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RESEARCH ARTICLE

Risk Detection and Assessment in Wood and Metal Products Industries using HAZAN Method

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Abstract

Developing and advancing technology in the industries has increased the number of risks at work environment and the number of workers at risk as well. These risks and the risk factors need to be managed, assessed, and controlled using systematic methods. Therefore, the present study is aimed at assessing and detecting risks in wood and mental products industries using HAZAN method. Data gathering was done using HAZAN worksheet, observation, walking and talking method, risk detecting checklists, technical documents, and plots available. The findings represented 137 risks at workshop, out of which 2.92% were 1st rank (unacceptable), 2.92% were 2nd rank (undesirable), 85.4% were 3rd rank (acceptable if controlled), and 8.76% were 4th rank (acceptable). Most of the risks were found at MDF section (n 30), metal assembly (n 28), metal works (n 27), and MDF assembly (n 23). In addition, high risks jobs were bending, electrical welding, PVC work, and guillotine work. The results showed that 3rd rank risks were the largest group of risks and this showed that great improvement could be made in cutting the number of accidents and financial and life loss by controlling these risks. It is notable that 1st rand risks should be controlled immediately using engineering and administrative controls and 2nd rank risks shall be turned into 3rd rank risks in a reasonable time frame. With regard to 3rd rank risks, we need to make sure of availability of controls; and the 4th rank risks were acceptable. Taking measures such as safety training and permanent supervision by the safety authorities were also effective to minimize the risks.

Keywords: *Risk, Assessment, HAZAN method, Industrials products, Workers risk.*

Introduction

Occupational accidents are one of the main causes of losing skillful workforce, capital, and time, which also threaten national progress and development (1). According to statistics, occupational accidents are the third and second cause of death and the world and Iran respectively. The first cause of death in Iran are car accidents. Therefore, occupational risks are of the main health, economic, and social problems (2, 3, 4).

Occupational accidents are not completely accidental as they can be predicted and effective measures could be taken to control and curtail them (5, 6). Accidents are of the main causes of loss and damage in the organization. They can be direct or indirect cause of financial and life losses in a producing organization. Accidents control is one of the main challenges that most of the managers are encountered with. Through determining the causes of accidents and their roots, they could be controlled in an efficient way. Usually, organizations need a system to evaluate their activities and processes, which also enables them to analyze the factors effective on accidents and the causes of accidents (7).

Risk assessment is one of the main parts of health, safety, and environment (HSE) system, which is aimed at detecting, assessing, and controlling the risk factors that might negatively affect health and safety of the employee (8- 14). According to OHSAS18001, risks assessment is an assessment process that focuses on the risks caused by the hazards at work environment while taking into account possible control measures and decisions regarding acceptability or unacceptability of the risks (15).

Surveying the risk factors and spotting risky areas in an organization is critical to prevent accidents. Risk in project, by definition, refers to unknown possible events that influence the project either positively or negatively. Each one of these events and situations have their own detectable causes and outcomes. The outcomes of these events directly influence time schedule, cost, and quality of the project. Therefore, having a good knowledge about the risk and determining the extent of positive and negative outcomes of them is of great importance for the objectives of a project.

The issue of limited resources, health, safety and environment are of the main concerns of the organizations and also human societies including those in developing countries and Iran in particular. One may say that protecting human life is one of the challenges in the new century. Reducing man's vulnerability to risks is one of the main objective of HSE management system (16).

Adopting proper techniques to analyze the risks in industries is a vital step toward determining the measures effective in reducing accidents rate. Risks analysis methods have developed considerably over the recent decades and each one of these methods have their own viewpoints, applications, and functions. Of the main reasons for development of risk analysis method are complicacy of situations, problems in combining information from different sources, and uncertainty of the outcomes of the decisions (1, 5, 6). Given the above introduction, the present study is aimed at assessing and detecting the risks in a wood and metal product workshop using HZAN method.

Material and Method

A descriptive-cross-sectional study was carried out in MDF kitchen cabinet workshop located in Kermanshah-Iran. HAZAN method was used to detect the risks. To collect the data and information, HAZAN worksheet, observation, walking-talking method, risk detection checklists, and technical documents and plots were used.

