

**HEALTH HAZARDS AND RISKS OF SHIP BREAKING ACTIVITIES IN
BANGLADESH: AN ENVIRONMENTAL IMPACT ASSESSMENT APPROACH**

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ABSTRACT

Ship breaking activities are facing both challenges and opportunities for coastal zone management in a holistic manner with increase of its demand of raw materials for re-rolling mills and other house hold purposes inspite of various negative impacts on coastal environments in Chittagong of Bangladesh. An attempt has been taken to know the livelihood and health hazards of workers by ship breaking activities with Environmental Impact Assessment (EIA) at Sitakunda industrial area of Bangladesh. The present study was carried out based on both primary and secondary data. It is observed from the study that most of the workers come from poverty stricken regions of Bangladesh, where opportunity of employment is least and also found that 59.59% workers are migrated from different districts and 40.40% are permanently living around the Chittagong area. The socio economic condition of the ship breaking workers indicated that most of the workers are engaged on low facilities and vulnerable by health hazards and diseases. Among them Physical, Mechanical, Biological and Ergonomic and Psychological Hazards are observed as the common hazards of workers as well as associated habitants nearest the breaking yards. The EIA for the ship breaking activities are observed as negative (69.46%) and positive impact (30.14%) from the ratio of EIVs in the study area. Among the negative impacts, the biotic factors (21.05%) followed by abiotic (19.14%), social (14.35%) and economic factors (15.31%) are observed in the study area. On the other hand the social (12.92%) and economic factors (17.22%) are observed as positive impacts of EIA in the study area. Considering the positive role of ship breaking in national economy ship breaking activities cannot be stopped. The study also suggested that a sustainable approach should be taken to minimize the negative impacts of ship breaking activities in the coastal zone of Bangladesh.

Keywords: Ship breaking activities, Hazards, Risks, Sitakunda, Chittagong.

INTRODUCTION

Ship breaking is a challenging process due to the structural complexity of ships with many environmental safety and health issues are involved (OSHA, 2001). The ship breaking activities are being practiced in the coastal areas of Bangladesh and have gained importance

in the macro and micro-economy of poverty stricken Bangladesh. Increasing demand of raw materials for re-rolling mills and other purposes and negative impacts on our coastal environments, ship breaking activities present both challenges and opportunities for coastal zone management in a holistic manner. These activities exemplify both the potentialities and the dangers of an increasingly globalized economy. This activity began in 1969 and since then it has earned a good reputation for being profitable by the cost environmental degradation (Hossain and Islam, 2006). Various refuse and disposable materials are being discharged and spilled from scrapped ships and often get mixed with the beach soil and sea water which in turn has a negative impact on our coastal environment and biodiversity. Moreover, accidents are normal phenomena in the ship breaking yards. Since the last 20 years more than 400 workers have been killed and 6,000 were seriously injured (Muhibullah, 2013). Due to unconsciousness and lack of government patronization, these activities are facing several internal and external problems. Considering all these facts, a distinct and well-balanced policy is necessary for sustainable ship breaking activities in the context of Bangladesh. To assess the various impacts of ship breaking industry including local environment and health of the workers, this type of research or study is urgently needed for the conservation of environment as well as for implementation a sustainable ship breaking policy to progress this activity should be carried out in a planned and hygienic way in Bangladesh.

