manage the increasing volume of vessels to be disposed, the Conference of the Parties to the Basel Convention on the Control of Trans boundary Movement of Hazardous Wastes and their Disposal (Basel Convention) decided to address the subject at their fifth meeting (COP 5) in December 1999. The Technical Working Group of the Basel Convention was instructed to initiate work on the development of Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships. Further, the Technical Working Group was instructed to provide a list of hazardous wastes and substances under the Basel Convention applicable to ship dismantling. Workers' safety is also threatened by the lack or absence of basic precautions. Due to the lack of a guiding norm when decommissioned, allowing preparatory actions onboard prior to dismantling, the vessel itself may represent potential risks. Basic risk reducing or eliminating measures are often ignored and ultimately, accidents occur. A lack of co-ordination of working procedures, lacking facilities and the absence of safety control of those available, represent elements of risk. The main concerns related to health include the exposure to harmful substances, insufficient sanitary facilities, as well as the nature of work operations (hard manual labor involving heavy lifting, etc.).

General exposure of pollutants originating from the ship dismantling facility is also a health concern for the people living in the immediate vicinity of the site. Both workers and the local society are potentially exposed to carcinogens and other harmful substances such as PCB, PAH, heavy metals and asbestos. The adverse effects of exposure to these substances are relatively well known. Their health impact is severe and can be passed on to the following generations. These Guidelines do not currently address measures to minimize the hazardous materials aboard a ship prior to it being sent to a ship recycling facility. However, Basel Convention Parties believe that such waste minimization guidelines are an important part of addressing the problems associated with ship recycling. IMO/MEPC is addressing this and related issues. They have plans for the short and long term actions. Further, these Guidelines do not deal in depth with the occupational health and safety aspects of ship recycling. The International Labor Organization has undertaken an effort to prepare such guidelines. Once developed, those guidelines may be incorporated herein

PCBs (polychlorinated biphenyls), ozone depleting substances, Organotin compounds include tributyltin (TBT), triphenyltin (TPT) and tributyltin oxide (TBTO), toxic and highly flammable paints, hazardous liquids & sediments (oils, bilge, ballast water), heavy metals (lead, mercury, cadmium and hexavalent chromium) and other hazardous materials must be handled, stored and recycled in a safe and environment friendly manner which will be. according to the Hong Kong convention guidelines.

A dedicated legislative framework is needed to develop ship breaking industry in congruence with international standards and in an environmentally sustainable manner. The government should arrange an inspection system to monitor the management of ship recycling activities including procedure of handling hazardous materials, cutting procedure, waste storage, incineration facility etc. for fulfilling the requirements of international standard. Otherwise, the existing practice of ship breaking industry will result risking its future in industry as well as environment.

If we have an overview of the ship breaking yard in the developed country like European country;Belgium, Spain, France,Italy or USA , Japan then the phase for ship recycling practices can be compared to mitigate the obstacles. Although all European countries contribute 6.5% in the ship breaking of total tonnages in the world, the practices are highly environment friendly. EU regulation paves the pathway to provide ship owners with the necessary services to bring the vessel to a responsible ship breaking party.These parties not only offer the ship owners a recycling plan but also continuously monitor the the dismantling process at the yard thus maintaining the standard in ship breaking industry. Coastal area of USA are contributing to ship breaking;mainly the naval fleet. But some yards at Brownsville, Texas, California are participating in international ship breaking to a limited extent. The practices of ship dismantling
In Japan can be considered as one of the standard practice.The process from buying to dismantling, recycling of materials are being strictly maintained by the local authority to protect the environment and ensure the safety of the employees. In the context Bangladesh is lagging behind to fulfill the standard ship dismantling practices.

Figure: Ship breaking yard at Netherland

4.2 Implementation Plan:

The beaching method used in Bangladesh needs to be developed to cope up the requirements of green recycling process. The term green recycling process is completion of the job without contaminating the environment. By implementing SRFP (according to international standard), the practice of ship recycling process in Bangladesh can be upgraded. The following things to be done step by step for ideal ship recycling process: -

- ❖ Ship inspection.
- ❖ Finishing the ship recycling licensing.
- ❖ Docking the ship.
- ❖ Transferring all type oil including oil in packaged form.
- ❖ Transferring bilge water, ballast water into curtained land storage tanks.
- ❖ Tanks draining and cleaning.
- ❖ Taking ship's unused materials (Furniture, sanitary items, wooden thing etc.)
- ❖ Separating ship's general waste.
- ❖ Picking up ship's mechanical & electrical equipment.
- ❖ Taking out dangerous materials such as asbestos.
- ❖ Temporary storing all the general storage outside of the ship.
- ❖ Cutting preparation.
- ❖ Risk assessment carried out.
- ❖ Conducting gas free procedure in the hull and other primary cutting space.
- ❖ Primary cutting: cutting the ship to small blocks.
- ❖ Secondary cutting: cutting the blocks into desired pieces.
- ❖ Separating the scrap & sending them to re-rolling mills.

