

Occupational Hazards of the Shipbuilding Industry in Bangladesh

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SUMMARY

The objective of the study is to examine the determinants of occupational hazards of a private shipbuilding industry in Bangladesh. The number of respondents was 190. The study venue and samples were selected purposively. Respondents were interviewed with the help of prestructured questionnaires. Descriptive statistics and multiple regression model have been used to identify the determinants of occupational hazards. Determinants were personal habits, personal protective equipment, residential status, overtime, health status and types of workers. It is found that personal protective equipment and health status have influence to reduce occupational hazards while personal habits and types of workers have no direct association with the occupational hazards. On the contrary, variables like overtime and residential status can increase the occupational hazards. The outcomes of the study will assist to accelerate the shipbuilding industry to expand the economic growth of the country and further research also.

Keywords: Private shipbuilding industry, occupational hazards, regression, Bangladesh.

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INTRODUCTION

Ship building industry is a progressive industry of Bangladesh. In Bangladesh, 1,50,000 skilled and unskilled peoples are involved in the ship building industry. Besides this, 20,00,000 peoples are also linked with this sector through different channels (Nazrul, 2021). There are some prominent shipbuilding industries in Bangladesh. These shipbuilding industries are able to make ocean going ships which have 10 thousand MT carrying capacity (ibid). Bangladesh had to face many hurdles in the past to make ocean going ships. Once upon a time, Bangladesh was a sea vessels importer country but now it can build ships domestically. The shipbuilding industry of Bangladesh is now a competitor with India, China and Vietnam. The foreign buyers are showing interest to import ocean going ships from Bangladesh. The present economic environment of Bangladesh is favourable to export ships. It is expected that the shipbuilding industry can earn \$4 billion by exporting ocean going ships to different countries (Anonyms, 2021). It is noted that the shipbuilding industry is comparatively more prosperous than the readymade garment industries and may be stood as the 2nd major source of foreign currency of Bangladesh. For this reason, the government of

Bangladesh is going to establish a slogan “from shirt to ship” in the world (Anonyms, 2020) and economic development of the country. The government of Bangladesh has declared to develop this industry as a “prosperous sector” to meet the future national demand of the country (Nazrul, 2021).

The ship building industry is a risky place and workers of this industry face many occupational hazards. Occupational hazards cause or contribute to the premature deaths of millions of people worldwide and it results in ill health or disablements of hundreds of millions of people. Globally occupational risks have been classified as the 10th leading cause of mortality and morbidity. The burden of disease from selected occupational risk factors accounts to 1.5% of the global burden in terms of disability adjusted life year lost (WHO, 2020). A survey (Odhikar, 2020) statistics showed that there were 20 cases of deaths due to accidents and injuries, 27 workers were seriously ill due to inhalation of toxic agents and workers were suffered from different distant illness. Shipbuilding industry of Bangladesh is a growing up industry and the development of this industry is similar to the readymade garment industry of the country (Anonyms, 2020). Shipbuilding industries in Bangladesh may face difficulties to compete with others in the world ship building market due to the presence of occupational

hazards. As the ship building industry of Bangladesh is a flourish one (Nazrul, 2021), the study of determinants of occupational hazards of workers in the ship building industry of Bangladesh will be helpful for the policy makers to formulate a future human resource policy of the ship making industry in Bangladesh and elsewhere.

LITERATURE REVIEW

The study (Barlas, 2012) considered that occupational health should be integrated with the general health services. It investigated (ibid) the Turkish shipyard fatalities for a span of 10 years between January 2000 and July 2011. The AHP technique was used by the study. Five precautions were determined for each of fatal accident group.

The study of (Hossain and Chowdhury et.al, 2008) conducted their study about the occupational health hazards of ship scrapping workers at Chittagong coastal zone, Bangladesh. Most of the workers were found to suffer from multiple disease and health hazards.

Another study (Yilmaz and Celebi et.al., 2015) has been done for analyzing occupational accidents at Tuzlaq, Turkey. The study revealed that 13 major accidents and 87 minor accidents happened in the shipyard. Both employees and employers should fulfill their respondents for occupational health and safety.

Study of Vaishali (2014) was carried out with an aim to assess the health profile of workers in the ship building industry and assess the occupational health issues related to the ship building. The important observations were those of prevalence of addictions, irregular use of personal protective equipment, presence of hypertension, overweight, hearing loss and poor safe care. Health, hygiene and safety education to the workers regarding occupational hazards and lifestyle diseases along with more emphasis on the use of personal protective equipment with regular health examination needs reinforcement (ibid).