HAZAN method is a comprehensive method to comprehend and detect occupation risks, which also generates a list of proper controls to attenuate the risks. In addition, having a clear image of occupational risks is effective in preventing occupational accidents. Risk assessment steps according HZAN method begins with classifying job activities, following by detecting the risks, determining decision making risks with regard to acceptability of the risks, determining risk control plan (if needed), and revising the plans. (Table 1-3)

Table 1: Risk severity classification

Severity	Remark
A	Death or severe injuries, serious leakage of contained materials, explosion, major fire outbreak, loss of production capacity, more than one million dollars loss per day
B	Severe injuries or permanent disability, moderate level leakage of contained materials, moderate scale explosion or fire outbreak, moderate level loss of production capacity, 500 thousand to one million dollars loss per day
C	Long-term injuries without permanent disability, trivial leakage of contained materials, trivial loss of production capacity, financial damage between 250 thousand to 500 thousand dollar per day
D	Injuries that need first aides with not disability, very small leakage of contained material with no notable effect on the environment, minimum damage to machineries and production capacity, financial damage less than 250 thousand dollar per day
E	Riskless, no need for further assessment, no problem, negligible negative economic loss

Table 2: Classification of risk probability

Probability level	Remark
1	Once or more per week
2	Once a month at least or once a month among 10 similar organizations
3	Once a year at least or once a year among 10 similar organizations
4	Once over the life cycle of the organization at least
5	No probable in general

Table 3:Risk ranking

Probability of accident					Severity of risk
5	4	3	2	1	
Not probable	3	2	1	1	**A**
Not probable	4	3	2	1	**B**
Not probable	4	4	3	3	**C**
Not probable	4	4	4	4	**D**
Riskless	Riskless	Riskless	Riskless	Riskless	**E**

Results and Discussion

Comparison of the results showed that 2.92% of the risks were 1st rank (unacceptable), 2.92% were 2nd rank (undesirable), 85.4% were 3rd rank (acceptable if controlled), and 8.76% were 4th rank (acceptable) (Diagram 1).

The results also showed that the 3rd rand risks were the largest group of risks and controlling these risks would be a great step toward reducing the accidents and the damages.

Table 4: Risks ranking based on jobs

Job Risk ranking	Risk frequency based risk ranking and jobs				Total
	1	2	3	4	
Guillotine operator	0	1	9	0	10
Drawing on sheets	0	0	4	0	4
Bending	0	0	12	1	13
Electrical welding	2	0	11	0	13
CO2 welding	1	0	6	1	8
Grinding	1	0	5	1	8
Rinsing and drying out cabinets	0	0	5	3	8
Powder painting	0	0	8	1	9
Cutting	0	0	8	1	9
PVC work	0	0	11	1	12
Shaping machine operator	0	0	8	1	9
Attaching wooden parts	0	0	1	0	4
Drilling	0	0	8	0	8
Stapler gun operator	0	0	4	1	5
Powered screw driver operator	0	0	6	0	6
Lift truck operator	0	3	4	1	8
Security personnel	0	0	4	0	4

Table 5: Frequency and percentage of risks based on job

Risk ranking	Frequency and percentage of risks based on job				
	4	3	2	1	Total
Total	12	117	4	4	137
%	8.76	85.4	2.92	2.92	100

Table 6: Frequency based on risks in units

Unit	Frequency based on risks in units				Total
	1	2	3	4	4
Metal works	0	1	25	1	27
Metal parts assembly	4	0	22	2	28
Rinsing	0	0	5	3	8
MDF	0	0	27	3	30
MDF parts assembly	0	0	22	1	23
Painting	0	0	8	1	9
Warehouse	0	0	4	0	4
Handling	0	3	4	1	8
Frequency	4	4	117	12	137
%	2.92	2.92	85.4	8.76	100

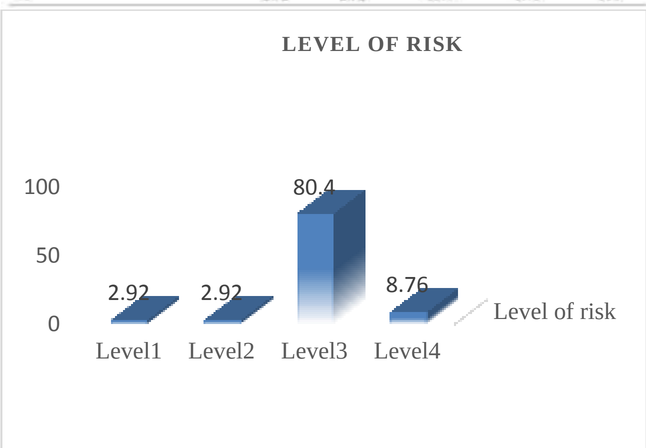

Fig 1: Percentage of risks based on their ranking

Table 7:Activities with unacceptable risks (1st rank)

