

INVESTIGATION OF INJURIES, ACCIDENTS AND HAZARDS OCCURRED IN A GARMENT FACTORY AND THEIR EFFECT ON PRODUCTIVITY

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Abstract-Industrial safety deals with how to prevent injuries and accidents that occur in the organizations. These injuries and accidents have cost the organization rare values in human resource and information. Therefore safety should be in the forefront of any manager's thinking and a priority in the organization's strategy, not only because of the humanitarian reasons but also because of the financial benefits. The aim of this research work is to investigate injuries, accidents, hazards of a selected garments factory and its effect on productivity. From the analysis of collected data and information it has been seen that most of the injuries occur in the Dying section are, from toxic chemicals and most of the time not for using personal protective equipment's (PPE) and due to unawareness of toxic chemicals. It has been seen from analysis that occurred hazards are mainly of mechanical (56%). Injuries in dying and sewing section are found to be 47% of total injury. It is also seen that 59% of the total injury was occurred in the eye, hand and finger. These injuries not only affected the total productive time but also influence the absenteeism of workers.

Keywords: Safety, Productivity, Workers and Safety Productivity Relation.

1. INTRODUCTION

Safety is the condition to which risks are managed to acceptable levels [1]. It is the activity that seeks to minimize or eliminate hazardous conditions that can cause bodily injury. According to Weick [3], safety is defined as a dynamic non-event that tends to be taken for granted, particularly in the face of continuous and compelling productive demands [1]. Safety deals with securing or reducing accidents at work environment, which has a negative impact on the organization operations at many levels. A positive safety culture can be an effective tool for improving safety in an organization and creating good atmosphere in the workplace [4].

2. LITERATURE REVIEW

Links between safety and productivity: According to Webb [2], a central belief in most of the occupational medicine/health promotion literature is that people perform better when they are physically and emotionally able to work and want to work which in turn leads to higher productivity [5].

2.1 Previous works

In 2010, a study was done by P. Katsuro, C. T. Gadzirayi, Taruwona M and Suzanna Mupararano on "Impact of occupational health and safety on worker productivity: A

case of Zimbabwe food industry". The study found out that bad occupational health safety (OHS) practices in food factories decrease the workers' performance, leading to the decline of productivity. A worker who is suffering from an occupational illness is slower and weaker, thereby, missing set targets [8].

In 2011, a study was done by Thanwadee Chinda, Supatana Techapreechawong, and Suthaporn Teeraprasert on "An Investigation of Relationships between Employees' Safety and Productivity". It is found that People Results has direct effect to Productivity, explaining that productivity tends to be higher when employees, for example, have high job satisfaction, are accounted for proper safety responsibilities, work as a team, and have adequate safety training. The results also show that productivity can be higher with a good safety implementation, as seen by an indirect effect from People to Productivity through People Results [9].

In 2012, a study was done by Bhattacharya A, Park RM on "Excess healthcare costs associated with prior workers' compensation activity". The results reveal that individuals with prior WC claims had higher probability of filing a group health medical claim and higher average monthly medical costs in all sectors. This suggests that a part of employer liability costs related to WC gets shifted to the group health medical insurance system [10].

2.2 Objectives:

The prime objectives of this research work are as follows:

- a) To identify the injuries & accidents and their causes in a selected garment factory.
- b) To identify the losses due to injuries & accidents in a selected production section (sewing & finishing)

3. METHODOLOGY OF THE PAPER

The case study research was conducted in a selected garment industry part of urmi group located at Ghargaria Master Bari, Kewa Sreepur, Gazipur, Bangladesh. It was studied with the management, workers and also work environment based on safety condition. Improvement of working conditions, safety, health and environment al work has important socio-economic benefits like added labor welfare giving workers far greater protection against injuries or death arising in and out of work. A comprehensive analysis of various accident, hazard and risk reasons of these is the main concern of this section. This case study was conducted in various steps that are described in the following points.

Step 1: Primary survey was conducted in order to get the clear conception of the project area and to have preparation of questionnaire.

Some sample questions of step 1 drawn from questionnaire are given below:

Three types of questions were prepared [6]:

- A. Open-ended type;
- B. Close ended type;
- C. Table type; etc.

Step 2: The questionnaire was prepared based on the primary survey in two categories as-

Category one: Questionnaire for injury data collection.

Category two: Questionnaire for work environment's existing safety condition.

