

# **An Assessment of Hazards and Risks in the Sewing Section of the Readymade Garment Industry in Bangladesh**

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## **Abstract**

Readymade garment industry is one of the production industries in Bangladesh where various types of materials, components, procedures, actions and conditions are being used and so there is high possibility of accidents to occur. Sewing section in garment industry is concerned with different hazards and risks which have surely negative impact on the environment and health of the workers. The main reason of this paper is to find out the hazards and risks existing in a sewing section of a readymade garment industry located in Bangladesh. A hazard analysis worksheet will be prepared including hazardous events, causes, control measurements, likelihood of occurring and severity to indicate risk score that have adverse effect on workers' safety in their workplace based on a systematic approach. Risk priority number can also be determined by severity, detention and occurrence data. These two methods will help the industry to understand immediate concerns and prevent injuries from these accidents in that section.

## **Keywords**

Workers' health and Safety Issue, Risk Priority Number, Risk Score, Hazard Evaluation Checklist and Worksheet.

## **1. Introduction**

Sewing section is one of the major sections of readymade garment industries that are the greatest export sector in our country. Approximately 78% foreign earnings are gained from this sector but due to lack of safety culture people working there do not feel safe. In various research it was found that there is risk in various occupation in shipbuilding industry including fiberglass production, welding, painting and other works (Celebi et al. 2010). In accordance with present statistics, about 10,000 ships are plying in Bangladesh, which transport almost 35% of passengers, 90% of total oil product and 70% of cargo (Iqbal, Zakaria & Hossain 2011). These ships are being manufactured to fulfill local demands and local shipyards can manufacture ships almost up to 3500 DWT ( Deadweight) and few shipyards have been able to fabricate around 10000 DWT (Iqbal, Zakaria & Hossain 2011).

In recent years, research have been performing on health and safety issues because of vibration exposure and a study focused on the consequences of various criterions related to environment such as vibration, dust, VOC, noise (Cherniack et al. 2004). Some research found that emission of VOC happen during proper health risk assessment and during painting of ships are necessary for this purpose (Malherbe and Mandin 2007) and shipyard workers face various pulmonary symptoms, asbestosis and functional impairment (Kilburn et al 1985). Also morality among shipyard workers were studied in various studies (Puntoni et al. 2001).

The sewing department of readymade garment environment wants proper care to minimize the hazards and risks in the procedures for producing elements. So various techniques are necessary to apply to prevent or manage those hazardous events or risks. In risk assessment process various types of failures and effects associated with various types of failures were included in various research works (Pickard et al. 2005). Various research indicated that in total quality management implementation processes various critical factors were studied in various sections of garment

industry in Bangladesh to ensure safety culture (Talapatra et al. 2009). TQM implementation in garment industry is prioritized in various works also in integrated management system (Talapatra and Uddin 2019; Talapatra et al. 2018). Awareness about safety issue were studied in research works to indicate workers' health hazards during their working in various garment industries. It was found that different hazardous situations occur in a garment industry and so workers' and senior management have to take necessary steps in ensure safety in their work place as they spend most of their time in their respective departments in an industry ( Talapatra and Rahman 2016).

In recent studies it was found that various types of reliability methods have been using for the purpose of assessment of motions of risks in various parts of human body such as shoulder range. These methods were highly used in these studies to indicate comfort in working of people in their respective occupation as well as in their normal daily routine (Hayes et al. 2001). Hand tool design based on hand measurement was included in many researches to evaluate the necessity of proper hand dimension for this purpose. The tools that were not ergonomically fit may have adverse effect on the health of users and thus can provide risk or hazard of causing harm (Wang and Cai 2017). Proper handle length and lift angle are essential for human safety and this necessity was indicated in some researches (Wu and Hsieh 2002). Various literature review provided the evident that realizing of the relation between management of risks and awareness are very much essential for proper understanding risks and hazards and also to provide necessary mitigation to control these hazardous events (Haltiwanger et al. 2010).

Balance between handle distance and handle orientation on manual push and pull strength were included in various experimental works as it very essential for human safety culture. (Lin et al. 2011). Balancing is also necessary for pulling and pushing carts or two wheeled hand trucks according to some studies (Jung et al. 2005).

In recent research it was evident that proper evaluation is essential for designing meal cart in hospital to provide proper safety to the users (Biman et al. 2002). Also designing is essential according to human factor concept such as trolleys which also took evident in some research works (Wilkinson 2000). Again some studies found the importance of handle design for designing cylindrical trolleys which is a must for proper surety of safety of users (Okunribido and Haslegrave 1999).