The research works of (Iqbal, Zakaria and Hossain, 2010) discussed the problems and prospects of ship building industries in Bangladesh. It was a descriptive type study based on secondary data. The study found that human resource, marketing policy, delivery, infrastructure, health, safety and environmental problems are the major barriers of the ship building industries in Bangladesh. It was suggested by the researchers to solve those problems as soon as possible to avoid the interruptions of the economic development again and again.

The purpose of the paper (Hossain, Nur and Jaradat, 2016) was to identify and evaluate the hazards of the Khulna Shipyard in Bangladesh. The Preliminary Hazard Analysis (PHA) was developed to find out the potential hazards and hazardous events of workers' health and safety. The study analyzed the risk reduction measures and recommendations were done to strengthen the workplace safety.

Rahman (2017) appraised the ship building prospects of Bangladesh. It observed the ship building

opportunities in the context of global facet, regional facet, and national facet including local ship building. The study also demonstrated the deficit and challenges in local ship building industries in the context of financing, absence of linkage industries, maritime policy, inter shipyard rivalry, negligence of safety and welfare, scarcity of site and infrastructure. The study expected that Bangladesh government needs to develop integrated comprehensive maritime policy for the sustainability of the ship building sector meaningfully.

The objectives of the study of (Saki, Ali and Martuza, 2019) were to examine the present condition of ship building industries in Bangladesh. The study also underlined the infrastructure and financial problems of the ship building industry in Bangladesh. They had recommendations for the public and private sectors to improve the ship building industry and create the demand for the "made in Bangladesh ships" in the world market.

It is evident from the above discussions that various studies have been conducted in different countries including Bangladesh from different perceptions. The current study examines the influence of residential status, health status, personal habits, and types of workers, personal protective equipment and overtime on the occupational hazards of the workers in a private shipbuilding industry. There is no such study conducted on this perception. Therefore, the actual results of determinants of occupational hazards of shipbuilding industries were unclear in previous studies which raises a question of research of such studies. Probably, further research was also suggested by Hossain, Nur and Jaradat (2016) for this reason. The current study can fill up the above research gap.

MATERIALS AND METHODS

Place of study

The place of study is Western Marine Shipyard (WMS). The shipyard is located at the Patiya Upazila, 20 km away from the City of Chittagong.

Site selection

There are many private and public shipbuilding industries in Bangladesh. The Western Marine Shipyard is the second largest private ship making industry of Bangladesh (Anonyms 2021). The site of the study has been selected purposively.

Sample size

The number of employees of the shipyard is around 3500 (Anonyms 2021). The size of sample was 190. The selected respondents were twenty years and above aged

workers of the WMS. The selection of the sample was done by following the convenient type of sampling.

Study data

Both primary and secondary data were collected. Primary data came from field survey. The secondary information was gathered from different journals, newspapers and websites.

Research instrument

The study was conducted with the help of pre structured survey form. Data were collected from the respondents by conducting face to face interview. Before the interview, verbal consent was taken from the respondents mentioning the objectives of the study.

Analysis technique

Both descriptive and quantitative methods have been used to analyze data. The analysis was done by SPSS version 23.

The Model

The model which has been considered in this work is that the occupational hazard (Y) as dependent variable and it is dependent on a number of independent factors such as types of workers (X_1), workers' personal habits (X_2), overtime (X_3), residential status (X_4), personal protective equipment (X_5) and health status (X_6). The proposed model that would determine the impacts of independent variables on the occupational hazards is as follows:

$$\text{LnY} = f(\text{LnX}_1, \text{LnX}_2, \text{LnX}_3, \text{LnX}_4, \text{LnX}_5, \text{LnX}_6) \dots(1)$$

The present study is based on qualitative data. It is necessary to apply score to convert qualitative data into quantitative for the descriptive and quantitative analysis. In this context, various previous relevant studies and logical expressions have been observed (Yasmin and Alam 2006; Mishra, 2020). It is also seen (ibid) that no consistent rules or concepts were adopted to score the variables for the purpose of such data conversion. It has been thus applied different scores to convert qualitative data into quantitative values on the basis of relevant past studies and logical expressions to reach the objective of the study. Similarly, the procedures of variables' selection and assumptions have been done by acquiring experiences from the related previous studies (ibid). The background of the variables' selection, assumptions and scores are found in Table-1. It has been performed logarithmic converter for the multivariate analysis in the above equation (1) and the reason of use the logarithmic converter in multivariate analysis can be found in (Yasmin and Alam, 2006; Mishra, 2020; Ashraf, Arafin and Kibria, 2016).