Step 3: Verifications and finalizing the questionnaire

Before finalizing the questionnaire, necessary modification was made through addition, subtraction, reformation, as well as correction. The questionnaire were finalized, arranged, and sequenced as per the objectives of the research to be fulfilled.

Step 4: Data collection

Based on questionnaire, data on the variables for a garment industry 66 workers data were collected. These steps also included diagnostic interviews with the management level and the individuals respectively to gather some other relevant information regarding health and safety issues.

Step 5: Data processing and analysis

Here the collected data were processed in tabulated form to represent the data more clearly. The data were

processed by means of Tables, Bar chart, Pie chart and Doughnut chart and analyzed with the help of ABC (Pareto analysis)

4. ANALYSIS AND DISCUSSION

Safety has always been a critical measure of success for industrial organizations. Companies that are not able to comply with safety regulations and procedures in an effective fashion are putting their people, assets, and market position at risk.

A. Injury frequency by the Location of injury: (Approximate 6 months)

According to the table 1 it is seen that 28.78% of the total injury was occurred in the dyeing section, 18.18 in sewing, 12.12 % in the both cutting and printing and rest 28.80% in the finishing, knitting, maintenance, administration, security, store, and quality inspection section. Figure 2 shows frequency by the location of injury.

B. Injury frequency by the body parts :

In table 2 which is given below clearly shows that 59.09% of the total injury was occurred by eye, hand and finger, 13.63% by both feet and back. Rest 13.65% injury occurred by ankle, shoulder, feet-skin, face, hand & eye. Figure shows how the injury by body parts differs. It is seen that 86.35% of the total injury occurred by eye, hand, finger, feet & back. From table 2, Pareto chart of injury frequency by the body parts has been developed as shown in figure 3. Here eye injury is the highest.

C. Injury frequency by the agent of accident :

From the following table 3 it is found that 71.21% of the total injury was occurred from toxic chemicals, lack of rest, improper light, needle, sharp edge, machines and rest 28.79% from trolley, hot mixture/boilers, slippery surface, cloth iron, heat, spindle, screw, pump, dust. In the fig it is clearly seen that 19.70% of the total injury mainly occurred from toxic chemicals. Figure 4 shows that 20% of the total injury by toxic chemicals and 14% by lack of rest which is higher than others.

D. Absence due to injury frequency by the Types of hazard:

According the table 4 given below, it is clear that 59.35% of total absences due to mechanical hazard which is height shown in the figure 5. And rest 40.65% due to Physical or general, chemical, and health hazard.

E. Absence due to injury by the level of worker & its effect as cost (Approximate 6 months):

In this factory 8% extra workers were recruited, to do work in replacement of injured workers who were absent. Extra hired workers were paid same salary scale of the level worker for 8 hour work day. It is to be mentioned that workers salary of absent due to injury are given. Example:

$$\begin{aligned} \text{Per day salary} &= \frac{\text{Monthly salary}}{25 \text{ (working day in a month)}} \\ &= \text{TK } \frac{4750}{25} \end{aligned}$$

= TK 190 per day

Losses for the workers absent

= Number of absent (day) × per day salary

= TK (113 × 190) = TK 21470.

F. Loss time due to injury from productive time and its effect on cost:

Table 6 shows the loss of total productive time as well as losses in polies (product) of lines due to injured workers replacement time.

According to the table 7 it is seen that 30% of total losses due to replacement of injured worker in sewing section, 20% in both cutting and printing section, 17.5% in finishing section and 12.5% in the knitting section.

The calculation of table 6 is shown in the example 1 and table 7 as example 2. Example1:

Total productive time loss

= Total productive time of before the injury day - Total productive time of injury day

= 174.28- 139.78 = 34.5 minute

Total poly loss (product)

= Total poly of before the injury day - Total poly of injury day

= 490- 393 = 97 polies

Losses for per injury

= Poly (product) losses × value

= 97 polies × TK 240 (\$3) = TK 23280

Average productive time losses per injury

= (34.5 + 26.28 + 25.13) / 3 = 28.64 minute per injury

Average product losses for the losses of productive time

= (97+ 43 + 165) = 101.67 polies per injury.