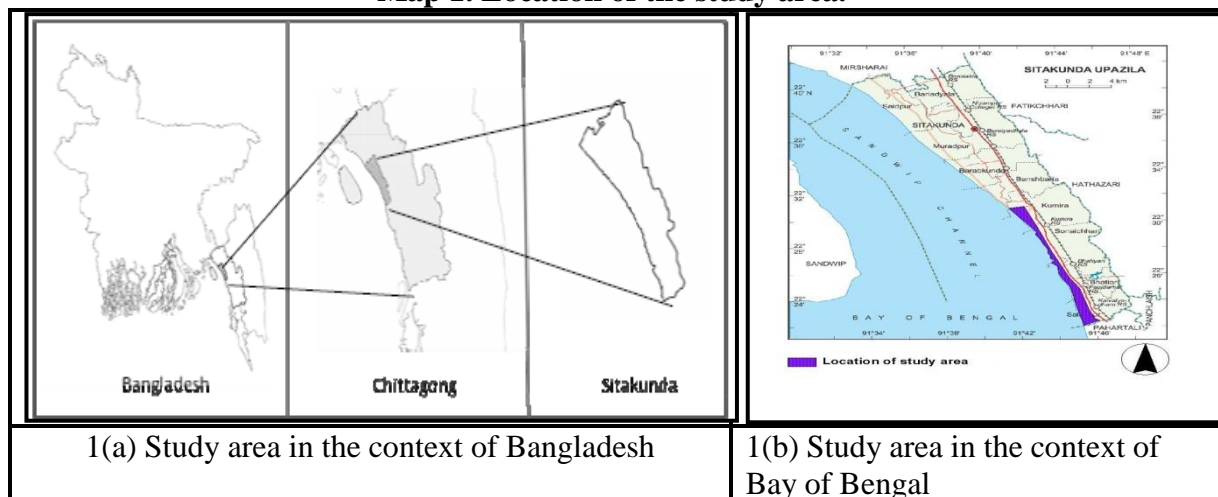
In this perspective, Ship breaking and recycling can be claimed to be a sound sustainable industrial activity. The material composition of a vessel structure, components and systems will reflect the era from when it was built. Similarly, the cargo remains system agents, onboard spares and other consumables will reflect its type and pattern of trade. At the end of operational life, the ship still represents a resource, as a considerable proportion of its lightweight is suited for reuse or recycling. It supplies a substantial quantity of scrap metal for the iron and steel industries as well as it create job opportunity. The tightened environmental regulations in industrialized countries results an increase in cost of disposing hazardous waste. Subsequently, this led to so-called 'toxic traders' exporting hazardous waste to developing countries where the environmental regulations are less stringent with low labor costs, weak regulations on occupational safety, and limited environmental enforcement. This 'global shift' in the industry to countries with comparatively weaker regulatory systems is of particular concern as ships contain many hazards that can have significant detrimental effects on humans and the environment if not dealt with properly. In Bangladesh, ship breaking industry has been turned into a promising sector and has contributed in considerable economic growth. This activity began in 1969 and since then it has earned a good reputation for being profitable but at a great environmental cost (Karim, 2010). Various refuse and disposable materials are being discharged and spilled from scrapped ships and often get mixed with the beach soil and sea water which in turn has a negative impact on our coastal environment and biodiversity. The area is severely degraded with loss of its physical, chemical and biological characteristics. However, the extraction processes required, produce debris and wastes that itself represent a threat to the environment and consequently to human health. Further, the methods adopted in the extraction and demolition processes are suffering from some deficiencies regarding some safety aspects related to the environment and workers. With a view to ensuring this safety, these extraction and demolition processes require sustainable development in term of managerial routines. Bangladesh needs 8 million tons of building materials per year, of which iron is a major component. Moreover, every year the Government collects about 900 core Taka (BDTk) by revenue from ship breaking industry through import duty, yard tax and other taxes (ibid). Considering the increasing demand and the levels of profitability, it is clear that there is a scope for developing more sustainable practices in Bangladesh.

MATERIALS AND METHOD

Selection of the study area

The ship breaking yards in Chittagong range are mainly located along 7 km. long coastline of Sitakunda Upazila. Most of the ship breaking yards of Bangladesh are situated in Sitakunda Upazila of Chittagong District. At present there are about 48 ships breaking yards (36 yards are active and 12 yards are closed) are laying along Dhaka-Chittagong highway which is 10 km. away from the Chittagong city. That's why; the Sitakunda has been taken for the present study (Map. 1).

Map 1. Location of the study area.



Source: Banglapedia, 2008

Objectives of the Study

The main aim of the present study is to know the livelihood and health hazards of workers by ship breaking activities with Environmental Impact Assessment (EIA) at Sitakunda industrial area of Bangladesh. The specific objectives are given as follows:

- 1 To find out the livelihood condition of workers in the ship breaking industrial area.
- 2 To assess the major health hazards and risks of workers due to ship breaking activities in the study area and
- 3 To explore the Environmental Impact Assessment (EIA) for ship breaking activities in the study area.

Data Collection and Analysis

The present study was carried out based on the combination of primary and secondary sources of data. The primary data were collected from various ways namely; direct field observation survey, focus group discussions (FGD), questionnaire survey, expert opinion survey and an Environmental Impact Assessment (EIA) was also conducted during the period of September 2011 to August 2012. There are four FGD have been conducted namely A, B, C and D groups. The group members were chosen from worker and labour, customer, local victims resident and as possible as owner association in the study area. There are about 400 questionnaires were conducted from different stake holders to find out the vulnerability and present condition of workers in the study area. All the questionnaires were conducted from

door to door and face to face. To know some technical aspects and health impacts of ship breaking related activities almost ten experts opinion survey have been incorporated in the present study. Secondary data were taken and incorporated from different books, journals, daily newspapers, magazines, data from City Corporation, CDA, GO and NGO's reports and various published and unpublished materials from different researchers regarding this field. Data collected from the field and secondary sources are imputed and analyzed by MS Word, MS Excel and Statistical Package for Social Science (SPSS). Pearson's product moment correlation (r) formula is used to test the null hypotheses and to check out the relationships between the independent and dependent variables by following the method of Islam (2011).