Table -1
Background of variables selection, assumptions and measurements criteria

Variables	Describe	Scores	Measurement Criteria	Basis
X_1 (Types of workers)	Employment status seems to be significantly associated with occupational hazards. It is expected that permanently employed workers become more loyal to the organization and also responsible than others. If the permanent work employment increases, the occupational hazards will decrease and vice versa.	3 2 1	Permanent Temporary Part-time	Number of workers
X_2 (Personal habits)	Personal habits such as smoking, drug addiction of workers have very close association with the occupational hazards with minor exceptions. If personal habits of the workers	4 3 2 1	No habit Betel leaf & smoking Smoking Betel leaf	Preference of habits

	increase, the occupational hazards will also increase and vice versa.			
X ₃ (Overtime)	Overtime work is an extra source of income. Workers expect overtime to maintain the living standard smoothly. But overtime work can create mental and physical stress which may cause various accidents. So, if overtime work increases, the occupational hazards will also increase and vice versa.	1 2 3	1-2 hour 2-4 hr. >4 hr.	Preference of higher overtime working hour
X ₄ (Residential status)	The life style of workers is also effected by residential status. The lives of workers become comfortable if the residence of workers are accommodated with well-structured residence. A comfortable life able to motivate workers to work enthusiastically and attentively. If the residential statuses of workers become comfortable, the occupational hazards will decrease and vice versa.	3 2 1	Dormitory Home Others	Accommodation criteria
X ₅ (PPE)	The use of Personal protective equipments (PPE) in any industrial work is very important. The proper use of PPE declines the various accidents during the working hours. If the uses of PPE increase, the occupational hazards will decrease and it is inversely true.	6 5 4 3 2 1	Helmets Goggles Gloves Ear plugs Gas masks Aprons	Highest number of PPE used by the respondents
X ₆ (Health status)	Health is wealth. A healthy worker can take burden of work pressure and move from one work to another without boring and fatigue. These symptoms are inverse in case of unhealthy workers. So health status is an important indicator of occupational hazards. It is assumed that healthiness of workers can decrease occupational hazards where unhealthy workers can increase the occupational hazards. Therefore, if healthy workers increase, the occupational hazards will decrease and vice versa.	2 1	No health problems Health problems	Health status
Y (Occupational hazards)	Shipyards are places where ships are repaired and built. The government of Bangladesh has considered it as the “thrust sector” for the development of economy of the country (Rahman 2017). But the ship building industry is a risky place and it can be faced many occupational hazards such as chemical, physical, psychological and mechanical hazards of the workers. So, occupational hazards have been taken as dependent variable of the study.	1 2	No occupational hazards Occupational hazards exist	Purposively

RESULTS AND DISCUSSION

Descriptive analysis

On the basis of employment status, 47.4% workers were permanent. In this organization, the remaining workers were temporary (40%) and part time (12.6%) respectively (Table 2-1).

*Table 2-1
Types of workers*

Items	Frequency	Percent	Valid Percent	Cumulative Percent
Valid PT*	24	12.6	12.6	12.6
TE*	76	40.0	40.0	52.6
PE*	90	47.4	47.4	100.0
Total	190	100.0	100.0	

*PT-Part time, *TE-Temporary, *PE-Permanent

The prevalence of addictions is also responsible for the occupational hazards. It is found that most of the respondents' (44.7%) had smoking habits (Table 2-2). Besides this, consumption habits of betel leaf (18.9%) and smoking and betel leaf (19.5%) were also visible among the respondents (Table 2-2). Similar observations such as alcohol addiction, smoking and tobacco consumption habits were also identified in the study of Vaishali (2014).

*Table 2-2
Personal habits*

Items	Frequency	Percent	Valid Percent	Cumulative Percent
Valid BL*	36	18.9	18.9	18.9
SM*	85	44.7	44.7	63.7
BS*	37	19.5	19.5	83.2
NO*	32	16.8	16.8	100.0
Total	190	100.0	100.0	

*BL-Betel leaf, *SM-Smoking, *BS-Betel leaf & smoking, *NO- No habit

Normally, in the Western Marine Shipyard, the duration of work for workers was 8-10 hours. However, 2-4 hours overtime was done by 74.7% workers while 24.2% and 1.1% workers conducted overtime 1-2 hours and 4 hours⁺ also (Table 2-3).

