RISK CONTROL ENHANCEMENT USING SAFETY CLIMATE FACTORS FOR HIRARC METHOD IN STEEL PRODUCT INDUSTRY

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To my beloved mother and father

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ABSTRACT

Accident in manufacturing industry in Malaysia has been high for the last five years. The current strategy of reducing accident by detecting the hazard and do necessary action to the hazard was found to be not enough to prevent accidents in manufacturing industry. The method used for that was Hazard Identification, Risk Assessment, and Risk Control (HIRARC). Meanwhile, safety climate was developed to understand the current condition of safety in the organization. The purpose of this study was to enhance selected risk control in HIRARC method using safety climate factors. The hazards were identified using observation, interview, and analysis of the accident history. Then each hazards were assessed to get the risk score and level. A survey was conducted to get the safety climate result. The safety climate result was subject to Exploratory Factor Analysis (EFA). From the EFA result, it was found that five factors were safety climate in steel product industry, involving management commitment and actions for safety, worker's commitment towards safety, priority for safety over production, emergency preparedness in the organization, and safeness in work environment. From analysing the factors, administrative control method was selected to enhance risk control that was already selected by incorporating techniques in administrative control parallel with other type of risk control. In conclusion, factors of safety climate could be used in enhancing the risk control method selected for HIRARC in steel product industry.

ABSTRAK

Kemalangan dalam industri pembuatan di Malaysia telah tinggi untuk tempoh lima tahun yang lalu. Strategi semasa mengurangkan kemalangan dengan mengesan bahaya dan melakukan tindakan yang perlu untuk bahaya yang telah didapati tidak cukup untuk mencegah kemalangan dalam industri pembuatan. Kaedah yang digunakan untuk itu adalah Pengenalpastian Bahaya, Penilaian Risiko dan Kawalan Risiko (HIRARC). Sementara itu, iklim keselamatan telah dibangunkan untuk memahami keadaan semasa keselamatan dalam organisasi. Tujuan kajian ini adalah untuk meningkatkan kawalan risiko yang terpilih dalam kaedah HIRARC menggunakan faktor-faktor iklim keselamatan. Bahaya telah dikenal pasti dengan menggunakan teknik pemerhatian, temu bual, dan analisis sejarah kemalangan. Setiap bahaya dinilai untuk mendapatkan nilai risiko dan paras risiko. Satu kajian telah dijalankan untuk mendapatkan hasil iklim keselamatan. Hasil iklim keselamatan adalah tertakluk kepada *Exploratory Factor Analysis* (EFA). Dari keputusan EFA, didapati bahawa lima faktor adalah iklim keselamatan dalam industri produk keluli, yang melibatkan komitmen dan tindakan untuk keselamatan, komitmen pekerja terhadap keselamatan, keutamaan untuk keselamatan ke atas pengeluaran, persediaan kecemasan dalam organisasi, dan keselamatan dalam persekitaran kerja. Dari menganalisis faktor, kaedah kawalan pentadbiran telah dipilih untuk meningkatkan kawalan risiko yang telah dipilih dengan melaksanakan teknik dalam kawalan pentadbiran yang selari dengan lain-lain jenis kawalan risiko. Kesimpulannya, faktor-faktor iklim keselamatan boleh digunakan dalam meningkatkan kawalan risiko yang dipilih untuk HIRARC dalam industri produk keluli.

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CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter is covering overview of the study from the background of problems, problem statement, objectives, scopes and significances. The brief overview explains the general information regarding the study, such as the problems studied, limits used, and goals of the study.

1.2 Background of Problem

Accident is an undesired event that causes injury or property damage (Bird and Germain, 1985). Malaysian Department of Occupational Safety and Health (DOSH) is keeping records of reported occupational accidents in Malaysia (OSHA, 1994). From the record, manufacturing industry has the highest number of accident occurrences in 2014 compare to nine other sectors. Furthermore, manufacturing industry also recorded to have the highest number of non-permanent disability and permanent disability as the result of accidents in 2014. In addition, the record also shows that manufacturing industry has been the highest accident occurrences for five consecutive years from the year 2010 until 2014. Zakaria *et al.* (2012) studied that accident in manufacturing industry is from changing the production method from manual or by hand process to mechanical or machine process. This change eliminates hazard from hand or manual to the new mechanical hazard.