a. Methods of EIA

For assessments of the identified impacts in the present study, the EIA method proposed by LGED (1992) had been used. The methodology was based on Environmental Evaluation System (EES) developed by Battle Columbus Laboratory in USA and simplified and adopted by LGED for Bangladeshi context. Due to the absence of database of in Bangladesh the existing environmental condition was used as the reference level. The positive and negative Changes in the environmental condition resulting from the undergoing activities *ie.* ship breaking activities have been evaluated. The present impacts as positive or negative were the present reference value and require comparing with the previous values. 'Before and after approach', as a recall method had been used to retrieve the previous reference value. The environmental impacts had been assessed by the Environmental Impacts Values (EIVs) which may be defined mathematically as follows:

$$EIV = \sum_{i=1}^n (V_i) W_i$$

Where,

EIV = Environmental Impacts Value

V_i = Relative change in the value of environmental quality of parameters with respect to the previous situation.

W_i = Relative importance or weight of parameters i

n = Total number of environmental parameters related to the topic of the study

b. Quantification of Environmental Impacts

The beneficial and adverse changes in environmental parameters resulting from the starting of hill cutting in the study area have been expressed in both qualitative and quantitative forms. Both types of impacts have been plotted in 11 points measurement scale (-5 to 0 to +5), the revised method of LGED (1992) to quantify the environmental alterations. The following figure-1 shows the correlation between qualitative statement and proposed quantitative values of environmental changes resulting from the intervention of hill cutting in the study area.

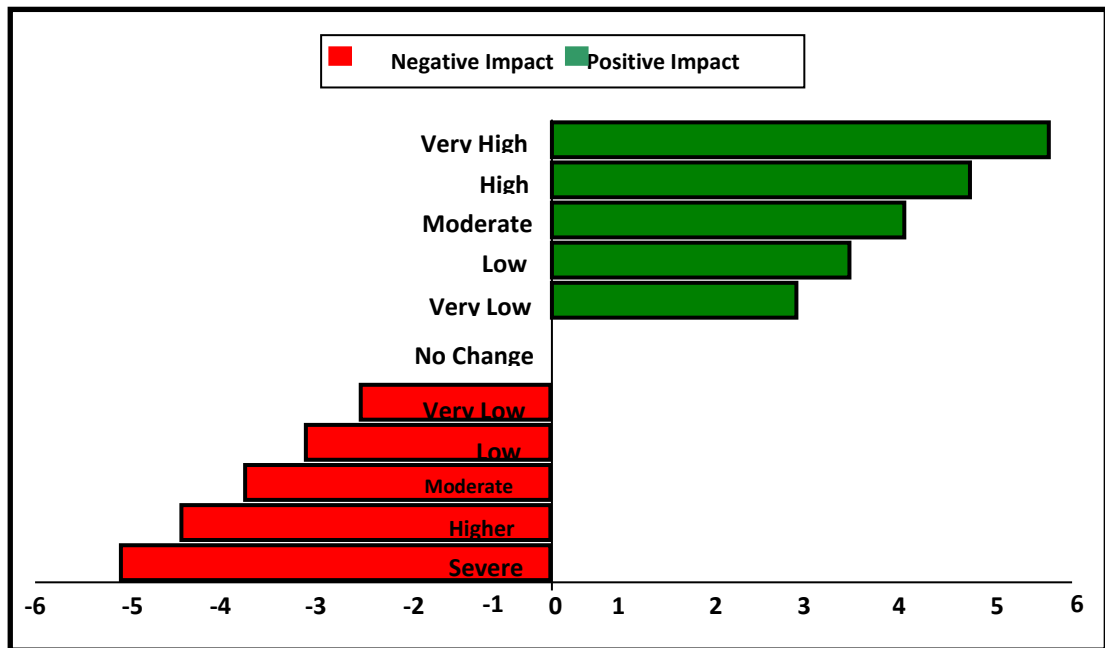


Figure 1 Quantification of qualitative data of EIA for the present study
Source: Revised method for EIA by LGED (1992)