Average losses per injury

= 101.67 polies × TK 240 (\$3) = TK 24400.8

Losses in sewing section

= Number of injury occurred × Losses for per injury

= 12 × TK 24400 = TK 292800

Table 1: Distribution of injury frequency by the Location of injury:

Location of injury	No. of injury	Percentage
Dyeing	19	28.78
Sewing	12	18.18
Cutting	8	12.12
Printing	8	12.12
Finishing	7	10.61
Knitting	5	7.58
Maintenance, administration & security	5	7.58
Store & Quality inspection	2	3.03
total	66	100.00%

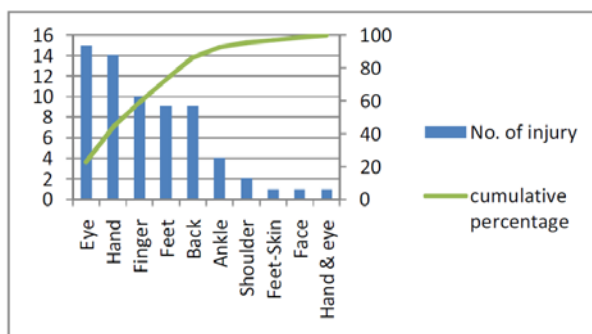


Fig 3: Pareto chart of Injury frequency by the body parts.

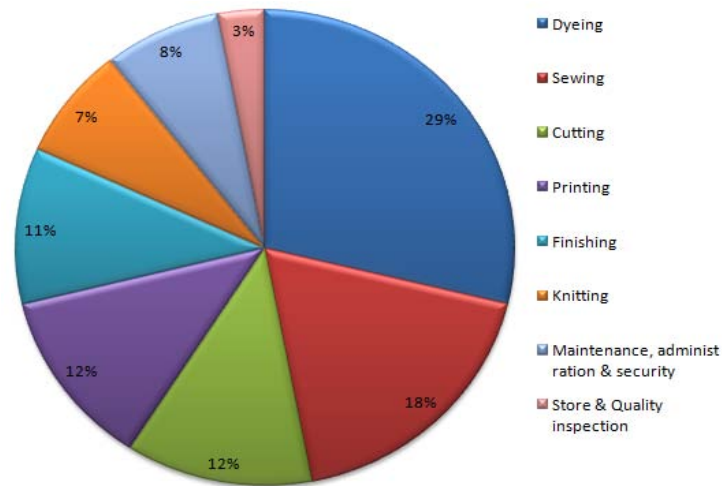


Fig 2: Pie chart of Injury frequency by the Location of injury.

Table 2: Distribution of injury frequency by the body parts

Body parts	No. of injury	Percentage
Eye	15	22.73
Hand	14	21.21
Finger	10	15.15
Feet	9	13.63
Back	9	13.63
Ankle	4	6.06
Shoulder	2	3.03
Feet-Skin	1	1.52
Face	1	1.52
Hand & eye	1	1.52
total	66	100.00%

Table 3: Distribution of injury frequency by the agent of accident

Agent of accident	No. of injury	Percentage
Toxic chemicals	13	19.70
Lack of rest	9	13.64
Improper light	7	10.60
Needle	6	9.09
Sharp edge	6	9.09
Machines	6	9.09
Trolley	4	6.06
Hot mixture/Boilers	3	4.54
Slippery surface	3	4.54
Cloth iron	2	3.03
Heat	2	3.03
Spindle	2	3.03
Screw	1	1.52
Pump	1	1.52
Dust	1	1.52
total	66	100.00%

Table 4: Distribution of absence due to injury frequency by the Types of hazard.

Types of hazard	No. of injury	Absences due to injury	Percentage
Mechanical	37	181	59.35
Chemical	12	54	17.70
Physical or general	9	42	13.77
Health	8	28	09.18
total	66	305	100.00%

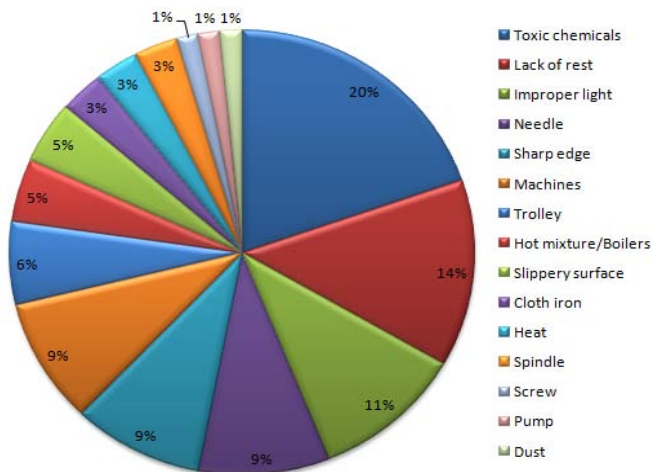


Fig 4: Pie chart of Injury frequency by the agent of accident.

