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Original

Textile Industry Hazard Identification and Risk Assessment by Using HAZAN Method

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Abstract

Background: Today with industry growth, hazards are increasing. The most important parts of these industries are human resources and employees, that face with many various hazards. Therefore, in order to protect and increase the productivity these hazards must be identified and analyzed to be controlled. **Methods:** The present study focused on hazard identification and risk assessment in spinning sector of a textile industry as one of the important and strategic industries by using HAZAN method. For data gathering, different methods including HAZAN worksheet, risk detecting checklist, walking, talking, process plots and documents were used, and then risk assessment was carried out. **Results:** The finding represented 102 risks in the production line. Most of the risks were found in ring section (n=33), Flyer (n=26), Autoconer (n=18), Tightening (n=15) and Packing (n=10) respectively. 20.59% of these risks were 2nd rank (undesirable), 16.67% were 3rd rank (acceptable if controlled) and 62.74% were 4th rank (acceptable). In addition, high-risk jobs were feeding the empty bobbin during the shift and bobbin handling from the Autoconer unit. Also, analyses were performed based on the risk assessment method and statistical tests were not required. **Conclusion:** The 4th rank risk was the largest group that's acceptable. It is notable that 2nd risk rank should be turned into 3rd risk rank in reliable time. For 3rd risk rank making sure that existing control is in place is sufficient. For making a safe work environment and increasing productivity, minimizing risk by safety training and other measures are useful.

Keys word: Textile industry; HAZAN method; Risk assessment

Introduction

Today in this industrial globe workers and employees are more and more in danger of different types of hazards from mild to severe that can lead to an accident. Occupational accidents cause different effects such as absenteeism, scarcity of experienced and reliable staff and permanent damage to the individual both psychologically and physically that directly effects the industry performance and the economy of the country as a result.[1] Based on occupational safety and health administration (OSHA) report, 5,190 workers were killed on the job in 2016 that shows the average more than 99 a week or more than 14 deaths every day.[2]

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In Iran, accident statistics were 18522 accidents in 2016.[3] These accidents cause financial and human damages to the organization. accidents can be controlled by identifying their causes, as well as the risk factors that might lead to damage.[4]

For accident prevention first, the causes of the accidents must be reviewed and processed. Risk assessment is one of the most important methods for controlling the hazards.[5] Before workplace hazards lead to an occupational accident or disease, they can be identified by risk assessment.[6] Risk assessment has a long history in industries, for example, the nuclear, petrochemical, military and space industrials have applied a vast various risk assessment techniques for over 40 years.[7] The hazard identification and risk assessment of workplace involve a careful examination of all risk factors that can lead to injury or illness in the workplace. It also indicates whether the control procedures were adequate and effective or not.[6] Risk assessment can be qualitative or quantitative. There are many different risk assessment techniques that have their own specific outcome.[8]

HAZAN or Hazard Analysis is a quantitative method that is also called risk analysis, risk assessment, probabilistic risk assessment (PRA) and quantitative risk assessment (QRA).[9] The textile industry has occupied an important position in the national economy especially in the Asian business environment.[10] Textile industry workers face many risks that may endanger their health. An OHS study in textile industries in Tamilnadu, India reported that RPN (risk priority number) is found high for dust (1000) and electrical hazards (900).[11, 12] Like other industries, textile workers also suffer from a musculoskeletal disorder.[12, 13] Many studies used HAZAN as a comprehensive method for detecting risks, some of them are mentioned in the following. Ali Nezhad and Movafagh carried out HAZAN risk assessment for health and safety risks in construction industries. Hadizadeh et al. used HAZAN method for assessing risks in one unit at Barez industries group. Jaafari and tabari applied HAZAN method in distill unit in a refinery industry. Sohrabi et al. conducted a study using HAZAN method in wood and metal production industries. To consider the information that were mentioned above, the present study aimed at detecting and assessing risks in spinning sector of a textile industry using HAZAN method.