Table 2-3
Overtime hour

Items	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1-2H*	46	24.2	24.2	24.2
2-4H*	142	74.7	74.7	98.9
>4H*	2	1.1	1.1	100.0
Total	190	100.0	100.0	

*H-hour;

Among the workers, 74.7% lived in their own house, 13.2% lived in dormitories and the rest had other residential facilities (Table 2-4).

Table 2-4
Residential Status

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid MS*	23	12.1	12.1	12.1
HM*	142	74.7	74.7	86.8
DR*	25	13.2	13.2	100.0
Total	190	100.0	100.0	

*MS-Miscellaneous, *HM-Home, *DR-Dormitory

The negligence of the use of PPE (Yilmaz et. al. 2015) revealed an alarming fact of a previous study. In the Western Marine Shipyard, all the workers use personal protective devices for protection purposes. It is

found that majority of the workers wear helmets (20%) which are followed by goggles (18.9%), gloves (16.8%), ear plugs (16.3%), gas masks (14.7%) and aprons (13.2%) respectively (Table 2-5).

Table 2-5
Personal protective equipment(PPE)

Items	Frequency	Percent	Valid Percent	Cumulative Percent
Valid AP*	25	13.2	13.2	13.2
GM*	28	14.7	14.7	27.9
EP*	31	16.3	16.3	44.2
GL*	32	16.8	16.8	61.1
GO*	36	18.9	18.9	80.0
HL*	38	20.0	20.0	100.0
Total	190	100.0	100.0	

*AP-Aprons, *GM-Gas mask, *EP-Ear plug, *GL-Gloves, *GO-Goggles, *HL-Helmets

It is detected that neurological disease were prevalent more among the workers (10%) while all other forms of diseases like cardiovascular disease (1.58%), respiratory disease (8.42%), gastrointestinal disease (4.74%), skin disease (5.26%) and others (4.21%) etc. were also found among the workers (Table 2-6). However, about 65.8% respondents had no disease

(Table 2-6). About 24.8% workers were found hypertensive, 12.8% had diabetes, 9.6% had dyslipidemia and 1.1% had obstructive lung diseases which were observed in a study (Kalyani, Bicholkar, and Cacodcar et. al., 2019). It can be inferred that ship building workers suffer several occupational health problems.

Table 2-6
Health status

Items	Frequency	Percent	Valid Percent	Cumulative Percent
Valid HP*	65	34.2	34.2	34.2
NHP**	125	65.8	65.8	100.0
Total	190	100.0	100.0	

**NHP-No health problem

* HP-Health problem & it includes Respiratory disease (8.42%), Cardiovascular disease (1.58%), Neurological disease (10%), GIT disease (4.74%), Skin disease (5.26%), others (4.21%);

About 57.4% of the respondents felt that the working environment was hazardous for them and 42.6% did not feel hazards during work (Table 2-7). Respondents complained during the field survey that they faced

physical hazards, chemical hazards, psychological hazards and mechanical hazards in their shipyard. Similarities are also observed in (Yilmaz et. al. 2015; Vaishali, 2014).

Table 2-7
Occupational hazards

Items	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes*	81	42.6	42.6	42.6
No**	109	57.4	57.4	100.0
Total	190	100.0	100.0	

*Yes-Occupational hazards **No-No occupational hazards

Results of Regression

The AR^2 value of multiple regression analysis is 0.746 and significant at 1% level of significance (Table 3-1). It indicates that the variables included in the model are reasonably accurate. The corresponding F-statistics is 93.758 (Table 3-2). The positive regression coefficients of the model indicate the direct relation or positive contribution to create occupational hazards of the workers. On the other hand, negative values of regression coefficients indicate no direct relationship or inverse relationship with the occupational hazards of the workers of the shipyard.