Checklist of hazards, hazard evaluation worksheet and also risk priority number are widely used to detect hazard that may result in various types of accidents and also to provide control measure for prevention purpose. This paper tells about method of research, data collection, instruments used, result and recommendation to assess risk in sewing section of a readymade garment industry.

## **2. Methodology**

To identify and evaluate hazardous events and accidents list for sewing section of a readymade garment industry , interview was done with open ended survey questionnaire containing experience of accidents, age, education, gender, occupation. Group discussions were also arranged to recheck the collected data including questionnaire.

### **2.1 Data Collection and necessary instruments**

Data was collected through interview and major hazardous events were identified having visible or tangible hazards, working condition, environment of work, electric and fire hazard and explosion in sewing section. A survey was performed to evaluate the main events caused by hazards that has question types given in the below:

- Identification of each kind of hazard including sources, causes, the hazard(s) and consequences of hazards, occurrence, severity, detection and recommendation to mitigate particular hazard was found out by the questions.
- The repetition of that hazard was identified by multiple choice questions.

The record was written for analyzing and evaluate the hazards of major types and accidents caused by hazards in the sewing section after obtaining the dataset. To carry more weightage risk priority number was also determined for each accidents. Results and suggestions are provided in the result.

### **2.2 Sample Study and Process**

Fifty employees of different qualifications and practices took part in interview session to evaluate hazards. After that a tabular format was prepared to identify reasons of occurring repetition, hazards and revelation. After the interview was done, risk score, controls, hazards related accidents were listed. Probability, Acuteness, Detention were also listed to identify risk priority number. Sample employees included (1) section-in-charge, (2) foreman, (3) senior manager, (4) operator, (5) worker and (6) cleaner.

Other categories were not considered because of time and resource limitations.

### 3. Data Analysis and Results

#### 3.1 Identification of Hazards and Causes

Major hazard events and their root causes for sewing department were identified for evaluation. This checklist had the evident of major hazard situations and their potential causes.

Table 1. Check-lists for Identifying Hazards

<b>Hazard or Danger Kinds</b>	<b>Reasons of Occurring</b>
1. Condition at work	1.1 Restricted place 1.2 Slips, trips and falls from height 1.3 Lack of comfort 1.4 Dangerous work
2. Health Related Problems 2.1 Cut of fingers  2.2 Back injury 2.3 Eye strain 2.4 Suffocation 2.5 Hearing problem  2.6 Temperature and Vibration	2.1 Sharp edges, knife blades, scissors and pins. 2.2 Poor posture, improper lifting processes. 2.3 Poor lighting 2.4 Restricted space 2.5 -Repeated sound of sewing machines -Heavy machinery -Working near sound pollution 2.6 -High humidity and temperature in room -Heavy equipment and power tools -Combustible material -Insufficient ventilation
3. Fire Hazard	3. -Locked exit -Block furniture -Lack of fire drill -Lack of extinguished workability -Bottleneck corridor -Occupant load -Lack of emergency light - Presence of combustible materials - Insufficient fire extinguisher -Excessive heat generation -Lack of maintenance
4. Electrical explosion	4 -Electric overload - Improper circuit management -Lack of consciousness about electrical equipment -Not having personal protective equipment -Short circuit -Having conductive equipment near circuits -Improper circuit design

### 3.2 Preparation of Hazard Evaluation Worksheet and Risk Priority Number

After identification of main hazardous events and causes hazard analysis worksheet was prepared to find out: what are the accidents, causes and control measures of the hazards, likelihood of occurrence and severity of these hazards. Table 2 and Table 3 represented likelihood, severity scale and Table 5 showed preliminary hazard analysis worksheet that included hazard events, accidents, causes, risk score (probability \* acuteness) and control measure (Pinto et al. 2015; Hossain et al. 2016). Table 4 represented ranking, severity, occurrence and detention percentage and Table 6 showed risk priority number of hazardous events (Xiao et al. 2010).

