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OCCUPATIONAL ACCIDENTS IMPACT HEALTH IN SHIP BREAKING INDUSTRY IN INDIA: A CASE OF WORLD'S SHIP BREAKING YARD

KEY WORDS: Industrial Accidents, Migrant Labours, Ship-breaking.

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ABSTRACT

Accidents are common phenomenon in today's advanced and fast growing industrialized countries. Ship breaking industry is one of the important industries which contribute to the economy in the form of revenue, employment and production of steel and also in many other ways. In India 9 ship breaking sites are active, out of which Alang is the world's largest ship breaking yard. Ship breaking industry of Alang employs more than 1.5-2 lakh labourers directly or indirectly. Out of which 30,000-40,000 workers are working inside the yard. Ship breaking activity is highly dangerous and hazardous. The rate of accident is much higher than the average industrial accident in the India. Therefore, the aim of this paper is to highlight the ship breaking industry in general and Alang ship breaking yard in particular. This paper also focuses on the factors which are responsible for the higher rate of accidents. The results of the study shows that skilled are more prone to accident which is 2.6 times more than unskilled labourers. The overall probability of accident is 8 per 100 workers per day and the high probability of accidents is faced by skilled workers, which are 13 per 100 workers per day.

INTRODUCTION

Ship breaking is the process of dismantling of old ships to recover steel scrap and other materials. Ships breaking industry is a recycling industry which recover steel from the ship which is expected to constitute 90 percent in terms of value. The other materials constitute the remaining 10 percent and consist of machines and equipment, furniture and fittings, asbestos, wood panels, oil, chemicals, electrical fittings etc. These items can at best be considered as by-products of this industrial activity. Ship breaking is a challenging process involving a complexity of issues like ecology environment, labour health and safety. Thus it has been recognized as one of the hazardous industries and this activity is mainly concentrated in developing countries of Asia.

The ship breaking activity shifted gradually from high-income countries to middle income countries and then to low income countries due to growing environmental concern and stringent regulations in developed countries. During this process the ship breaking industry has transformed from being a capital-intensive industry to labour intensive industry. Although Ship breaking industries produce the potentiality for economic growth, it also brings with it dangers of environmental imbalances. Until the 1970's ship breaking activities were concentrated in developed countries. But after 1980, due to availability of cheap labour, a shift of these activities from the developed countries to developing countries is witnessed. Countries like India, Bangladesh, China and Pakistan have less stringent norms or legislation pertaining to environment and also the availability of huge labour force.

It is estimated that on an average 700 ships are taken for decommissioning every year world over. Out of these 350-450 ships are scrapped in India. The ship breaking activities are carried out at various places in India along the sea coast of the country Viz, Alang in Gujarat, Sachana in Gujarat, Dharukhana near Bombay, Tadri in Karnatka, Maipe in Karnataka, Baypore in Kerala, Vishakhapatnam in Andhra Pradesh, Valinokan in Tamil Nadu and at Tuticorin in Tamil Nadu. However, the main ship breaking centre is located on the west coast at Alang, Gujarat. The ship breaking activity at Alang began in 1982 and currently, 141 plots are in operation and Alang is considered to be the largest ship breaking yard in world. India has the world's largest ship breaking facility in terms of volume. According to Basel convention report of 2003, 38 percent of ship breaking activities are concentrated in India, followed by China 25 percent, Bangladesh 19 percent and Pakistan 7 percent.

Alang has grown from small coastal village with a small population of fishermen and farmers to become world's largest ship breaking yard. Upto 1980's ship breaking activities were limited to the breaking of small-sized ship at Darukhana yard near Bombay. At the end of 1970's, the Metal Scrap Trade Corporation (MSTC) of the Government of India decided to import non-useable ships from foreign countries and the Government decided to set up ship breaking yards. During 80's there was a tremendous demand for scrap from large number of foundries and re-rolling mills in Gujarat. Therefore, Government of Gujarat adapted policies in favour of ship breaking industry on Gujarat coast. The Gujarat Maritime Board made intensive survey and identified Alang as the most suitable site for developing ship breaking activity. In 1983, the first ship was beached and this laid the foundation of ship breaking at Alang, which has now grown as world's largest ship breaking yard.