Table 3-1
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.869 ^a	.755	.746	.17305

a. Predictors: (Constant), LnX1, LnX2, LnX3, LnX4, LnX5, LnX6

Table 3-2
ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.846	6	2.808	93.758	.000 ^b
	Residual	5.480	183	.030		
	Total	22.326	189			

a. Dependent Variable: LnY

b. Predictors: (Constant), LnX1, LnX2, LnX3, LnX4, LnX5, LnX6

Table 3-3
Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.785	.034		23.148	.000
	LnX ₁	-.493	.108	-.514	-4.550	.000
	LnX ₂	-.545	.069	-.711	-7.902	.000
	LnX ₃	.515	.081	.454	6.375	.000
	LnX ₄	.681	.087	.558	7.832	.000
	LnX ₅	-.234	.109	-.396	-2.154	.033
	LnX ₆	-.064	.081	-.062	-.794	.428

a. Dependent Variable: LnY

It is seen in Table 3-3 that the regression coefficient of types of workers (X_1) is $-.514$ which is significant but the coefficient has negative impact on the occupational hazards. It is assumed that there is no direct relationship between types of workers and occupational hazards.

The regression coefficient of personal habits (X_2) has no effect on the occupational hazards (Table 3-3). The regression coefficient (-0.711) is negative and significant at 1% level of significance. It is evident that the shipyard premise is completely smoking free zone and workers always reluctant to take betel leaf and smoking during the working hours. It is, perhaps, this

variable could not create any occupational hazards in the area of shipyard.

The factor overtime (X_3) has positive and significant effect on the occupational hazards. The regression coefficient is 0.454 and t-value indicates the 1% level of significance (Table 3-3). This means if overtime increase by 1, occupational hazards will increase by 0.454 and vice versa Overtime is essential to increase income of the workers but it can also induce mental and physical stresses of workers. So occupational hazards can be occurred due to overtime.

The regression coefficient of housing conditions (X_4) is positive (0.558) and significant at 1% level of significance (Table 3-3). It means that if the regression coefficient of housing conditions increase by 1, occupational hazards increase by 0.558 and vice versa. The infrastructure of residence is an important factor of workers' motivation. A well-structured housing condition ensures workers to enjoy comfortable life which can help workers to perform their works enthusiastically and this is inversely true also. The living conditions of the respondents are assumed to be not comfortable. The housing structures of the respondents are semi structured with minor exceptions which were found during the field study. Therefore, the existence housing conditions of the respondents increased the occupational hazards drastically.

The use of PPE (X_5) is essential factor for the sustainability of industrial working environment. The use of PPE can reduce occupational hazards. It is seen in Table 3-3 which the regression coefficient (-0.396) of PPE on occupational hazards is significant at 5% level of significance and it has negative impact. Thus it can be inferred that if, the use of PPE increase by 1, the occupational hazards decrease by 0.396 and vice versa.

The ill health is the root of many accidents in the working premises. The occupational hazards increase if the diseases of workers increase. It is seen in Table 3-3 that the regression coefficient (-0.062) of the health status (X_6) of workers is negative. It means that if the number of healthy workers increases by 1, occupational hazards may be decreased by 0.062 and vice versa. It is possible since number of healthy workers is comparatively higher than the number of unhealthy workers in the study respondents. However, the magnitude of the regression coefficient is weak since the regression coefficient is not significant

LIMITATIONS

1. The study was conducted on only 190 workers of the shipyard. So, result may not reflect the whole scenario of the occupational hazards of all the workers.
2. Category of work was not fixed. Workers had to perform different types of works according to the needs.

CONCLUSION

The findings of the research work are consistent with the expectations in the context of types of workers, overtime, personal protective equipment and health status. However, personal habits and residential status are found exceptions to the assumptions. The outcomes of personal habits and residential status of workers of the present study may be a scope for the future research work in the context of shipyard industries.

RECOMMENDATIONS

Following suggestions can improve the occupational hazards of the shipyard.

1. The authority of the shipyard should ensure the use of personal protective equipment for all their workers.
2. The employment of permanent workers should be increased.
3. It is found that over time increases occupational hazards. The HR administration of the shipyard should take necessary steps by discussing this matter with the workers.
4. The shipyard can arrange housing complex for the workers of the industry so that workers can improve their living status.
5. The health condition of most of the workers is found good but many workers are found unwell also in the study. It is necessary to moderate the existing health care facilities for the welfare of the shipyard workers.

The above proposals may or may not be the best ones rather it can be explorative. The WMS can consolidate these outcomes with their human resource policy. The WMS will also use other hazard analysis tools for the similar data set to check the validity of the result if necessary. Alternately, they can use the same analysis technique by taking similar data for analyzing the hazards of the workplace to find out the acceptability of the outcomes of the study. In this regard, here it lies a huge gateway for further research by the researchers of HRM, public health and others. Finally, the ship builders can consider this case study to reduce the occupational hazards of their industries to make ships in order to play a big role in the economic development of their countries.

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