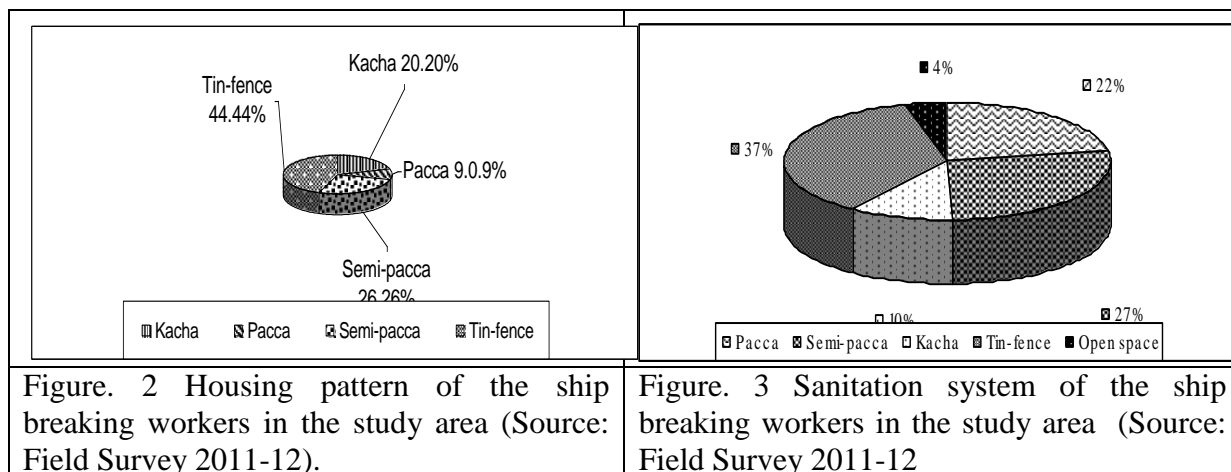
c. Relative Importance Values of Environmental Parameters for EIA

All environmental parameters influenced by fill cutting were not to equal importance or weight. Usually, the importance of the same parameters varies from country to country depending on the environmental concerns of the country. For Bangladesh context disaster, flood, agriculture, unemployment problems, environmental degradation etc. carry more importance than many others do. The environmental and socio-economic factors related to hill cutting have been given different values/weightage following and modifying the 'Relative Importance value of environmental Parameters' developed by LGED (1992) which is shown in the above fig.1. The quantified impact value derived from the 11 points measurement scale (-5 to 0 to +5) has been multiplied by the representing assigned 'Relative Importance Value' to compute the relative impacts of the parameters which are then summed up to obtain the total EIV of hill cutting in the study area.

RESULTS AND DISCUSSION

Livelihood condition of ship breaking workers

(i) **Housing pattern of the workers:** It is observed from the survey that most of houses (44.44%) of the ship breaking workers are tin-fence and followed by 26.26% houses are Semi-pacca (*Semi pacca* houses are made by Bricks and Tin) 20.20% houses are *Kacha* (*Kacha* houses are made by mud or Bamboo) and 9.09% houses are *Pacca ie.*houses are made by Bricks and concrete (Fig. 2). It may be stated that ship breaking workers are living poor housing with unhealthy environment. The following fig.2 has shown as the housing pattern of the ship breaking workers in the study area.



(ii) Sanitation system of the workers: The above fig.3 has shown as the sanitation system of the ship breaking workers in the study area. It is observed from the survey that most of toilet systems (37%) of the ship breaking workers are used to tin-fence as Kacha latrines, 27% are used to Semi-pacca, 22% are used to Pacca and 4% workers are used to open space for their toilet which is not hygienic (Fig. 3)

(iii) Financial facilities and advantage of workers: It is observed from the survey that though majority workers expressed (58%) are getting overtime by their hard work but 17% workers informed that the owners' authority provides minimum medical allowance while 14% workers didn't get less or no financial facilities (Fig. 4).

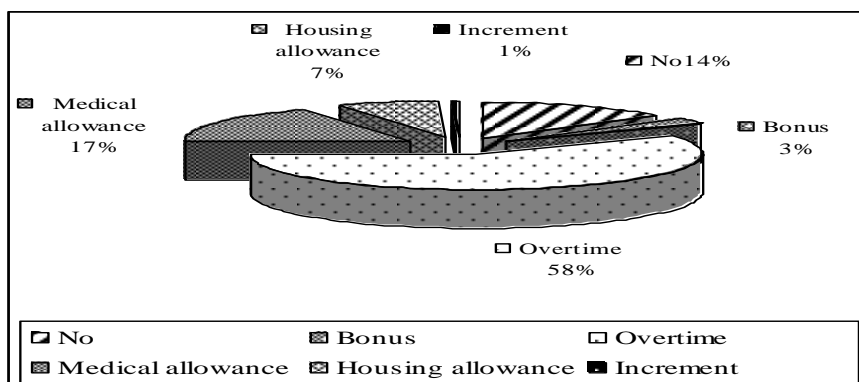


Figure 4: Financial facilities and advantage of the ship breaking workers in the study area
 (Source: Field Survey 2011-12)

(iv) Satisfaction level of workers: In Bangladeshi context, there are five parameters are well known human rights namely, food, clothing, education, living place and medical facilities which are also our constitutional rights. The following Table 1 has shown as the financial facilities and advantage of the ship breaking workers in the study area.