Table 2. Probability Scale

Probability of Cause	Existence for Cause	Grading
Very Probable	One time in a month or more	05
Probable	One time in a year	04
Bearably Feasible	One time in ten years	03
Unlikely	One time in thousand years	02
Very Unlikely	One time in ten thousand years	01

Table 3. Acuteness Scale

Acuteness	Existence for Cause	Grading
Calamity or Sudden Disaster	Greater injury or death from failure	05
Noteworthy	Less injury from failure	04
Crucial	High or medium revelation level from failure but injury is not caused	03
Slight	Lower revelation level from failure but injury is not caused	02
Trivial	Trivial revelation level	01

Table 4. Acuteness, Existence and Detention Scale

Grading	Acuteness	Existence (parts per million)	Detention
10	Very Intense	Five lakh	90%
09	Very Intense	One lakh	90%
08	Intense	Fifty thousand	98%
07	Intense	Ten thousand	98%
06	Bearable	Five thousand	99.7%
05	Bearable	One thousand	99.7%
04	Bearable	Five hundred	99.7%
03	Slight	One hundred	99.9%
02	Slight	Fifty	99.9%
01	Very Slight	One	99.99%

Table 5. Records for Analyzing Hazards

Written Records for Hazard Analysis							
Serial	Hazardous Incidents	Misfortunes	Feasible Causes	Probability (P)	Acuteness (A)	P*A	Measurements for Control
1	Type 1  Poor working condition	1.Mental and Physical Injury	1. -Restricted work space -Lack of comfortable area -Gloomy environment	4	4	16	-Proper ventilation system in particular section -Having personal protective equipment (PPE) -Wide space -Adequate lighting
		2.Fall, slips and trips	2. -Colliding with objects -Excessive fall from heights	5	4	20	
		3.Long term damage to health	3. - Full of fume in work area - Dirty and dangerous environment	3	5	15	
2.1	Type 2  Finger cut and injury	General tissue trauma, cut, wound and other musculoskeletal disorders	-Having sharp edges, knife blades, scissors and pins in work area	5	2	10	-Provide first aid -Having personal protective equipment (PPE) -Using gloves
2.2	Back injury	1.General tissue trauma, wound	1 -Repeated and poor posture	5	2	10	-Taking break during work -Practice good posture -Implementing safety process
		2.Spine	2 -Improper lifting technique	4	2	8	
2.3	Eye strain	Blurred vision and Cataract	-Poor lighting in the work area	3	3	9	-Adequate source of lighting -Using eye protector
2.4	Suffocation	1.Delayed effect on body or permanent disability	1. - Cramped work area	4	4	16	-Wider place -Proper ventilation -Air respirators to be used
		2.Lack of concentration	2.	4	3	12	

			- Working close to air pollution and fume				
2.5	Hearing problem	Permanent disability	-Heavy machinery -Repeated sound of sewing machine -Working near sound pollution	4	3	12	-Using ear protector -Having personal protective equipment (PPE)
2.6	Temperature and Vibration	1.Musculoskeletal disorders 2.Wound and burn 3.Delayed effect 4.Permanent disability 5.Lack of concentration	1. -Heavy equipment 2 - Combustible materials 3. -Power tools 4. -Heavy equipment 5. -Improper ventilation	4 3 3 2 4	2 2 4 4 3	8 6 12 8 12	-Proper ventilation system -Proper management of heavy and powered components -Heat source has be kept away from combustible materials - Using Personal protective equipment (PPE)
3	<u>Type 3</u> Fire hazard	1.Burn  2.Death	1. -Locked exit -Block furniture -Lack of fire drill -Lack of extinguished workability -Bottleneck corridor -Occupant load -Lack of emergency light -Presence of combustible materials -Insufficient fire extinguisher -Excessive heat generation -Lack of maintenance	4  3	4  5	16  15	-Proper maintenance -Providing fire extinguisher at the time of need -Keeping lubricants away from heat generating source -Proper management of corridor, exit, furniture, emergency light and load - Providing training

			2. -All the above causes (1)				
4	<u>Type 4</u> Electrical explosion	1.Shock (major or minor)	1. -Electric overload -Improper circuit management -Lack of consciousness about electrical equipment -Not having personal protective equipment -Short circuit -Having conductive equipment near circuits	4	4	16	-Proper circuit design -Having personal protective equipment -Conductive equipment has to be away from circuits -Maintenance -Providing training
		2.Catastrophy or death	2. -All the above causes (1)	3	5	15	

Table 6. Calculating Risk Priority Number (RPN)

Hazardous Events	Accidents	Acuteness (A)	Existence (ppm) (E)	Detention (%) (D)	A*E*D
Poor working condition	1.Mental and Physical Injury	10	500000	90.00	4.50
	2.Fall, slips and trips	9	100000	90.00	0.81
	3.Long term damage to health	8	50000	98.00	0.40
Finger cut and injury	General tissue trauma, cut, wound and other musculoskeletal disorders	5	1000	99.70	0.005
Back injury	1.General tissue trauma, wound	5	1000	99.70	0.005
	2.Spine	5	1000	99.70	0.005
Eye strain	Blurred vision and Cataract	4	500	99.70	0.002
Suffocation	1.Delayed effect on body or permanent disability	8	50000	98.00	0.40
	2.Lack of concentration	7	10000	98.00	0.07