A sustainable ship recycling process is described in Hong Kong Convention for Safe and Sustainable Ship Recycling Practice. The process is given below: -

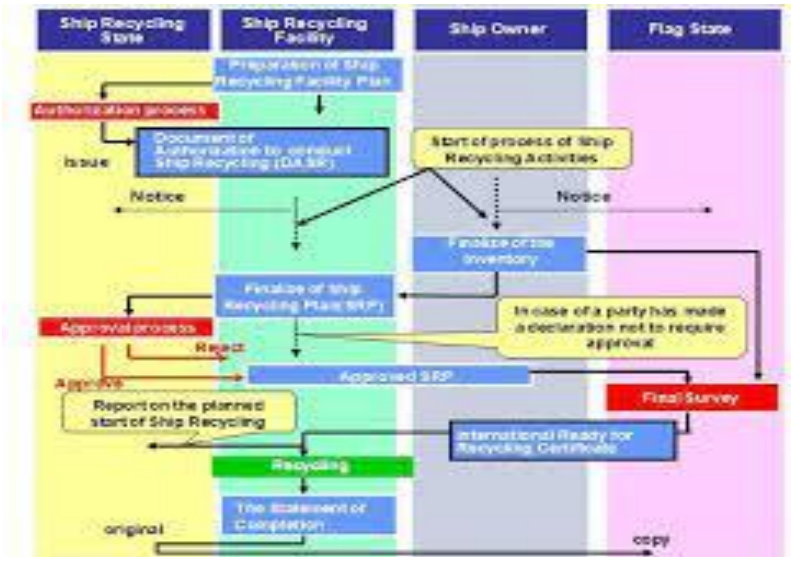

Figure: Sustainable ship recycling process (Source: Hong Kong convention; Appendix 3, MEPC 23/63)

The "Ship Building and Ship Recycling Board" (SBSRB) is the ONE STOP SERVICE provider under The Ministry of Industries .The Board is headed by Chairman appointed by the Government under Board of council which will govern and administer the Board .Chairman of the Board of council will be the Minister of Ministry of Industries with members Secretary of Ministry of Industries , Secretary of Ministry of Commerce ,Secretary of Ministry of Environment and Forestry ,Secretary of Ministry of Shipping ,Secretary of labor & employment ,DG Shipping ,DG DOE ,DG Fire brigade and Authorized Representative from Bangladesh Naval Head quarter .The Board will operate on having expertise on the various department i.e. Department of Environment , Directorate of Shipping ,Department of Explosives, Chief Inspector of Factories & Establishment , Collector of Customs , Bangladesh Navy, Directorate of Labour and Employment, Ministry of Commerce , Mercantile Marine Department and Directorate of Health service .