Table 1 Satisfaction level of workers on five essential parameters

Items of Satisfaction	Satisfaction (%)	Un-satisfaction (%)	Acceptable (%)	Poor (%)
Food	21.12	37.37	38.39	3.03
Clothing	13.13	42.43	40.40	4.04

Living place	12.12	32.33	30.30	25.25
Education	5.05	38.39	36.36	20.20
Medical	4.04	40.41	30.30	25.25

Source: Field Survey 2011-12

It is observed from the above Table 1 that huge portion workers are unsatisfied on food (37.37%), clothing (42.43%), living place (32.33%), education (38.39%) and medical facilities (40.41%) in the study area. On the other hand a little portion are observed as satisfied on food (21.12%), clothing (13.13%), living place (12.12 %), education (5.05%) and medical facilities (4.04%) in the study area (Table 1).

(v) Socio-economic conditions of ship breaking workers: To asses the socio economic condition of the workers five parameters area considered in the present study namely, Gender, age, education, occupation and monthly income of the workers in the study area. The socio economic conditions of the ship breaking workers have been shown in the following Table 2.

Table 2 Socio economic characteristics of the ship breaking workers in the study area

Gender			Age			Education			Occupation			Monthly income (Tk)		
Sex	f	%	Age interval	f	%	Education level	f	%	Occupation	f	%	Income range	f	%
Male	27	69.5	21-30	42	10.5	Illiterate	56	14.0	Services	90	22.5	> 1000	32	8.0
Female	12	30.5	31-40	13	34.0	Primary	10	27.0	Business	80	20.0	1000-3000	64	16.0
Total	40	100	41-50	17	44.0	S.S.C	82	20.5	Student	30	7.5	3000-5000	96	24.0
			51-60	30	7.5	H.S.C	64	16.0	Labour	18	45.5	5000-7000	12	30.0
			60+	16	4.0	Degree	52	13	Housewife	16	4.0	7000-9000	56	14.0
			Total	40	100	Masters	38	9.5	Total	40	100	9000+	32	8.0
						Total	40	100				Total	40	100

Source: Questionnaire survey 2011-12 (Here; f = Number of respondents as frequency)

It is observed from the above Table 2 that the male respondents are dominated on the survey. The above table also indicated that about 14% are illiterate followed by primary (27%), SSC (20.5%), HSC (16%) and above degree passed are constituted about 22.5% in the study area (Table 2). In this context, 45.5% people are found as labours and 20% are also observed as ship breaking materials business in the present study (Table 2).

Health hazards and risks of workers due to ship breaking activities

It is observed from the survey that on an average at least a worker died or injured at the spot yards during the working period in every week in the study area. The observed common hazards of hazards and risks of ship breaking activities are divided into five categories namely, serious accident related hazards, Physical Hazards, Mechanical Hazards, Biological hazards and Ergonomic and Psychological Hazards on workers as well as residences nearest the breaking yards in the study area. A list of common hazards that are responsible for injuries and death, diseases and among ship breaking workers in the study area are cited in the following Table 3.

Table 3 Types of hazards and risks of ship breaking activities in the study area

SL No	Major categories of Hazards	Mechanisms of hazards
01	Serious accident related hazards	• Fire and explosion by explosives flammable materials
		• Being stuck by falling materials
		• Compressed between heavy materials
		• Snapping of cables, ropes, chains, slings
		• Handling heavy objects; poor access to progressively dismantled vessels (floor, stairs, passage ways)
		• Falls from height inside ship structures or on the ground
		• Stuck by moving objects
		• Slipping on wet surfaces
		• Sharp materials
		• Oxygen deficiency in confined spaces. Lack of PPE, housekeeping practices, safety signs
02	Physical hazards	• Noise pollution
		• Extreme temperatures
		• Vibration
		• Poor illumination
03	Mechanical Hazards	• Trucks and transport vehicles
		• Scaffolding, fixed and portable ladders
		• Impact by heavy an sharp-edged tools
		• Power-driven hand tools, saws, grinders abrasive cutting wheels
		• Shackles, hooks; chains
		• Cranes, winches, hoisting & hauling equipment;
		• Lack of safety guards in machines
		• Poor maintenance of machinery and equipment.
04	Biological hazards	• Toxic marine organisms
		• Risk of communicable diseases transmitted by pests, vermin, rodents, insects and other animals that may infest the ship
		• Bitten by insects, snakes and others
		• Infectious diseases (TB, malaria, dengue fever, hepatitis, respiratory infections etc.)
	Ergonomic	• Repetitive strain injuries, awkward postures, repetitive and

05	and Psychological hazards	monotonous work, excessive workload.
		• Long working hours, shift work, night work, temporary employment
		• Mental stress, strained human relations (aggressive behavior, alcohol and drug abuse, violence)
		• Poverty, low wages, under age, lack of education and social environment.