METHODOLOGY

The study is based on the primary data collection from the respondents working inside and outside the yard i.e. at the place of work as well as at living place. The researcher selects 300 respondents for the survey with structured questionnaire. These 300 respondents represent 1 percent of working population inside the yard. The study intends to analyse the factors associated with accident inside ship breaking yard. The study also intends to focus on the measurement of accident in ship breaking industry. An analysis of the accident faced by workers is taken up in detail in the next section.

OCCUPATIONAL RELATED ACCIDENTS IN ALANG SHIP BREAKING YARD

Accidents are the result of both working environment and also the human factors. The working environment factors include outdated machinery and equipments, poor lighting, excessive noise and vibration, unsuitable walls, floors, roofs etc. They have a great impact on the rate of accident. The human factors include lack of knowledge of industrial mechanized environment, lack of training, incorrect methods of working and negligence at the workplace. In addition to these factors, the physical and physiological capacities of workers may not meet the requirements of the job. Apart from this, failures in implementing safety practices and improper use of mechanical safeguards and personal protective equipments account for many accidents. Most of the studies have pointed out that human factors are much more responsible for accidents than the environment hazards. A larger number of accidents could easily be avoided with due care and legal compliance.

Industrial workers face much economic insecurity in their life, which have its source and origin in numerous occupational and non-occupational risks like ill health, accidents, injuries etc. The industrial worker as a wage-earner has to face almost total economic ruin if his earnings are affected by any of the risks.

According to one of the estimations provided by the International Labour Organisation, about 50 million work related accidents occur every year around the world, a vast majority of them in

developing countries which is about five times higher than in developed or industrialized states.

In Alang ship breaking yard, the frequency of accidents is high because of hazardous nature of activities. The labour is unskilled, uneducated and untrained. The various laws relating to labour safety applicable to factories and also to ship breaking units are rarely implemented in Alang ship breaking yard. Humid atmosphere is also harmful to health of the worker. During the ship breaking process gas torches are used to cut the iron body of the vessels, inhaling of various types of toxic fumes of lead paint and other gases cause various types of respiratory diseases to the workers.

The cuts and burns are common to workers in Alang ship breaking yard. These are treated as minor but hamper the efficiency of the labour. Workers are frequently found to be reporting to work with cuts and burns. Sometimes these cause serious difficulty but not enough to worry the workers in comparison with other types of accidents. Grave accidents occur due to falling objects or at times due to fall of persons themselves. Sometime workers fall down from the height of 50-70 feet while working that result in serious injury or even in death. The low rate of mechanization in Alang ship breaking yard is often the cause accidents. As such authorities have classified the yard area into restricted and unrestricted to prevent workers being in the wrong place. Sometimes workers reported slip, accidental fall from vertical stairs or injuried due to poor lighting. This practice violates the section 11 of Factories Act, 1948 which provides that the workplace should be clean, well light and ventilated.

Workers at Alang are facing various types of accidents, which result in various types of temporary as well as permanent disablement. The frequency of accident is significantly high as the environment at place of work is not conducive and the regulation of norms is not done in the right earnest. The second type of accidents are considered as the most dangerous and the least predictable, are related to fire, that could range from lesser fire to explosion. Explosions and fires are caused by using gas torches in confined spaces where toxic, flammable gases are kept or get accumulated. The workers are at greatest risk of serious burning or injury and most often to death due to injuries. In the following paragraphs the types of accidents faced by the respondents and their frequency is analysed.