Methods

This descriptive cross-sectional study was done in the spinning segment of a textile industry located in Iran in 2018. In this industry, the spinning sector includes five unites flyer, ring, Autoconer, tightening and packing. For detecting the risks, HAZAN method was used because it considers all types of hazards and powerful to Hazard identifying, detecting the risk and control planning. The data were gathered by HAZAN data sheet, walking, talking, process technical plots and information. HAZAN methodology was done in research field step by step that included job activities classification, hazard detection, decision making for acceptable risk limit, risk determination, risk control plan preparation (if necessary), and plan to revise table 1-3.[4]

Table 1. Risk probability classification

Probability	Risk probability description
1	Once or more per week
2	At least once a month or once a month among 10 similar organization
3	Once a year or once a year among 10 similar organization
4	Once over the life cycle of the organization
5	None probable in general

Table 2. Risk severity classification

Severity	Risk severity description
A	Death or severe injuries, serious leakage of contained material, explosion, major fire outbreak, more than one million dollars per day.
B	Serious injuries or permanent disability, moderate level of contained material, explosion or moderate fire outbreak, moderate level loss of production, 500 thousands to one million dollars per day.
C	Long-time injuries without permanent disability, minor leakage of contained material, minor production loss, 25 thousands to 500 thousands loss per day.
D	Injuries that need first aid without disability,
E	Riskless, no need for further assessment, no problem, negligible negative economic loss.

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Table 3. Risk ranking

		Probability of accident				
		1	2	3	4	5
Severity of risk	A	1	1	2	3	Note probable
	B	1	2	3	4	Note probable
	C	3	3	4	4	Note probable
	D	4	4	4	4	Note probable
	E	Riskless	Riskless	Riskless	Riskless	Riskless

Results

In this industry in the production line 5 jobs, 38 tasks, and 102 risks were totally recognized. 20.59% of risks were undesirable (2nd rank), 16.67% were acceptable with control (3rd rank) and 62.74% were acceptable (4th rank) figure 1.

The highest number of risks was detected in-ring job (more than 32%), and the lowest risk was detected in packing job (lower than 10 %). In Flyer unit undesirable risks were more than other units. In Autoconer unite acceptable risks with control and in Ring unite acceptable risks were higher than other units. Table 4 shows some activities with different risk rank.

Moreover, the type of activities and related units that had undesirable risk (2nd rank), acceptable with control risk (3rd rank) and acceptable risk (4th rank) are shown in tables 5-7. Based on the results there were no unacceptable risks in this industry.

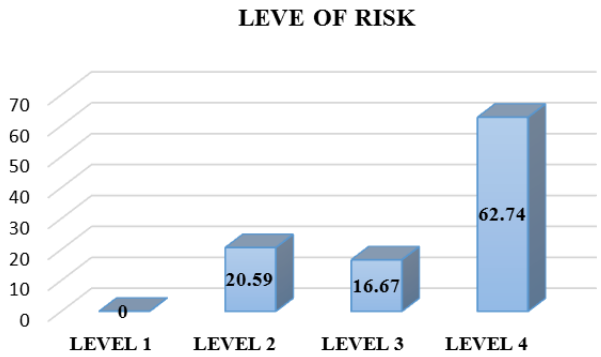

Figure 1. The percentage of risk based on risk ranking

Table 4. Frequency and percentage of risk based on units

Job risk ranking	Risk frequency-based risk ranking and jobs				Total
	1	2	3	4	
Flyer	0	10	3	13	26
Ring	0	4	4	25	33
Autoconer	0	4	5	9	18
Tightening	0	2	4	9	15
Packing	0	1	1	8	10
Frequency	0	21	17	64	102
Percent		20.59	16.67	62.74	100

Table 5. Activities with undesirable risk (2nd rank)