Source: Questionnaire survey 2011-12

It is observed from the above Table 3 that several mechanisms area vastly responsible and associated on above mentioned types of hazards on direct workers and local habitants in the study area. Salim (2009) had observed that many factors and issues area correlated on ship breaking accident at Sitakunda ship breaking industrial areas.

Environmental impact assessment (EIA) for ship breaking activities in the study area

Environmental Impact Assessment (EIA) is the systematic study, assessment and reporting of the beneficial and adverse changes in environmental resources or values resulting from a proposed program, plan or project, including a plan for dealing with the negative impacts (LGED 1992). The process of EIA may also include a monitoring plan to observe the performance of the environment from degradation. In the present study, the EIA impacts have been identified both qualitatively and quantitatively from the study area. For the assessment of the magnitude of the impacts, the qualitative data have been converted into quantitative form.

1. Logic development for quantifications of impacts: Following the 11(+5 to 0 to -5) point quantified scale developed by LGED (1992), both qualitative and quantitative parameters derived from hill cutting related activities are quantified. For the quantification, the following assumptions were considered during logic development of EIA.

- In case of qualitative parameters the value of degree of impact was assigned to them individually depending on the significance.
- For respective quantitative parameters, every 10% change was considered as 1-point change in the 11(+5 to 0 to -5) point scale and the developed logics are described below:

- **The abiotic factors of environmental parameters:** The abiotic factors of urban environmental parameters are considered for EIA as soil quality with fertility, Air and Water quality in the study area.

(i) **Soil quality with fertility:** In the study area, about 80-90 % respondents reported that due to ship breaking related pollutions and contaminations, soil qualities with fertility have been reduced that has affected the surface topography and vegetation on lands, resulting in reduced crop production, less grown-up greeneries, dying of fruit and medicinal plants and decreases of plantation agriculture in the study area. All this negative impacts have exposed to the local hill habitants as a deplorable condition. Considering all these things the impact may be measured as ‘higher’ in the study area with quantified impacts value of (-4).

(ii) **Air and water quality:** In the study area, about 85% respondents reported that due to ship breaking related pollutions and contaminations, air and surface water

qualities have been reduced that affected on the health of the local habitant. Considering the above aspects, the impact can be evaluated as 'Moderate' of air quality and 'higher' of water quality in the study area with quantified impacts value of (-3) and (-4) respectively.

- **The biotic factors of environmental parameters:** The biotic factors of environmental parameters are considered for EIA as vegetation coverage, animal life and forests with biodiversity in the study area.
 - (i) **Vegetation coverage:** In the present study, about 80-90% respondents of the study area reported that huge vegetation coverage are declined due to ship breaking pollution. It is also observed that many plant species are going to be disappeared by these types of activities. So, the impacts on vegetation coverage of hills can be evaluated as 'higher' in the study area with quantified impacts value of (-4).
 - (ii) **Animal life:** In the present study, about 78% respondents of the study area reported that a large quantity of animal species with many wild lives on Sitakunda area completely declined due to various pollutions of ship breaking activities. It is also observed from the survey that many animal species have already been disappeared as well as several species are struggling to sustain with their present living atmospheres into the local environments in the study area. Considering the above aspects, the impacts animal lives may be evaluated as 'Higher' in the study area with quantified impacts value of (-4).
 - (iii) **Forest with biodiversity:** In the present study, about 70-80% respondents of the study area reported that a large amount of local forest is lost in every year as well as loss of biodiversity due to ship breaking contamination. The present study has also observed that the local Biodiversity is huge disturbed through imbalance among the flora and fauna components by this activity. So, the impacts on hilly forests with biodiversity can be evaluated as 'higher' in the study area with quantified impacts value of (-4).
- **The Social Parameters of EIA for the study:** The social parameters are considered for EIA as gender issue, education, occupation, health and nutrition in the study area.
 - (i) **Gender issue:** It is observed from the field survey that the male people are more involved on ship breaking activities than the female but the female is comparatively more affected by various social problems in the study area. Carefully, considering the extent and magnitude of the gender issue, the impact has been evaluated as 'low' in the study area with quantified impacts value of (-3).
 - (ii) **Education:** From the study, it has observed that there are remain remarkable difference of concepts and involvement nature of ship breaking activities between educated and illiterate workers in the study area. This difference is significant at secondary, higher secondary, graduate and postgraduate level in the study area. So, the positive impacts of education regarding ship breaking activities may be assessed as 'Moderate' with quantified impacts value of (+3).
 - (iii) **Occupation:** It is observed from the study that there are also a remarkable difference of concepts and involvement nature of ship breaking activities between officials and

workers among the habitants in the study area. So, the positive impacts of occupation regarding hill cutting activities may be assessed with positive as 'Moderate' with quantified impacts value of (+3).