From the table 1 it is clearly seen that workers in Alang ship breaking yard are facing various types of accidents, which cause them temporary as well as permanent disablement. Burns and cuts are common in Alang ship breaking yard and they account for 43.6 percent of total accidents reported during previous month. Other types of accidents faced by the workers are head injury, leg injury and fracture, which is 15.6 percent, 6.4 percent and 19.3 percent respectively. Therefore, it can be concluded that workers in Alang ship breaking yard are facing various types of accidents while working in yard. Out of 300 workers surveyed 218 have reported some type of accidents or other. Therefore more than 70 percent of the respondents have faced some type of accident or other. Many of these faced accidents on more than one occupation.

Table: 1 Nature of Work and Type of accident faced by Respondents

Type of Accident	Manual	Semi-Skilled	Skilled	Highly Skilled	Total
Burn	4.76 (2)	11.76 (6)	25.81 (24)	18.75 (6)	17.43 (38)
Cuts	23.81 (10)	29.41 (15)	27.96 (26)	18.75 (6)	26.15 (57)
Head Injury	19.05 (8)	15.67 (8)	13.98 (13)	15.63 (5)	15.60 (34)
Fracture	26.19 (11)	13.73 (7)	16.13 (15)	28.13 (9)	19.27 (42)
Leg Injury	7.14 (3)	7.84 (4)	3.23 (3)	12.50 (4)	6.42 (14)
Other Injury	19.05 (8)	20.57 (11)	12.90 (12)	6.25 (2)	15.14 (33)
Total	100 .00(42)	100.00 (51)	100.00(93)	100.00 (32)	100.00(218)

Note: Figures in bracket are number of respondents.

According to various studies construction and brick kilns industry is one of the accident prone industries where the frequency of accident is high.[4] It is also found by the present study that the frequency of accident is also very high in the Alang ship breaking yard. 218 respondents out of 300 i.e. 72.7 percent had faced accidents while working in yard (Table 2). Most of the workers faced accident more than one time while working in yard.

Workers facing accident 2 and 3 times constitute 86.7 percent of the respondents which is very high for an industry operating in organized sector.

Table: 2 Frequency of Accident faced by Respondents

Number of accident in a month	Number of Respondents
Once	1.38 (3)
Twice	59.63 (130)
Three time	27.06 (59)
More than 3 times	11.93 (26)
Total	100.00 (218)

Note: Figures in bracket are number of respondents.

In ship breaking industry of Alang, manual workers who work for longer are highly prone to accidents ((Table 3). The correlation value is 0.355 and is significant at 5% level. In case of skilled workers the correlation is 0.212 and is significant at 1% level. Skilled workers are also prone to accidents because during cutting process they face numerous accidents. Many other studies have found that the hours of work and accidents are positively correlated. [6]

Table 3 Correlation between Hours of Work and Number of accident

Nature of Work	Average Working hours per day	Correlation (Hours of Work * Number of Accident)
Manual	10.67 (86)	0.355**
Semi-Skilled	10.04 (74)	-0.053
Skilled	8.85 (106)	0.212*
Highly Skilled	8.03 (34)	-0.077
Total	9.39 (300)	

* 1 percent significant level.
** 5 percent significant level.

Note: Figures in bracket are number of respondents.

According to Factories Act, 1948 when an accident occurs it is mandatory that company should file a report with the Ministry of Labour. But in Alang ship breaking yard, employers hardly inform voluntarily either to the authorities or to the media. It is only in case of serious accidents which employer can not neglect the owner of the yards design to speak. The information they provide then is fragmentary and generally falls short of the reality. After an occurrence of a major accident, which results in death of workers, the work is stopped for sometime and the yard doors are closed for the outsiders as well as for workers. Work is said to resume in due course with new vigor.