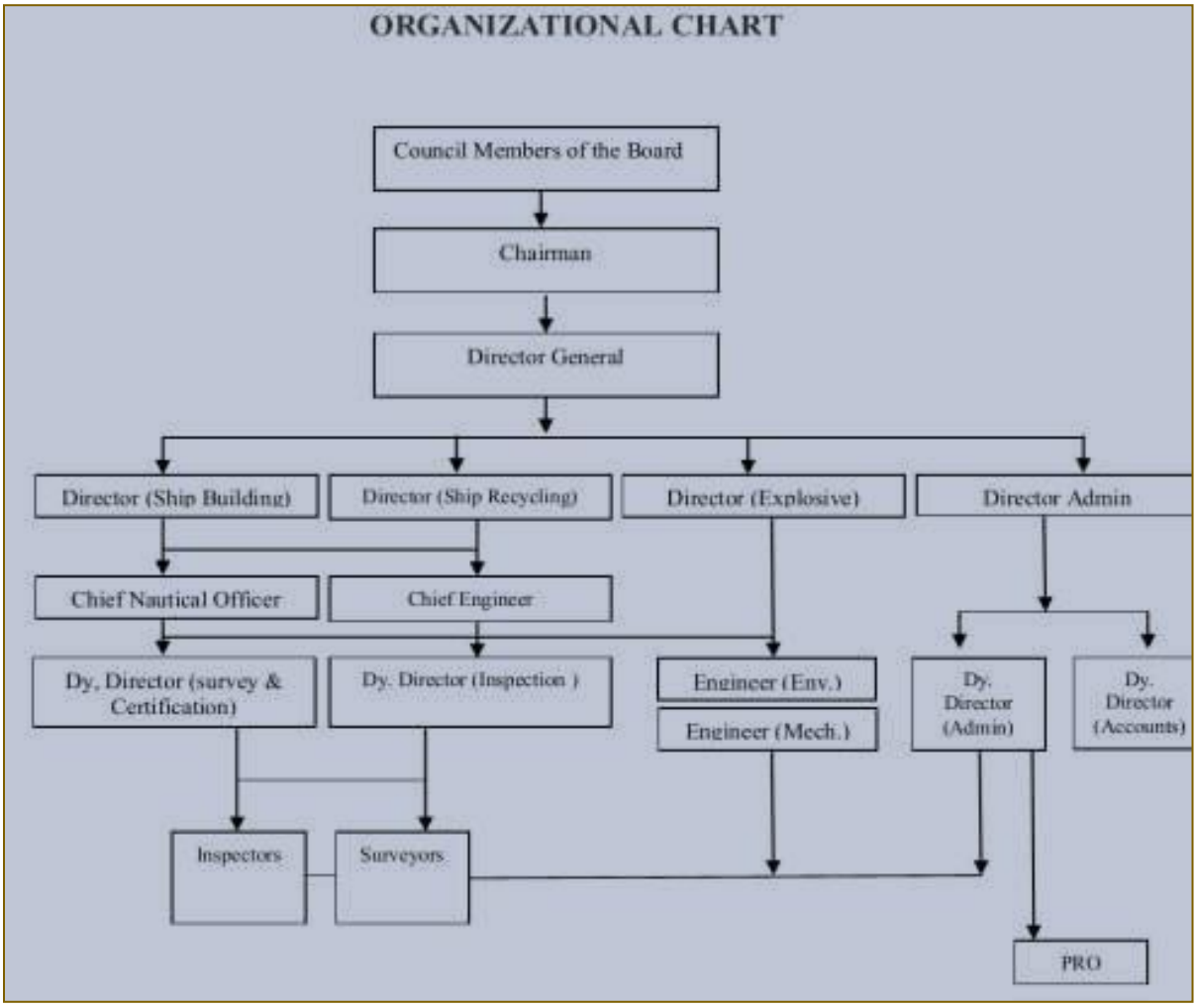

Figure 16: Organizational chart of the Ship Building and Ship Recycling Board (SBSRB)Source: The Ship Breaking and Recycling Rules, 2011

- **Activities of SBSRB**

1. Ship Building and Ship Recycling Board (SBSRB) will provide NOC (No Objection Certificate) to facilitate letter of credit to import scrap vessel by evaluating and examine of Ship's detail, MOU and Inventory of HW (Hazardous Waste).
2. In cooperation with The SBSRB the customs department makes visit to the ship at the Outer anchorage high seas to test its inventory. If the department assesses that the ship doesn't carry any cargo or item banned by Bangladesh laws, it gives its clearance for demolition. The surveyors make assessment of the ship, which is matched with the figure in the ship breaker's invoice to spot any discrepancies upon which action can betaken.
3. In cooperation with the SBSRB, The Department of Environment simultaneously thereafter examines the ship for Hazardous Waste excluding in built/toxic materials. Then they issue an environment clearance certificate.

4. Under the SBSRB, The Department of Explosives issues two certificates: “Gas Free for Man Entry” and “Gas Free for Hot Work”, which suggests that the ship are often cut

   by torches. Prescribed Check list must be followed for particular activity and duly submitted for each certificate.
5. Before provide demolition or cutting permission, the Yard owner must submit The Ship Recycling Plan (SRP) and replica of permit for Ship Recycling Facility Plan (SRFP). The SBSRB is the authority designated to ensure compliance with all ship breaking rules and regulations. It also oversees hazardous waste generation and disposal. Default or non-compliance leads to the cancellation of the permit. The ship Recycler can get a new permit only after a full re-inspection. The SRFP conducts its monitoring activity half yearly. It conducts more inspections when accidents occurs. The inspector works under the SBSRB to ensure that all safety gear requirements are adhered to. If the procedure for worker safety is found flouted, the inspector is obliged to tell the SBSRB, who revokes the dismantling and beaching permit for the following Ship.
6. Waste generated report in précised form to be submitted to SBSRB every afterdemolition of each Ship.