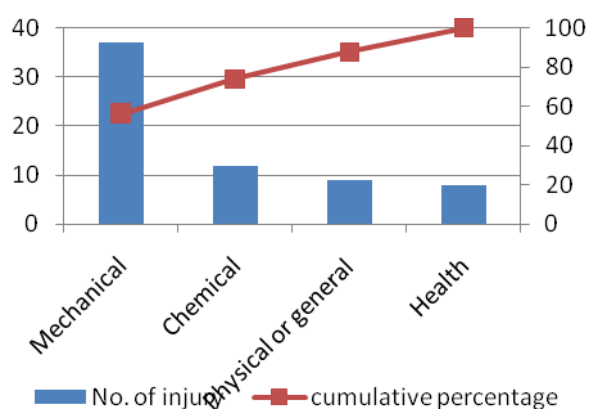


Fig 5: Pareto chart of Absences due to injury frequency by the Types of hazard.

Table 5: Distribution of absence due to injury by the level of worker & its effect in cost (Approximate 6 months)

Level of worker	Absences due to injury (Day)	Avg. salary (Per month)	Per day (TK) (25 working day in a month)	Losses for workers absent in TK
Operator	113	4750	190	21470
Quality inspector	36	15000	600	21600
Supervisor	39	13500	540	21060
GPQ (Guideline for Production & Quality)	19	27500	1100	20900
Expert (admin)	9	30000	1200	10800
Assistant	40	3650	146	5840
GPS (Garment Production Staff)	9	13500	540	4860
Q.E	7	13500	540	3780
Security officer	6	13000	520	3120
GQU (Garment Quality)	8	4750	190	1520
Peon	5	5500	220	1100
DHE (Dyeing helper)	7	3650	146	1022
cleaner	3	5000	200	600
Reporter	2	6500	260	520
GEU (Garment embroidery)	2	6500	260	520
Total	305			1,18,712

Table 6: Distribution of productivity losses due to workers absence for injury.

Date	Producti on line no.	Total productive time of that day (min)	Outcome of that day (Producti on of poly)	Losses (avg. value added as \$3 equals to TK 240)
Before the injury day	10A Sewing	174.28	490	23280
Injury day	10A Sewing	139.78	393	
Before the injury day	10A Sewing	108.98	315	10320
Injury day	10A Sewing	82.70	272	
Before the injury day	2 Finishing	142.43	935	39600
Injury day	2 Finishing	117.30	770	

Table 07: Distribution of Loss time due to injury from productive time and its effect on cost

Location of injury	No. of injury	Cost (TK)	Percentage
Sewing	12	292800	30
Cutting	8	195200	20
Printing	8	195200	20
Finishing	7	170800	17.5
Knitting	5	122000	12.5
total	59	TK 9,76,000	100.00%

5. DISCUSSION

According to the figure 1 and table 1, it is clear that 28.78% of the total injury was occurred in the dyeing section caused by toxic chemicals, excessive heat and Dust also causes long period hazards, workers working long time standing in many sections, continuously long time work causes hazards.

In the figure 2 it is clear that most of the total injury occurred to eye, hand, finger, feet and back for not using gloves, boots, eye protective glass and insufficient light

while working with cutting, sewing machine and toxic chemical especially. Back pain developed due to continuously long time working as more than 2 hours. Eye problem occurred mainly for not using goggles while working with toxic chemicals, dust and heat or other radiations exposure situation.

From the figure 3 it is seen that about 71.21% of the total injury was occurred from toxic chemicals such as Hydrogen peroxide (H_2O_2), Acetic acid (CH_3COOH or $C_2H_4O_2$), Sodium hydroxide (NaOH), hydrozo etc., lack of rest, improper light, needle, sharp cutting edge and machines for especially unawareness, lack of training, over confident, not using personal protective regularly etc.

It is very much clear from the figure 4, that 59.35% of the total absence due to only mechanical injury. Because cutting or burning takes long time to recover as the damage of body parts was in a notable amount.