Information regarding the number of accidents faced by the workers at Alang ship breaking yard in the month preceding the data collection by the researcher has been collected from 300 respondents. They have reported either a minor or a major accident during work. Using this information the probability of an accident for each of the respondent groups as well as for the total labour at Alang has been estimated. The average number of accidents for the respondents as a whole is 3.26 in a month and this varies from one group to another but skilled labour face highest average number of accidents. Using this information an attempt is made to estimate the probability of an accident on a working day for each group. The method of estimation is as given below.

$$\text{Average number of Accidents per Day} = \frac{\text{Total number of Accidents per month}}{\text{Total number of Working Days in a month}}$$

$$\text{Probability of an Accident per day} = \frac{\text{Average number of Accidents per day}}{\text{Total Number of respondents}}$$

For example, for skilled worker the probability of accident is estimated as follows:

$$\text{Average Accidents per Day} = \frac{381}{26} = 14.67$$

$$\text{Probability of Accident per Day} = \frac{14.67}{106} = 0.13868$$

Therefore, the result shows that 14 out of 100 skilled labours are facing accident per day at Alang ship breaking yard while working. The accident could be a minor burn or an injury or a fracture or a major accident. However the probability of accident of 0.138 is high by any normal standards. The detailed results are presented in table 4

Table: 4 Nature of Work and Probability of Accidents per Day

Nature of Work	Average Number of accidents in a month	Number of respondents faced with Accident	Total number of respondents	Probability of Accident
Manual	2.95	42	86	0.05581
Semi-Skilled	2.71	51	74	0.07162
Skilled	4.10	93	106	0.13868
Highly Skilled	2.13	32	34	0.07647
Total	3.26	218	300	0.083

In Alang ship breaking yard the probability of accident faced by workers is very high than the average industrial accident in India. A study conducted on "Construction Industry of Ahmedabad" where author found that the construction work is marked by drudgery and hazards. In addition the trend towards multi-storyed construction makes the work is more prone to accidents. The authors found that 14 percent of workers met with accidents. Further they found that the probability of accident is higher for the skilled, which is higher than other categories of workers.

In Alang, the frequency of accident is much higher than the industrial accidents in India. One of the important causes of high accident rate in ship breaking yard in Alang is due to poor mechanized process in recycling industry. It is found from the table 4 that the skilled workers are more prone to accident than other categories of works, which are 14 out of 100 workers per day. Other categories of labours semi-skilled labour face accidents around 7 out of 100 labours and 6 out of 100 manual workers per day. The accidents faced by the workers at the yard in general are explained by the safety equipment, conditions of work and the implementation of rules and regulations. However these are common to all the workers. Does experience of a workers, the type of work done and the length of work duration have an effect on facing an accidents or not. Some individuals working in similar conditions face accidents and some don't. To explain these phenomena functions are fitted with the dependent variable taken as a dummy and the explanatory variables, are both qualitative and quantitative. The function form used to analyse is called logit model.

LOGIT MODEL

To analyse the qualitative variables such as accident faced logit model is made use of. Logit model is also known as logistic regression, which is useful when dependent variable takes value only between 0 and 1. When dependent variable value is between 0 and 1 neither ordinary least square method nor weighted least square method is helpful. The dependent variable is 1, if a labour faces accident and 0, if the labour does not face accident during a given period of time. Therefore for all 300 respondents the dependent variable is 0 or 1. In logit model instead of t statistic to evaluate statistical significance of a coefficient, Z statistic is used. So inferences are based on normal table and if sample size is large, then t distribution converges to normal distribution. In logit model, the conventional measures of goodness of fit, R^2 is not meaningful. However, in binary regressand models, goodness of fit is of secondary importance. The important thing in logit model is expected sign of the regression coefficient and their statistical significance. Hence in logit model instead of using as F test as in linear regression model; likelihood ratio (LR) statistic is used. LR statistic follows the Chi square distribution with degree of freedom equal to number of explanatory variables.

For meaningful interpretation of logit result the odd ratio is used which is obtained by taking the antilog of various slope coefficients. Odd ratio shows the ratio of probability in the model.

In the study an attempt is made to examine the factors responsible for accidents in Alang ship breaking yard. There are various factors, which contribute to the occupational accidents. The Binary logit model is used to examine the factors responsible for accidents. An attempt is also made to fit accident faced function. Many variables are included in the model and it was found that some of the variables could not explain any variation in the function significantly. The following function is considered:

Accident Faced (Y) = f (Years of Experience, Experience2, Skill, Hours of Work, Cutters/Other)

Where, Y= 1 if worker faced accident and Y= 0 if worker does not face accident.