Hearing problem	Permanent disability	7	10000	98.00	0.07
Temperature and Vibration	1.Musculoskeletal disorders	4	500	99.70	0.002
	2.Wound and burn	4	500	99.70	0.002
	3.Delayed effect	6	5000	99.70	0.003
	4.Permanent disability	5	1000	99.70	0.005
	5.Lack of concentration	6	500	99.70	0.005
Fire hazard	1.Burn	9	100000	90.00	0.81
	2.Death	10	500000	90.00	4.5
Electrical explosion	1.Shock (major or minor)	9	100000	90.00	0.81
	2.Catastrophy or death	10	500000	90.00	4.5

#### 4. Result, Risk Mitigation Measurement and Recommendation

Using a Preliminary Hazard Analysis process, a total of 19 kinds of accidents are found from sewing section in a readymade garment industry having risk scores from 6 to 20. These risk scores shows that a total of 14 types of accidents are equal to or greater than 10. It is also found that 10 types of accident has higher RPN. Worse consequences results from high RPN and risk scores. In fact some may face permanent disability or death. In this regard it is very much important to take risk mitigation techniques and recommendations to provide safety to the workers working in that particular section. Various control measures are provided in hazard analysis worksheet which can help the workers in this regard.

Based on the interviews taken and results it was found that 30.5% people recommended proper maintenance, 21.7% of the workers proposed of using PPE for ensuring safety culture. Approximately 15.3% and 12.5% of total participators believed that safety training and safety campaign could help respectively. 16% of people recommended improving working environment and remaining 5% suggested others techniques.

Figure 1 showed hazard mitigation measures by interviews and questionnaire according to the process (Hossain et al. 2016).

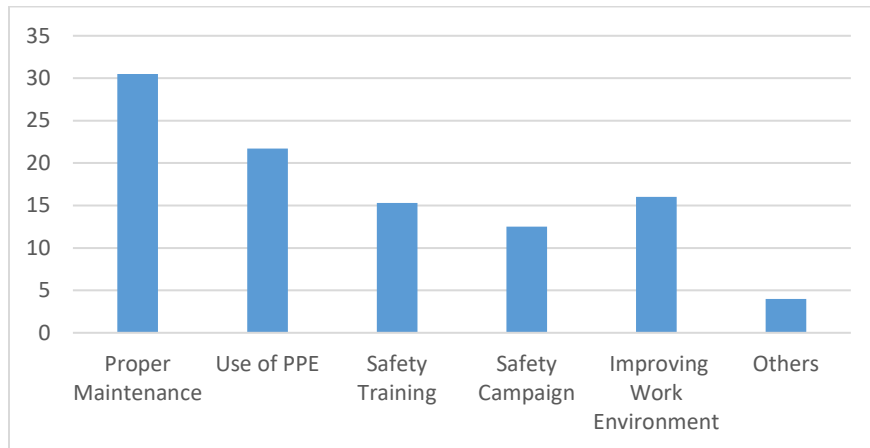


Figure 1. Hazard Mitigation Measures by interviews and questionnaire

Following 5 recommendations are provided for ensuring safety of workers in the sewing section of readymade garment industry

1. Providing safety training and safety awareness campaign for reducing accidents in the work place.
2. Encouraging workers to have personal protective equipment and first aid with them.



3. Proper maintenance and upgrading working environment
4. Combustible materials, flammable fumes should be secured in a place away from heat source and circuits
5. Wider space and safety signals should be provided.

## **5. Discussion and Conclusion**

Workers spend most of their time in work place and so ensuring work place safety is a must. For ensuring safety an interview session was completed with questionnaire. A hazard analysis worksheet was prepared to identify risk scores and control measures for accidents. Risk priority number was also calculated to prioritize risk. At the end of this paper recommendations were provided for safety issue in sewing section of readymade garment industry. By implementing prevention measure accidents can be reduced to a large extent. Result shows that by using PPE and proper maintenance are the major prevention techniques. Consciousness and personal effort of each worker are essential for overall safety of sewing section. Above all, the research was done by using PHA and RPN techniques whereas other techniques can be used in same department or same techniques can be used in other departments. As sewing section is one of the largest departments of a readymade garment industry, proper precautions are needed to take to save life of the workers as well as money and investment.

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