- (iv) **Health issue:** It is observed from the present survey that about 70-87% respondents feel that many health hazards risks with impacts are associated to ship breaking activities in the study area. Among them are mentioned such as breaking of body organs, bitten by insects, skin diseases, respiration problems and breathing problems are observed in the study area. So, the negative impacts on health can be evaluated as 'higher' with quantified impacts value of (-4).
- **The Economic Parameters of EIA for the study:** The economic parameters are considered for EIA as the benefit or profit, land value, household income, Govt. revenue income, employment opportunity related on ship breaking activities in the study area.
- (i) **Benefit or profit:** It is observed from the present study that a huge quantity of economic activities with ship breaking oriented business in the study area. Considering profit return business regarding ship breaking activities may be positive as 'Moderate' with quantified impacts value of (+3).
- (ii) **Land value:** In the present study observed through investigation and concerned officials that the entire area land price is radically increased due to ship breaking activities in the study area. So, the negative impacts on urban land value and price can be evaluated as 'higher' with quantified impacts value of (-4).
- (iii) **Household income:** It is observed that among the poor habitants are engaged as workers, day labours, Rickshaw driving, house workers and also unemployed people are found in the various slums in the study area. On the other hand, several groups of merchants' business men and officials are found in the study area. So, there is gap between the household income among the poor and rich people as the hill habitant that reflected as a negative impacts on the whole urban society as well as on middle class civil society in the study area. So, the impacts on household income are assessed as 'higher' with quantified impacts value of (-4).
- (iv) **Govt. revenue income:** It is observed from the revenue office of Chittagong that Govt. revenue income gradually is increasing as parallels on increasing of land price and value through huge transactions of buy-sell of commercial activities and businesses in the study area. So, the positive impacts on revenue income are assessed as 'high' with quantified impacts value of (+4).
- (v) **Employment opportunity:** It is observed from the present study that a scope of good employment opportunities related to ship breaking activities in the study area. Among them are mentionable as offices staffs of various private company, retail business, shop keepers, self business and employee as direct worker, supervisor at field level in the various projects are observed in the study area. So, the positive impacts on employment opportunities are assessed as 'Moderate' with quantified impacts value of (+3).

2. Matrix for impact assessment of ship breaking activities on environment: Based on developed logic, the following the matrix has been developed to reflect as the impacts of ship breaking activities in both qualitative and quantitative forms. The impacts have been grouped into three categories- abiotic, biotic parameters of environment, social and economic parameters for the impact of ship breaking activities on local environment has shown in the following Table 4.

Table 4 Matrix for (EIA) impacts of ship breaking activities in the study area

SL	Factors	Parameters	Sitakunda ship breaking area (Study area)		
			EIA scale⇒	+Ve	0
01	Abiotic factors	Soil quality with fertility	— — — —	— — —	‘Higher’ (-4)
		Air quality	— — — —	— — —	‘Moderate’ (-3)
		Water quality	— — — —	— — —	‘Higher’ (-4)
02	Biotic factors	Vegetation coverage	— — — —	— — —	‘Higher’ (-4)
		Animal life	— — — —	— — —	‘Higher’ (-4)
		Forest with biodiversity	— — — —	— — —	‘Higher’ (-4)
03	The Social factors	Gender issue	— — — —	— — —	‘Moderate’ (-3)
		Education	‘Moderate’ (+3)	— — —	— — — —
		Occupation	‘Moderate’ (+3)	— — —	— — — —
		Health issue		— — —	‘Higher’ (-4)
04	Economic factors	Benefit or profit	‘Moderate’ (+3)	— — —	— — — —
		Land value	— — — —	— — —	‘Higher’ (-4)
		Household income	— — — —	— — —	‘Higher’ (-4)
		Govt. revenue income	‘High’ (+4)	— — —	— — — —
		Employment opportunity	‘Moderate’ (+3)	— — —	— — — —

Source: EIA survey 2011-12

3. Assessment of Environmental Impact Values (EIVs) on hill cutting: Adopting the LGED model (1992) and modifying it in to fit with specifically ship breaking activities, EIVs in the study area has been calculated by multiplying the degree of impact values with the relative importance value are shown in the following Table 5.

