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European Journal of Advances in Engineering and Technology, 2020, 7(6):48-56

Research Article ISSN: 2394 - 658X

An Approach for Risk Management in Production Sector of Electronics Industry in Bangladesh

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ABSTRACT

Electronics industry is one of the largest industries in Bangladesh where electronic products are designed, manufactured, tested and sold. Production section is concerned with the generation of various parts of electronic products or the whole electronic products and so many workers are involved in this section of electronics industry. Various types of risks in production section may result in accidents that have surely negative impact on the health of workers working there, safety culture of the particular section as well as working environment. The main purpose of the research work is to evaluate risk incidents, relative accidents, higher impactful misfortunes (by risk score) and control measures by creating risk analysis worksheet. Another important objective is to analyze risk priority number with the help of extremity, detention and occurrence data to find out more harmful accidents. Using these two methods, the production section and involved personnel will realize immediate concern and thus may help reducing injury and ensuring the safety culture of the workers in that particular section of electronics industry.

Key words: Production section, Risk evaluation worksheet, Risk priority number, Workers' health and safety culture, Working environment

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1. INTRODUCTION

Various research works were performed regarding risk management. A study found out that there were different types of risks during purchasing electronics from market places and it was observed that risks and trust issues were associated with purchasing purpose [1]. Another study was based on the accident analysis and prevention. It was pointed out that risks occurred because of the perception of male drivers depending on their ages. Accidents were analysed based on the perceived drivers' ability [2]. Additional research created a model for motivational factors and their role in the decision making process of the drivers. With the help of the model, accidents would be analysed and prevented [3].

A research implemented that approximately seventy eight percent earnings would be gained from foreign countries in the production sector but because of the lack of safety in the working place, workers might feel unsafe. From the research work it was found that there are risks in various occupations in shipbuilding industry such as painting, production, welding and also in other works [4].Another publication pointed out that in shipbuilding industries, all these ships might be built to meet local demands and local shipyards mightbuild ships almost three thousand and five hundred deadweight and few shipyards would fabricate up to ten thousand dead weight [5]. A study found out that the production department of electronics industrywould demand proper prevention to reduce the risks inherent in production processes. So various techniques were used to manage risks. Failure mode and effect analysis (FMEA) of varieties of failures were observed in thatresearch study [6].

Cross cultural varieties in risk analysis and treatment were also included in a research work and it was noticed from the work that risk management process was different for various cultures of drivers to mitigate accidents [7]. It was found from a study that risk taking and risk prevention activities varied for different managerial perspectives. In that studycertain industry had their different sections and each section had a management team. A manager was responsible for taking care of all the managerial works [8].

Another study was performed to evaluate risks and hazards in the sewing section of readymade garments industry in Bangladesh. For this purpose a hazard evaluation worksheet was prepared and risk priority number was calculated. Higher harmful accidents caused by hazardous events were found out and risk prevention ways were determined [9]. A research work was done to assess risk priority number prioritization for effects of failure mode and analysis of criticality. A ranking from 1 to 10 was used for this purpose [10]. Hazards on workers' health was evaluated and safety awareness was created among the garments workers in another research work for ensuring safety and preventing risks. Causes of health hazards were found out and preventive actions were also made [11].
Difference between risk management and knowledge management were clearly pointed out in a research work [12]. A study was performed to analyse health life threatening health problems caused by exposure of polycyclic aromatic hydrocarbons because of certain risk events and risk assessment procedure was indicated in that study [13].
A model was built for perceived risk and intended risk-mitigating activity in another research [14]. A study was done to find out if different welders would be at more risk of respiratory infections and if so what preventions would be taken were written in that particular study of work [15]. Additional study showed the subjective accident occurring probability for various risks and the mitigation processes varied for different ages and behaviors [16].

2. TECHNIQUE OR METHOD

To perform this study two methods were used and these are risk evaluation worksheet and risk priority number. Tabular formats were prepared to analyse risk priority number and risk evaluation worksheet.

2.1. Sample Size

To identify and evaluate hazardous events and accidents list for sewing section of a readymade garment industry. Interview as well as survey were performed to identify the risk incidents and relative accidents for production department of electronics industry among the workers of different gender, education, age, working experience and knowledge of accidents.

- Open ended questions were asked to identify risks, accidents, detention and severity of these accidents.
- Multiple choice questions were used to find out the frequency of these accidents where these occur weekly, quarterly, monthly or yearly.