Unit	Activity
Flyer	workplace Sweeping, instrument cleaning, bobbin replacement,
Tightening	Fuzz cleaning, ventilator discharge,
Autoconer	Empty duke and bobbin feeding, Instruments feeding, carrying loop from ring to Autoconer, Feeding and loading the device along shift
Ring	Bobbin feeding on the ring

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Table 6. Activities with acceptable risks with control risk (3rd rank)

Activity	Unit
Carrying bobbins from autoconer,	Packing
Coiler cleaning, loop cleaning,	Tightening
bobbin replacement, loop basket filling,	Autoconer
Re operate after repairing	Ring

Table 7. Activities with acceptable risk (4th rank)

Activity	Unit
Wheels cleaning, back conductor cleaning, Cleaning the bows' wheels	Flyer
Mahoti cleaning, ventilator discharge, bobbin feeding on ring ,	Ring
Banke carrying to salon NO 1,	Tightening
Carry and pull loads, Grill feeding on the machine shakers,	Autoconer
Bobbin covering, putting the bobbin in box, box plumping, putting box on plates.	Packing

Discussion

The Result of the study showed that 20.59% of the risks were in 2nd rank (undesirable), 16.67% were 3rd rank (acceptable if controlled) and 62.74% were 4th rank (acceptable) figure 1. Qara Gozlou et al. studied an oil factory using HAZAN method and found that 0.8% of risks were in 1st rank, 12.7% were 2nd rank, 29.36% were 3rd rank and 57.14% were 4th rank.[14] Sohrabi et al. carried out HAZAN method in wood and metal production industries, in which 2.92% of risks were 1st rank, 2.92% were 2nd rank, 85.4% were 3rd rank and 8.76% were 4th rank.[4] Ghaljahi & Namrudi used FMEA method in a flour factory and reported that 45.54%, 36.36%, 9.09%, 0.09% of the identified risk were within the unacceptable, unfavorable, acceptable, and inconsiderable risk level, respectively.[15]

As listed in table 4 the most hazardous units were ring and flyer units. In addition bobbin feeding a ring (7 risks), cleaning the clamps of the machine (6 risks) and cleaning of the mahoti (5risks) were the riskiest jobs in the spinning sector. Kazemi et al. found that handwork and sensory in different shifts among the textile industry had significant relationships with the occupational hazard ($P < 0.05$).[16] Malik et al. mentioned that the factors which are responsible to create hazards in the environment of the textile industry are physical, chemical, biological and ergonomic factors. To minimize this hazard, hazards control measure should be applied.[17]

Reinhold et al.carried out a study in the middle textile industry in Estonia. They mentioned that the main risk factors in the textile industry are hazardous tools and equipment, heavy physical loads, ergonomics, noise, and textile dust. They also found that from the viewpoint of accident/trauma, the hazards for finger trauma exist.[18] Mosadegh & Rezaeian used HAZAN method to detect excavating operation risks. They found 140 risks in different ranks, the operation with the highest risk was soil pollution because of dangerous trash. In the current study, %62.74 were in 4th rank.[19] Sohrabi et al. followed HAZAN method in wood and metal production industries and found that 3rd rank risks were the largest group and 1st and 2nd with 2.92% were the smallest groups in risks rank.

The following are a few recommendations to reduce the hazards:

- Regular and periodic training program establishment
- Worker involvement in safety planning
- Clear work instructions preparation
- Warning signs being placed at suitable place
- First aid box being available
- Training the workers to follow the emergency procedures
- Employees encouragement to have a voice in safety
- Maintaining all machinery in a good working order
- Avoiding and removing unnecessary hazards
- Having a review safety guideline every year

Conclusion

The results showed that 4th rank was the largest group in the spinning sector but there are still risks that should be managed. It's notable that 2nd rank risks shall be turned to 3rd ranks in a reasonable time. With regard to 3rd rank risks it is needed to make sure that the controls are available and 4th rank risks are also acceptable. Tacking actions such as providing safety procedures, safety training and continuous monitoring of workplace safety can help reduce risks and accidents.

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