The logit model can be written as:

$L_i = (P_i / 1- P_i) = \beta_1 + \beta_2$ (Years of Experience) + β_3 (Experience^2) + β_4 (Skill) + β_5(Hours of Work$_{1+}$ β_6 (Cutters/Other)

Where P_i= Probability of an accident and L_i is the odd ratio.

Three models are fitted with Accident faced as explanatory variable. The results are presented in table 5

It is found from the Table 5, that the accident faced function is best fitted for the variable such as Experience Square, hours of work and skill. In model-1 the years of experience, cutters/other and hours of work are the explanatory variables with one dummy variable i.e. cutter/other. In this model variation in dependent explained to the extent of variable is 9 percent. But in binary Logit model the R^2 is not meaningful thus in the present model McFadden R^2 is used.

Thus, the cutter/other coefficient is 1.1696 which means that other variable in the model being held constant, cutters are facing accidents which is 1.17 times more than the others category of workers, indicating a positive relationship between the two. Years of experience have a positive effect whereas the hours of work have negative value and both are not statistically significant. It would lead to conclude that cutters are facing greater probability of accidents in Alang ship breaking yard. All three variables have significant effect on the accident faced function, as LR statistic is positive and statistically significant. As in case of linear regression F-test is used to test null hypothesis similarly Likelihood ratio (LR) statistic is used in logit model.

A more meaningful interpretation of the results is in terms of odd ratio, which can be obtained by taking antilog of the various slope coefficients. Thus, by taking antilog of the cutter/other coefficient of 1.1696 the antilog value is 3.22 ($e^{1.1696}$). This suggests that cutters are facing 3.22 times more accidents than the other workers at Alang ship breaking yard.

In model-2, one dummy variable is introduced viz, skill (skilled/unskilled). From model-1 to model-2 the result improves. In

the model skill, years of experience and hours of work are the explanatory variables. All the independent variables including one dummy variable show positive but only two variables are significant and the variable years of experience is positive but not significant which is indicated by the corresponding Z-value. Therefore, it can be concluded that the accident faced is significantly higher where skilled labour are employed and working for longer hours.

Therefore, the skill coefficient is 2.626, which means with the increase in skill on an average accidents increased by 2.6 times, which suggest positive relationship between the two. All other variables in the model have positive effect, although statistically the effect of years of experience is not significant. However, all the three variables have a significant impact on the accidents faced as LR statistic is significant at 1% level. For better interpretation of the result the antilog of the coefficient is appropriate which explains the odd ratio. Thus, if skill coefficient is 2.626, the antilog value is 13.82 ($e^{2.626}$), which explains that the skilled are 14 times more prone to accident than the unskilled labours. In Alang ship breaking yard skilled workers are facing more accidents. The reason is their nature of work, most of tem are cutters engaged in the cutting process either inside the ship or outside ship. It causes various types of accidents either minor or major. Similarly, antilog of hours of work coefficient is 1.7, which suggests that those who are working long hours are more prone to accidents.

In model-3 five variables are considered as explanatory variable viz. cutters/other, years of experience, experience^2, hours of work and skill along with two of the dummy variables. Compared to model-1/model-2, in the model-3 the result improves. In the model-3 only three variables are statistically significant and other two variables are not significant. The variable skill coefficient is 2.644 which means that other variables held constant skilled are more likely to faced accident by 2.6 times than the other category of labours. Hours of work and years of experience square are statistically significant showing positive relationship with the dependent variable. All the variables in the model have significant impact on the dependent variable as LR statistic is positive and significant at 1% level. Taking antilog of the coefficient, skill coefficient is 14.06 suggests that skilled workers face accidents 14 times more than the other type of labours. The coefficient corresponding to experience square is negative indicating that the rate of accidents fall as workers gain more experience. Therefore, in Alang ship breaking yard skill, hours of work, years of experience and cutters/other explain the variation in the accidents faced. For these variables the coefficient is positive and significant and the LR statistic for all three models is high and significant.