2.2. Data Collection

The age of the workers was between 25 years and 40 years. Sample employees are the following (1) section manager, (2) foreman, (3) operator, (4) cleaner, (5) worker. Only male workers were taken as sample size as there was no female worker. Using equation (1), (Odunaiya, Owonuwa and Oguntibeju 2014), sample size was calculated. So, N = population size, n = anticipated sample size, and *e* = accuracy level. In this study, N = 80, *e* = 5% at 95% confidence level.

$$n = N/(1+Ne^2) \quad (1)$$

So from the acceptable sample size was observed to be 66 or more. So 70 workers were taken into consideration.

3. DATA ANALYSIS

Data analysis is discussed below:

3.1. Preparation of Risk Analysis Worksheet

Risk analysis worksheet was prepared to find out: what are the misfortunes, causes and prevention for risks, plausibility and extremity of risks. Table 1 and Table 2 show plausibility and extremity scale which are necessary for the rating of risk score [9]. Also Table 3 shows risk evaluation worksheet [9].

Table -1 Plausibility scale

Plausibility of Cause	Eventuality of Cause	Rating
Very anticipated	Once per every month or more often	5
Likely anticipated	Once per every year	4
Moderately anticipated	Once per every ten years	3
Unlikely anticipated	Once per every thousand years	2
Very Unlikely anticipated	Once per every ten thousand years	1

Table -2 Extremity scale

Extremity	Occurrence of Cause	Rating
Disastrous	Miscarriage leads the outcome to major injury or death	5
Remarkable	Miscarriage leads the outcome to minor injury	4
Significant	Miscarriage leads the outcome to medium or high level of exposure but does not cause any injury	3
Insignificant	Miscarriage leads the outcome to low level of exposure but does not cause any injury	2
Negligible	Miscarriage leads the outcome to negligible exposure	1

Table -3 Risk Evaluation Worksheet

S. No.	Risk incidents	Accident	Feasible causes	Plausibility (P)	Extremity(E)	P*E	Control measure
1.	Environmental	Toxic fume	Disposal problem of exhaust gas	2	5	10	1. Proper training 2. Sufficient gas disposal unit 3. Widen space 4. Sufficient ventilation system
		Sound pollution	Vibration from machinery Excess sound from engine	3	1	3	
		Poor ventilation system	Unplanned construction Congested production site	3	2	6	
		Insufficient lighting	Disconnection of electronics device	2	3	6	
		Excess heat	Frequent running of engine	3	2	6	
2.	Health of workers .	Physical injury	Over lifting Fall from height, slip and trips	2	5	10	1. Proper training 2. Avalability of first aid appliances 3. Provide personal protective equipment (PPE) 4. Proper cleaning and washing
		Long and short term disease	Combustible material Unhygienic workplace	2	5	10	
		Vision problem	Insufficient lighting	1	3	3	
		MSDs	Greater tissue trauma Wrong posture Overtime working	3	3	9	
		Suffocation	Intolerable temperature	3	2	6	
		Stress	Overtime working Lack of rest	4	2	8	
		Lack of concentration	Work pressure Personal issues	3	2	6	

3.	Financial	Budget problem	Insufficient fund for production	1	3	3	1. Proper budget planning 2. Expert consultation 3. Managing abundant funding
		Low productivity	Low utilization of machines Machine breakdown	1	4	4	
		Infrastructure damage	Incorrect planning and production work Natural disaster Settling problem	1	4	4	
		High turnover rate of workers	Insufficient salary Lack of incentives Poor working condition Organizational conflicts	1	5	5	
		Unreasonable scheduling	Lack of experts Communication gap Lack of automation in production system	2	3	6	
4.	Machineries	Break down	Lack of machine maintenance Using for long time period	2	4	8	1. Proper machine maintenance 2. Good technical planning 3. Providing proper training
		High idle time	Improper production planning Paucity of workers	3	3	9	
		Low utilization	Improper production planning Paucity of workers	3	3	9	
		Increasing defect	Lack of technical knowledge of workers	2	5	10	

			Insufficient opportunities for training Improper production planning				
		Low efficiency	Outdated machines Imprudent production planning	3	3	9	
5.	Technical	Technological error	Lack of technical knowledge Paucity of technician Network insecurity	2	5	10	1. Providing basic technical knowledge 2. Managing network security 3. Emergency response planning
6.	Procurement for production	Time delay	Scheduling problem Communication gap	2	4	8	1. Suitable scheduling 2. Appropriate budgeting and production planning 3. Strenthening distribution network
		Increase cost	Improper production budget planning High inventory Imprudent production planning	2	4	8	
		High inventory rate	Production Planning problem Scheduling problem Distribution problem	1	4	4	
7.	Product quality	High defect rate	Lack of skilled workers Machine error Lacking in proper planning and guidance	2	5	10	1. Good production planning 2. Proper maintenance 3. Providing technical training
		High rate of return	Product defect	2	5	10	
		Blemish of brand image	Low quality product	1	5	5	