7. SBSRB shall issue permit of Ship Recycling Facility Plan “SRFP" for every applied ship breaking and Recycling yard after evaluate their facilities to break and recycle ships in safe and environmentally sound management.
8. SBSRB shall facilitate ,establish ,commission and operate Treatment ,Stowage , Disposal Facilities (TSDF) and central incineration plant for common use of Hazardous materials/wastes . A private partnership facility is also conducted under SBSRB.
9. SBSRB shall approve training curriculum, supervise, monitor and evaluate the academic training activity and On Job training for workers provided by Trade body Training Institute.
10. SBSRB shall oversee yard activity regarding worker’s safety, adequate measures and facilities to handle, manage and dispose Hazardous materials / Wastes in the Ship breaking yards.
11. SBSRB shall maintain a panel of Safety Officers by examining their technical competency .Safety Officer will be assigned for overall supervision of Ship dismantling activities directed by SBSRB for a Ship or Ships. Safety officer will get their remuneration from SBSRB which will be realized from the concern Yards.
12. SBSRB shall maintain a panel of Beaching Masters with their valid class one

    Master’s certificate of competency. Beaching fee will be decided by SBSRB according to the size and type of the Ship.

13. For used Oil/ sludge handling ,Hazardous waste(Specially asbestos) abatement and Cable handling ,SBSRB may appoint competent agency for the purposes at the operational Ship recycling yards to reduce occupational and Environmental risks. Vendors have to be registered by prescribed directions under SBSRB. (Bangladesh, 2011)

Ship Recycling Facility Plan can be implemented at environment friendly condition if ideal ship recycling yard is available. In Bangladesh, the beaching method is used for ship recycling which is having the chances to contaminate the environment. If docking system can be introduced through proper technical support with the patriotization of government. The greener ship recycling will be gained through flourishing the ship breaking industry. The ideal ship recycling yard is having the facilitation of scrap separation, general waste storage, landfill facility, temporary hazardous materials handling facility, machinery equipment storage facility, yard technical & monitoring team etc. An ideal ship recycling yard design is given below: -

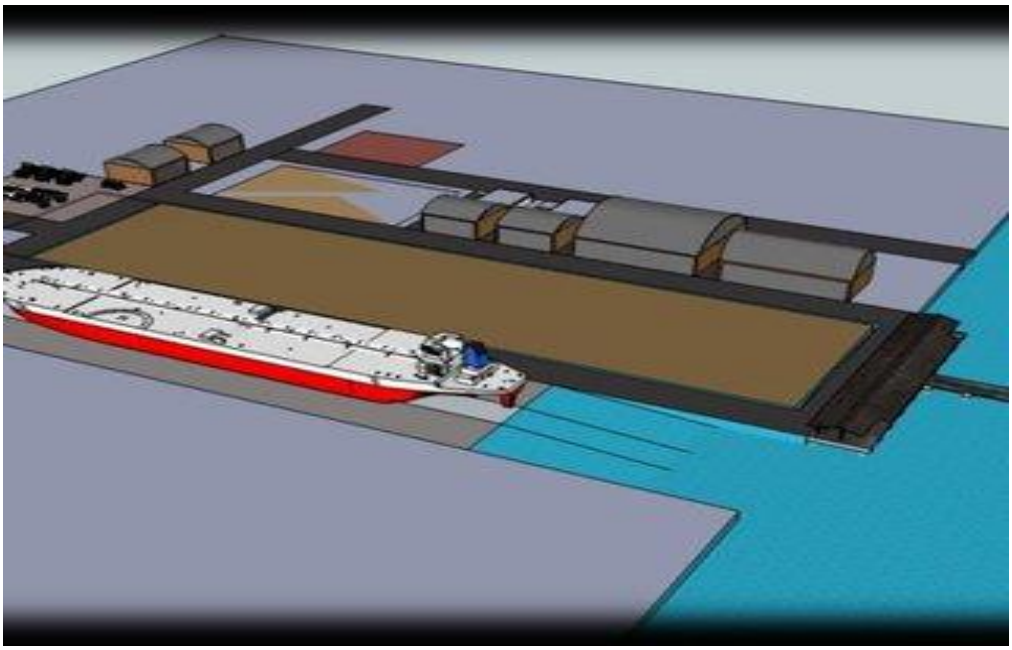

Figure: An ideal ship recycling yard design (source :Jo Sunaryo; Journal of naval architecture & marine engineering.12(1).15)