Table 5 Accident Faced by Workers at Alang Ship Breaking Yard
Dependent Variable: Accident Faced[a]

Variable	Model 1	Model 2	Model 3
Constant	2.5745	-5.422	-5.1859
Cutters/Other [b]	1.1696 (2.702)***		0.0030 (0.0048)
Years of Experience	0.04535 (1.648)*	0.0362 (1.28)	0.0407 (1.421)
Experience^2			-0.0026 (-1.658)*
Hours of Work	-0.2357 (-1.280)	0.5277 (1.86)*	0.5205 (1.821)*
Skill [c]		2.6255 (4.397)***	2.6439 (3.412)***
N	300	300	300
Log-Likelihood	-160.806	-154.065	-152.697
LR Statistic	30.316***	43.798***	46.534***
McFadden R-square	0.086	0.124	0.132

*Significant at 10%; ** Significant at 5%; *** Significant at 1%
Note: Figures in bracket are Z-value
[a] If Work Faced Accident = 1 otherwise 0
[b] If worker is Cutter = 1 otherwise 0
[c] If worker is Skilled = 1 otherwise 0

CONCLUSION

Ship breaking industry is one of the hazardous industries and workers face severe conditions at work. The risk of accident is high and accidents are common because of hazardous nature of activities and also due to unskilled, uneducated and untrained workforce. The logit analysis indicated that cutters face accident 2.7 times more than other category of workers. The analysis also shows that skilled are more prone to accident which is 2.6 times more than unskilled labourers. The overall probability of accident is 8 per 100 workers per day and the high probability of accidents is faced by skilled workers, which are 13 per 100 workers per day. The analysis found that the rates of accidents at Alang are higher than the average industrial accident in India.

In Alang ship breaking yard workers face high probability of occupation related accidents. However workers are neither covered by life insurance or medical insurance. Workers report that they do not personally have any cover and many of them are not aware of such policies. It is also observed that there exists no systematic insurance and compensation scheme, which covers both assets and workers.

The conditions of workers at Alang are poor as compared to other industries. After functioning for 25 years, there is little improvement in the area of the occupational safety of the workers. The implementation of labour rights is only a dream for workers at Alang ship breaking yard.

RECOMMENDATIONS

From the foregoing analysis, it is found that Government is aware of problems of migration and migrants in the country. Fifth Five Year Plan proposed regulation of employment and conditions of service of interstate migrant labour and to provide them certain welfare amenities, the Interstate Migrant Workmen Act 1979 has been enacted. This Act provides for registration and licensing of the establishments and contactors. There are many obligations on the part of contractor related to wage and allowance, provision of amenities like suitable residential accommodation, adequate medical facilities to suit varying climatic condition and suitable conditions of working.

Further, in Sixth Five Year Plan Government planned to take effective steps for the implementation of this Act by suitable machinery at Centre and State level. For the same a Migrant Labour Board is formed and suitable machinery is set up. However, even today much of the task as proposed above is still remains unfulfilled and needs serious consideration. From the present study the following suggestions and policy recommendations are put forward.

References

1. Gujarat State Government and Gujarat Maritime Board (GMB) should implement various labor laws in the right earnest. Their implementation of rules and regulations, in a way, will lead to safe working and better living conditions at Alang. This can ultimately increase the productivity of labour and also the growth of the industry.
2. The provision of medical insurance and life insurance for workers employed at Alang is of prime importance. The provision of medical and life insurance will increase the working conditions of the workers enormously. GMB also needs to take initiative for monthly medical checkup for workers.
3. GMB should provide requisite training to the workers. The workers employed in hazardous and risk prone activities must be trained and provided with proper equipments. The training will reduce the frequency of accidents and increase the productivity of workers at Alang.

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