In order to stop accident from occurring, numerous studies have been done. The earliest theory known for accident causation model is written by Heinrich in 1931. In his theory, he stated that accident happens as the result from sequential of events. Thus, in order to prevent accident from occurring, simply removing one of the events from the sequence would be sufficient. In manufacturing industry, removing hazards from the sequence of events would prevent the accident from occurring.

To remove a hazard, it is started with identification of hazard. Hazard is a situation with potential for it to cause any harm in terms of human injury or ill health, damage to the property or environment, or any combination of these (DOSH, 2008). Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method suggested by Department of Occupational Safety and Health (DOSH) Malaysia could be used in identifying hazards in the process. After identifying hazards, the hazards could be prioritized before any preventive measures are given by assessing the risks from each hazard. The hazards are assessed using three method of assessing, such as qualitative method, quantitative method, and semi-quantitative method. Then risk control strategy selected for each hazards based on the priority or risk level assessed.

However, there are six method of risk control available according to DOSH (2008), such as elimination, substitution, isolation, engineering control, administrative control and using personal protective equipment or PPE. The selection of a method using DOSH guideline is based on the hierarchy of risk control method and proposed duration of risk control method will be applied, such as for long term or only for short term. For short term or temporary control, it is usually for the high risk hazard where immediate action is required. But for the long term control, it needed further planning on which method should be applied to control the risk. Meanwhile, safety climate is employees' current perceptions or opinions regarding safety policies, procedures, practices, and general importance and priority of safety at work (Griffin and Neal, 2000; Zohar, 1980). From the result of safety climate, it is expected to get the factors that are contributing to the safety in the company. By

focusing on the factors, selected method for risk control could be further enhanced mainly for the long term plan.

1.3 Problem Statement

HIRARC method as strategy in preventing accident has been used in many industry. The three steps of HIRARC are applicable in every industry. The last step in HIRARC is selecting risk control method and implementing it to the hazard. On the other hand, safety climate has been studied by many researchers to understand the safety condition in the industry. From the previous studies, many dimensions as a result of safety climate have been found, such as management commitment, safety procedure, and many others. However, very limited studies of safety climate have been done in the manufacturing industry, especially in steel product industry. In addition, safety climate factors are different for each industry even between organizations in the same type of industry due to differences of the employees' perception of the safety condition in the organization. Furthermore, HIRARC as a method of preventing accident is rarely integrated with safety climate for enhancing the selected risk control method.

1.4 Objectives

The objectives of this study are as follows:

a. To determine the structure of safety climate in steel product industry using an exploratory factor analysis.
b. To applied safety climate factors for enhancing risk control selected in HIRARC method.

1.5 Scopes

The study scopes are as follows:

a. The study was conducted in Kiswire Sdn Bhd located in Pasir Gudang, Johor, Malaysia.
b. Historical data of accident from the company was collected for three years.
c. Safety climate data was collected from operators and staff in the company.
d. Risk control method suggested is for long term duration in wire rope department in the company.

1.6 Significances

There are two significances from this study, there are:

a. Gained more understanding about hazards and risks in the steel product industry.
b. Give application of enhancing risk control selection of HIRARC method using safety climate factors.

1.7 Organization of the Thesis

Chapter 2 dealt with literatures related to HIRARC and safety climate. It began with a brief overview on accident causation theories. Then followed by a detailed explanation about HIRARC method which consist of hazard identification, risk assessment, and risk control. Safety climate and dimensions were also described. Current legislation of safety in Malaysia were briefly explained. This chapter was ended with a complete review on HIRARC method and safety climate.

Chapter 3 presented the methodology used in this study. This chapter showed the data collection and data analysis process of the study. The data collection process included the data collected from the company. The analysis of the data were explained in detail. This chapter also explained the background of company where the study took place.

In Chapter 4, the data collected was represented in tables and graphics. The data then briefly explained. The analysis result of the data were also showed in this chapter. Discussion of the data and theory were the last part of this chapter. The proposed enhancement for risk control method in HIRARC using safety climate factors were discussed in detail.

In Chapter 5, concluded the discussion of this study and several recommendations for future study were given. The limitations of this study were also explained in this chapter.

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