		Poor quality	Technical error Defective product Lack of knowledge and guidance Machine error Improper planning	2	5	10	
8.	Material handling	Severe injury	Careless working Over lifting Lack of training	2	5	10	1. Reducing manual handling by automation 2. Providing proper training 3. Expert consultancy
		High time consuming	Improper production system design Lack of automation	3	1	3	
9.	Others	Fire explosion	Presence of combustible material Excess heat	1	5	5	1. Availability of fire extinguisher 2. Proper training 3. Strong administration 4.Strong production security 5. Providing personal protectiveequipment (PPE) 6. Emergency response planning
		Production security issue	Weak administration	1	4	4	
		Electrical explosion	Inappropriate circuit design Error in circuits and electronic device	2	4	8	

3.2. Calculation of Risk Priority Number (RPN):

Risk priority number or RPN number was calculated by multiplication of extremity, eventuality and detection for each accident caused by risk incident. Table 4 and Table 5 show extremity, eventuality, detection ranking scaleand risk priority number calculation according to [10].

Table -4 Extremity, Eventuality and Detection ranking scale

Extremity		**Eventuality**		**Detection**	
Rank	**Effect**	**Rank**	**Effect**	**Rank**	**Effect**
10	High risk without warning	10	Very high: Failure is almost inevitable	10	Absolute uncertainty
9	High risk with warning	9		9	Very Remote
8	Very high	8	High: Repeated failures	8	Remote
7	High	7		7	Very Low
6	Moderate	6	Moderate: Occasional failures	6	Low
5	Low	5		5	Moderate
4	Very Low	4		4	Moderately High
3	Minor	3	Low: Relatively few failures	3	High
2	Very Minor	2		2	Very High
1	None	1	Remote: Failure is unlikely	1	Almost Certain

Table -5 Determining RPN (Risk Priority Number) through Eventuality, Extremity and Detection

Risk incidents	Accident	Eventuality (E)	Extremity (E)	Detection (D)	E*E*D (RPN)
Environmental	Toxic fume	5	10	2	100
	Sound pollution	8	3	2	48
	Poor ventilation System	7	5	4	140
	Insufficient lighting	5	7	3	105
	Excess heat	7	5	4	140
Health of workers	Physical injury	5	10	3	150
	Long and short term disease	5	10	3	150
	Vision problem	3	6	4	72
	MSDs	7	6	3	126
	Suffocation	6	4	4	96
	Stress	8	5	3	120
	Lack of concentration	7	5	3	105
Financial	Budget problem	2	6	6	72
	Low productivity	2	7	6	84
	Infrastructure damage	2	7	6	84
	High turnover rate of workers	2	8	6	96
	Unreasonable scheduling	4	6	5	120
Machineries	Break down	5	8	3	120
	High idle time	7	7	3	147
	Low utilization	7	7	3	147
	Increasing defect	5	10	3	150
	Low efficiency	7	7	3	147
Technical	Technological error	5	10	3	150
Procurement for production	Time delay	5	8	3	120
	Increase cost	5	8	3	120
	High inventory rate	3	8	4	96
Product quality	High defect rate	5	10	3	150
	High rate of return	5	10	3	150
	Blemish of brand image	2	10	5	100
	Poor quality	5	10	3	150
Material handling	Severe injury	5	10	3	150
	High time consuming	6	2	5	60
Others	Fire explosion	4	9	3	108
	Production security issue	2	7	6	84
	Electrical explosion	4	8	4	128

4. RESULT ANALYSIS AND DISCUSSION

Accidents for respective risk incidents were shown in data analysis. It was found that summation of accidents for risk incidents such as environment, heath of workers, financial, machineries, technical, procurement for production, product quality, material handling and others are 31, 52, 22, 45, 10, 20, 35, 13, 17 (by risk evaluation worksheet) and 533, 819, 456, 711, 150, 336, 550, 210, 320 (by risk priority number calculation. Figure 1 and Figure 2 show the analysis of these two methods and it was observed from the mentioned figures that the sequence of impactful risk incidents are the following: health of workers, machineries, product quality, environment, financial, procurement for production, others, material handling and technical problems where accidents caused by health of workers are the most harmful and problems caused by technical reasons are least harmful.