Table 5 Environmental Impact Values (EIVs) of ship breaking activities in the study area

SL No	Factors	Parameters	Relative Importance value	EIV for the study area			EIV Score value
				Degree of impact	Relative impact		
					+Ve	-Ve	
01	Abiotic factors	Soil quality with fertility	4	(-4)		-16	-40
		Air quality	4	(-3)		-12	
		Water quality	4	(-4)		-12	
02	Biotic factors	Vegetation coverage	3	(-4)		-12	-44
		Animal life	4	(-4)		-16	
		Forest with biodiversity	4	(-4)		-16	
03	The Social factors	Gender issue	2	(-3)		-6	-3
		Education	4	(+3)	+12		
		Occupation	5	(+3)	+15		
		Health issue	6	(-4)		-24	
04	Economic factors	Benefit or profit	4	(+3)	+12		+4
		Land value	3	(-4)		-12	
		Household income	5	(-4)		-20	
		Govt. revenue income	3	(+4)	+12		
		Employment opportunity	4	(+3)	+12		
Total EIVs					+63	-146	-83

Source: EIA survey 2011-12 and summarization of Table 4

DISCUSSION

The above table 5 stated that the overall EIVs of factors and parameters are observed as negative (-83) in the study area. The EIVs for ship breaking is negatively highest of Biotic factors and parameters (-44) followed by abiotic factors and parameters (-40) and The Social factors and parameters (-3) in the study area (Table 5). On the other hand, only economic factors showed in favour of positive impacts (+4) in the context of study area (Table 5). So, the above Table 5 also revealed that the sum-up of the EIVs is observed as negative impacts in the whole study area. The ratios with percentage of negative and positive impacts for different parameters of EIVs are shown in the following Table 6.

Table 6 Negative and Positive impacts ratio for different parameters of EIVs

Impact nature	Parameters	Total EIVs	Percentage of EIVs (%)
Positive (+Ve)	1. Abiotic factors	0	0
	2. Biotic factors	0	0
	2. Social factors	+27	12.92
	3. Economic factors	+36	17.22
	Sum of positive impacts	+63	30.14
Negative (-Ve)	1. Abiotic factors	-40	19.14
	2. Biotic factors	-44	21.05
	2. Social factors	-30	14.35
	3. Economic factors	-32	15.31
	Sum of negative impacts	-146	69.86
TOTAL(positive & negative)		209	100.00

Source: Summarization of Table 5

It is observed from the above Table 6 that among the total impacts (100%), the negative impact is observed 69.46% and positive impact is found 30.14% from the ratio of EIVs in the study area. Among the negative impacts, the Biotic factors and parameters (21.05%) followed by abiotic factors and parameters (19.14%) and The Social factors and parameters (14.35%) and economic factors and parameters (15.31%) observed in the study area (Table 6). On the other hand, the biotic factors and parameters (0%) followed by abiotic factors and parameters (0%) and The Social factors and parameters (12.92%) and economic factors and parameters (17.22%) observed in the study area (Table 6).

CONCLUSION

The ship breaking activities is treated as a profitable business activity with an important source of raw materials of scrap iron and steel industries in Bangladesh. Recently, it is declared as an industry but still there is no separate guideline or rules for ship breaking activities in Bangladesh. As a result, there are often occurred accidents, loss of valuable lives and serious violation of laborers rights. On the other hand, ship breaking activities impacts on biodiversity and environment which are matter of exploration. All the workers done their works manually and sometimes the workers are forced to work more than their capacity in a short time, which causes major or minor accidents very often. There is no good arrangement for pure drinking water, healthy food, hygienic toilet and living place for workers. The present study also revealed that the entire scrapping process remains manual where worker's safety is jeopardized by a near-total absence of precautions and planning. Usually, these workers carry weights far above the limit prescribed in the industrial Act and rules. There is no training for workers about the dismantling process and no safety measures. So, workers are not aware of hazards to which they are exposed. It is found that the beaches, where ship breaking takes place are strewn with chemicals and toxic substances, small pieces of pointed and sharp iron splinters pasted on the surface of the beach causing injuries. The ship breaking plan should ensure the occupational safety and health protection for the workers so that the death and injury by accidents, work place related diseases would be reduced in a minimum level. It is also observed from the study that it has huge negative impacts on coastal fishermen and workers of the ship yards. The ship breaking activities contaminate the coastal soil and sea water environment and thus impair ecological siftings. Considering the positive

role of ship breaking in national economy ship breaking cannot be stopped. So, a sustainable approach should be taken to minimize the negative consequences and impacts of ship breaking activities in our coastal zone. The following steps should be taken for sustainable practice of ship breaking activities in Sitakunda ship breaking industrial area in the context of Bangladesh.

ACKNOWLEDGEMENT

The authors are gratefully acknowledged to University Grant Commission (UGC) of Bangladesh for research grant to conduct the present study peacefully.

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