From the table 5 it is seen that most of the cost associated with the operator and supervisor level worker as TK 21,470.00 and TK 21,600.00 respectively. The total cost for the absent of worker due to injury is about TK 118712 in six month.

It is clearly seen from the table 6 that as per injured workers replacement by other worker consumed some productive time which result in output as production loss. This loss as in the sewing section is TK 2,92,800.00 which is about 30% of the total loss by replacement of worker. In the cutting and printing section it is about 20% each.

So, the hazards 46.96% mainly occurred in the Dyeing and Sewing section are by the toxic chemicals and machines which 56.05% affected the operators and assistant level workers eye and hand as 43.94% because they are directly attached to the work or machine. But if as a whole the hazard was mainly mechanical in the dyeing, printing and sewing section with respect to the total workers in each section and which was affected to the male permanent type of worker. So the absences due to injury were higher in the mechanical and chemical in the dyeing, printing and sewing section as 67.21%. And hand and Eye injury absences are as 45.90% of the total absences by thr operator and assistant level of worker as 50.16%. It is also found that the injury frequency in each month was remaining the same in last six months.

From the analysis, it may be shown that only providing hand and eye protective equipment to the operator and assistant level of worker of dyeing and sewing section worker, the injury may be reduced as

$$= \frac{46.96 \times 56.05 \times 43.94}{100 \times 100 \times 100} \times 100 \% = 11.57\% \text{ of the total injury and}$$

The absences may be reduced as

$$= \frac{67.21 \times 45.90 \times 50.16}{100 \times 100 \times 100} \times 100 \% = 15.47\% \text{ of the total absences.}$$

But if these equipments are provided in all section then the injury may be reduced as

$$= \frac{56.05 \times 43.94}{100 \times 100} \times 100\% = 24.62\% \text{ of the total injury}$$

and

The absences may be reduced as

$$= \frac{45.90 \times 50.16}{100 \times 100} \times 100 \% = 23.02\% \text{ of the total absences.}$$

So the loss may be reduced to $(\frac{24.62 \times 976000}{100} +$

$$\frac{23.02 \times 118712}{100}) = \text{TK } 26,7618.70 \text{ in six months. Which}$$

is $(\frac{26,7618.70 \times 100}{976000 + 118712}) \% = 24.45\%$ of the total loss due to injury in six months.

6. RECOMMENDATIONS

From the analysis and findings of the previous section this study recommends a few steps and action plan which if implemented carefully and sincerely in the concerned organization the frequency of injury might have been reduced considerably about 70% to 80% [7].

The recommendations are as follows:

- Adequate supply, regulation and distribution of personal protective equipment and firefighting equipment.
- They should use safety sign and color codes.
- Regular medical checkup on hearing, sight and strength of workers.
- Proper safe guards to the agent of accidents such as pump, needle, cutting, sewing, and printing machine and need special care while working with toxic chemicals.
- Leisure during a shift for worker to reduce fatigue and to do quality full work which may leads to improvement in productivity.
- Ensuring the use of gloves, shoes, eye protective glass and mask while working with chemicals; mandatory of using gloves and masks while working with cutting, sewing, finishing, printing machine etc.
- Ensuring that the fire alarm and fire equipment are working.

Every industry should have a safety department for reducing accident, injury and to get maximum output.

7. CONCLUSION

From the analysis and discussion the conclusions are as follows:

1. 29% injury was occurred in the dying section by toxic chemical, and 18% was in sewing section.
2. 59% injury occurred in eye, hand and finger.
3. Among the total injured persons 56% are operator and assistant.
4. It is also seen that total of 67% absenteeism occurred in dying, printing and sewing section.
5. Mechanical and chemical type's hazards are 56% and 18% respectively.
6. This absenteeism occurred mainly for injury in hand, eye and feet.
7. Production loss due to injury in the sewing section is about 30%, which is greater than the other sections. Then the losses are as 20% both in cutting and printing section.
8. If, only Eye protective goggles and hand gloves are provided to the operator and assistant level of worker of Dyeing and Sewing section, then

11.57% of the total injury and 15.47% of the total absences may be reduced.

9. But if the Hand and Eye protective equipments are provided to every sections operator and assistant level of worker, then the injury frequency may be reduced to 24.62% of the total injury and 23.02% of the total absences.
10. So thus the loss may be reduced to 24.45% of the total loss due to injury in six month.

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