Job	Unit
Shaping, electrical and CO2 welding	**Metal parts assembly**

Table 8:Activities with undesirable risks (2nd rank)

Job	Unit
Lift truck operator	**Handling**
Guillotine operator	**Metal works**

Table 9:Activities with acceptable with control risks (3rd rank)

Job	Unit
Guillotine operator, drawing on sheets, bending	**Metal work**
Electrical and CO2 welding, shaping,	**Metal parts assembly**
rinsing cabinets	**Rinsing**
Painting	**Painting**
Cutting, shaping, PVC operator	**MDF works**
Drilling, attaching parts, stapler operator, powered screw driver operator	**MDF parts assembly**
Security	**Warehouse**
Lift truck operator	**Handling**

Table 10: Activities with acceptable risks (4th rank)

Job	Unit
Bending	**Metal work**
CO2 welding, shaping	**Metal part assembly**
Rinsing and drying out metal parts of cabinets	**Rinsing**
Cutting, shaping, PVC machine operator	**MDF**
Stapler operator	**MDF parts assembly**
Power painting	**Painting**
Lift truck operator	**Handling**

The findings represented 137 risks at workshop, out of which 2.92% were 1st rank (unacceptable), 2.92% were 2nd rank (undesirable), 85.4% were 3rd rank (acceptable if controlled), and 8.76% were 4th rank (acceptable). Mohammad Fam et al. conducted a study in an oil company using HAZOP method and found 1180 risks including 38.13% unacceptable risks and that 31.35% of the risks were due to human errors (17).

Khandan et al. studied a tile production unit using FUHA method and found that out of 60 detected risks, 7 were unacceptable, 17 were undesirable, and 36 were acceptable with control (18). As listed in Table 6, the most hazardous units were MDF unit, metal parts assembly unit, metal works units, and MDF parts assembly unit. In addition, according to Table 4, electrical welding (13 risks), bending (13 risks), PVC works (12 risks) were the riskiest jobs. Kenaroudi et al. used William Fine method in East Cement Company as found that welding and cutting activities (electrical shock, welding fume, excessive pressure on the muscles, and noise) and electrical equipment service and maintenance (electrical shocks) were the riskiest jobs (19).

Mortazavi followed ETBA method in petrochemical industry and found that the majority of risks were in drilling and earthwork jobs, works that need to be done at high altitude, electrical works, welding, and cutting (20). According to the literature review, the main causes of unsafe behaviors in the personnel are lack of knowledge about safe ways of doing jobs (skills), negligence of safety measures (attitude), beliefs that doing jobs in an unsafe manner would not cause a problem (belief), failure to observe safety measure due to stresses (emotional), and thinking that safety measures are time consuming (personality).

In addition, and taking into account type of the detected risks, designing and implementing preventive repair services would be effective on controlling detected risks (21, 22).

The following are few recommendations to reduce hazards of the risks:

- To design and implement routine and periodical education programs for the employees;
- To carry out safety culture and attitude assessment among the managers and employees and to carry out intervention programs to improve them;
- To screen the personnel in critical areas based on examining accident- proneness;
- To design and implement accident information analysis registration and analysis system (17);
- To educate the employees with regard to how to handle objects and use cart to more parts;
- To designate a permanent technical safety supervisor; and
- To implement permanent safety training program for employees to remind them the outcomes of unsafe and risky actions.

Conclusion

The results showed that 3rd rank risks were the largest group of risks and this showed that great improvement could be made in cutting the number of accidents and financial and life loss by controlling these risks. It is notable that 1st rand risks should be controlled immediately using engineering and administrative controls and 2nd rank risks shall be turned into 3rd rank risks in a reasonable time frame. With regard to 3rd rank risks, we need to make sure of availability of controls; and the 4th rank risks were acceptable. Taking measures such as safety training and permanent supervision by the safety authorities were also effective to minimize the risks.

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