Recommendations or guidelines to prevent the accidents are the following:

- Using control measures discussed in risk evaluation worksheet.
- Creating proper awareness among the personals.
- Industries should be provided with strict laws for the violation of preventive or control measures

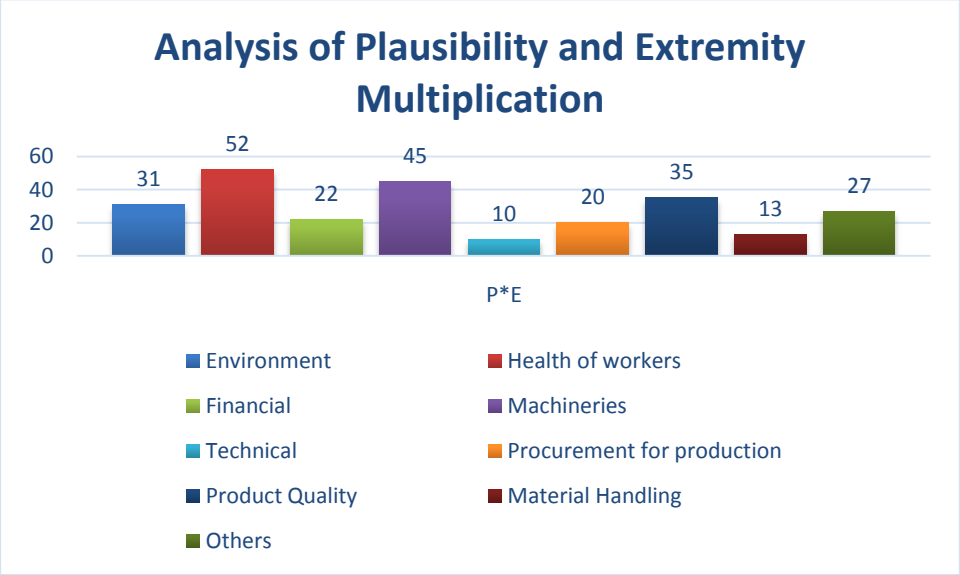

Fig. 1 Analysis of Plausibility and Extremity Multiplication

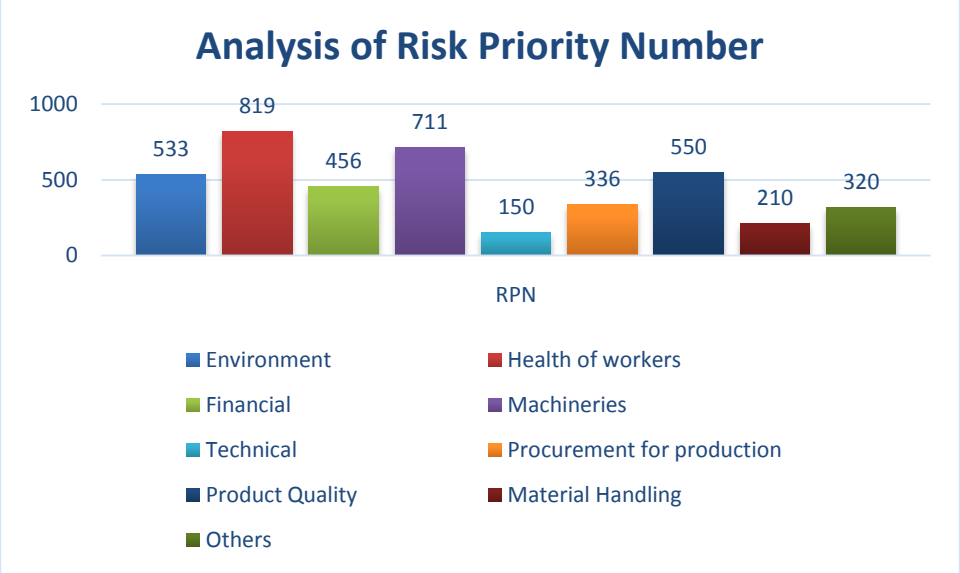

Fig. 2 Analysis of Risk Priority Number

5. CONCLUSION

Electronics industry play an essential role in the economy of our country. Profit from this industry needs better working environment, safety of workers, equipment maintenance, proper procedure, education, budget and other necessary steps in production department. In case of causing risks can badly hamper the reputation and success rate of the industry. In this research work, the risks associated with production section, harmful accidents and preventive measure with recommendation were discussed. By getting help from the study, production section of electronics industry will be able to manage the risks to a great extend as well as can ensure safety culture among the workers.

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