An ideal ship recycling yard is necessary for sustainable ship recycling practice. The beaching method used for ship breaking in Bangladesh can be upgraded through proper infrastructure, co-ordination, modern technology etc. The initiatives of the PHP ship breaking yard in metropolis ought to be used as associate degree example of fine observe to encourage others to adopt higher practices. Government and Port-Authority ought to implement a collection of national policies that befits international standards associated with environmental safety. Research project methodologies ought to be adopted within the ship breaking industries to stay a watch on the time-to-time impact of ship breaking method on the

setting.

Chapter -5.1 Conclusion

Shipbreaking activities are of significant importance in the national economy of Bangladesh and statistics reveals that the industry is an important sector for the development of Bangladesh, but it has to be regulate through proper legislation, in the management of hazardous heavy metals to control marine pollution in the Bay of Bengal coast. The current national legislative framework is not exhaustive to deal with such significant sector appropriately. Politician and decision maker are so much strong and are involved with the industry. As the presence of heavy metal concentrations at Chittagong coast indicates high concentration of marine pollution and there are no specific government bodies, which specially deal with shipbreaking activities and their pollution. All of the activities regarding shipbreaking and their impacts should formalized and implemented separate legal regulation regarding marine pollution control.

The researchers conclude that heavy metal pollution in this area is at an 'alarming' level. Shipbreaking may be a serious environmental hazard which if the industry is to continue in Bangladesh, efforts must be made to minimize the pollution. For instance, they assert the authorities should use a separate area for the shipbreaking activities, such as a dockyard, to mitigate damage to the coastal environment. The Government should support a study to define the extent and distribution of contamination in and around the shipbreaking yards, and develop an inventory of hazardous wastes (e.g. for the unmarked asbestos dumping grounds). It should identify "hot spots" that require to be cleaned up. It can seek the international organization's expertise and support for this task. The SBC (UNEP) has started a survey in this sense and the Government should ensure they cooperate and access the evidence gathered.

Chapter -5.2 Recommendations

Ship breaking industry is one of the foremost potential industries for the economics development of N Bangladesh. It is needless to mention that it's great impacts on GDP yet. From the above discussions we might wish to recommend some essential points which might increase the growth and working environmental safety of this industry in Bangladesh.

1. Existing laws should be strictly enforced by the government.

2. A sustainable Coastal Zone Management must be adopted to confined ship breaking

industries in a particular area of coast so that it don't have any impact on settlement.

3. The sea shall be kept undisturbed as far as practicable for healthy growth of marine biodiversity and human health. Because, many of the ship-breaking components are highly toxic, persistent and carcinogenic in nature and they prove fatal for aquatic food chain & human health.

4. Government organizations, NGOs, INGOs, Civil society and BELA has to come forward and raise their voice for the environmental protection.

5. The impact of ship breaking industries in Bangladesh is a threat to life, both on and off shore. So a specific zone for ship breaking process should be introduced within the coastal region.

6. Construction of Standard model Ship breaking yard facility should be implemented to release the

hazardous materials within the confines of the yard and then collect the spilled or released materials.

7. There must be provision for on-site and off-site disposal of solid and hazardous wastes.

8. Every ship has to be inspected properly by an expert team, only te ships with toxic gas and

waste free certificate should be allowed to dismantle.

9. Government and Related Authority should implement a set of national policies that

associated with international standards related to environmental safety.

10. Scientific research methodologies should be adopted in the ship breaking industries to

keep an eye on the time to time impact of ship breaking process on environment.

11. For the safety of aquatic lives, disposal of metals and oils into the sea water in any manner must be prevented by the authority and provision for fine or penalty should be incorporated in the environmental conservation rules.

12. High level of metal concentration in the water and sediments around the ship breaking area should be kept in tolerable level for both human and aquatic life.

13. Rules and regulations of International Maritime Organization (IMO) and "Hong Kong international convention for safe and environmentally sound recycling of ships" must be implemented.

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