THE RELATIONSHIP AMONG SAFETY MANAGEMENT SYSTEM, SAFETY CLIMATE AND SAFETY PERFORMANCE IN CONSTRUCTION SITES

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND SYMBOLS USED

λ	Lambda (Standardized Regression Weights)
χ^2	Chi-square (CMIN)
α	Cronbach's alpha (internal reliability)
β	Beta weight
ϕ	Phi
γ	Gamma
AGFI	Adjusted Goodness of Fit Index
AMOS	Analysis of Moment Structures (Statistical program)
ANOVA	Analysis of Variance
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CI	Confidence Interval
CR	Critical Ratio
df	Degrees of Freedom
e	Delta
EFA	Exploratory Factor Analysis

GFI	Goodness of Fit Index
IFI	Incremental Index of Fit
ISO	International Organization for Standardization
N	Sample size
NPAR	Number of Parameters
NFI	Normed Fit Index
OSHA	Occupational Safety and Health Act
p	Probability of statistical significance
R^2	Regression square (Square Multiple Correlations)
RMR	Root Mean Square Residual
RMSEA	Root Mean Square Error of Approximation
SC	Safety Climate
SD	Standard deviation
SE	Standard error
SEM	Structural Equation Modeling
SMS	Safety Management System
SC	Safety Climate

SOCSO	Social Security Organization
SPSS	Statistical Package for the Social Sciences (Statistical program)
TPB	Theory of Planned Behaviour
VE	Variance Extracted

HUBUNGAN ANTARA SISTEM PENGURUSAN KESELAMATAN, IKLIM KESELAMATAN DAN PRESTASI KESELAMATAN DI TAPAK BINAAN

ABSTRAK

Pada keseluruhannya konseptual model membincangkan tentang hubungan antara sistem pengurusan keselamatan, iklim keselamatan dan prestasi keselamatan adalah kurang. Menurut Choudhry et al. (2008), model adalah diperlukan untuk mengesahkan hubungan iklim keselamatan dengan prestasi keselamatan. Audit pematuhan sistem pengurusan keselamatan cuma memberi pengaruh kecil kepada prestasi keselamatan sekiranya faktor-faktor yang mempunyai pengaruh terbesar kepada keselamatan dan kesihatan tidak dapat dikenalpastikan (Makin dan Winder, 2008). Justeru itu, soalan yang dijawab sendiri dikendalikan dengan menggunakan 7 mata skala Likert yang merangkumi skala-skala sistem pengurusan keselamatan, iklim keselamatan, dan keselamatan prestasi digunakan untuk mengumpul data di tapak binaan di Malaysia.

Objektif-objektif kajian ini adalah mengenalpasti hubungan di antara sistem pengurusan keselamatan dan iklim keselamatan, iklim keselamatan dan prestasi keselamatan serta sistem pengurusan keselamatan dan prestasi keselamatan, membentuk model konseptual hubungan antara sistem pengurusan keselamatan, iklim keselamatan dan prestasi keselamatan dan juga mengenalpasti iklim keselamatan sebagai pengantara penuh di antara sistem pengurusan keselamatan.

Soalan-soalan kajian ini adalah dibentuk melalui adaptasi dari penyelidik-penyelidik sebelum ini, selanjutnya prosidur pengurangan item, ulasan ahli pakar, kajian cuba permulaan dan proses pengurangan data dengan menggunakan SPSS 16.0 analisis faktor eksploratori telah pun dijalankan untuk menghasilkan kebolehpercayaan yang mencukupi bagi setiap dimensi pengukuran.

Kajian kuantitatif ini dilakukan di kalangan kontraktor yang telah sah di bawah ISO 9001 dan berdaftar di bawah kategori G7 dengan Lembaga Industri Pembinaan Malaysia (CIDB). Tinjauan soalan sebanyak seribu tiga ratus telah diedarkan kepada kontraktor melalui surat dan e-mel. Akibatnya, dua ratus tiga puluh dua responden yang sah telah menjawab soalan tersebut. Iklim keselamatan tampaknya menjadi pengantara penuh untuk hubungan antara sistem pengurusan keselamatan dan prestasi keselamatan yang disahkan dengan menggunakan analisis faktor konfirmatori dan pemodelan persamaan struktur AMOS 18.0. Hasilnya menunjukkan bahawa sistem pengurusan keselamatan mempunyai pengaruh langsung terhadap iklim keselamatan dan iklim keselamatan mempunyai pengaruh langsung terhadap prestasi keselamatan. Namun, sistem pengurusan keselamatan hanya mempunyai kesan tidak langsung pada prestasi keselamatan. Model konseptual hubungan pengurusan keselamatan, iklim keselamatan dan prestasi keselamatan yang didapati adalah memenuhi syarat-syarat model yang dikehendaki dengan data yang dikutip, justeru itu kontraktor-kontraktor perlu menumpu ke atas iklim keselamatan untuk mencapai prestasi keselamatan yang baik di tapak binaan mereka.

THE RELATIONSHIP AMONG SAFETY MANAGEMENT SYSTEM, SAFETY CLIMATE AND SAFETY PERFORMANCE IN CONSTRUCTION SITES

ABSTRACT

There is a lack of conceptual model seek about the relationship among safety management system, safety climate and safety performance. Safety climate is linked to safety performance and more research or model is needed to validate the relationship (Choudhry et al., 2008). Unless identified which factors have the greatest impact on health and safety, if not the safety management system compliance auditing will have little impact on organization's overall safety performance (Makin and Winder, 2008). Thus, a self-administered questionnaire by using 7 points scale that includes the safety management system, safety climate, and safety performance scales were used to collect the data in construction sites of Malaysia.

The objectives of this study are to identify relationship between safety management system and safety climate, safety climate and safety performance, and safety management system and safety performance in construction sites, to develop a conceptual relationship model among the safety management system, safety climate and safety performance and also to identify safety climate as a mediating role between safety management system and safety performance.

This study instruments are developed through the generation of items adapted from previous researchers, subsequent item reduction procedures, experts' interview, pilot study and data reduction by using SPSS 16.0 exploratory factor analysis to yield adequate reliabilities for each dimension of measurement.

The quantitative survey was conducted among the Grade G7 ISO 9001 certified contractors registered under Construction Industry Board of Malaysia (CIDB) with an amount of 1300 survey questionnaires distributed through mail and emails. As a result, 232 valid respondents were answered to the questionnaires. Safety climate appeared to be a full mediator for the relationship between safety management system and safety performance which has confirmed by using the confirmatory factor analysis and Structural Equation Modeling AMOS 18.0. The results have shown that safety management system has direct effect on safety climate and safety climate has direct effect on safety performance. However, safety management system only has indirect effect on safety performance. The conceptual relationship model among safety management, safety climate and safety performance were found to be model fit to the data set in real world, thus contractors shall concentrate on safety climate factors in order to achieve good safety performance in their construction sites.

CHAPTER ONE

INTRODUCTION

1.1 The Background

Construction industry is well known as the most hazardous industry and it is normally considered as difficult, dirty and dangerous industry. In construction site, the work conditions and environment are changing on a day to day basis, especially a project is working in few shifts with a group of workers, and therefore the changes can be significant. Normally, the construction workers are required to have some basic safety awareness in order to be aware of the potential hazards and dangers in construction site. They are working in the site which is changing on a daily basis where they complete a specific task and then leave and continue at another site.

Basically, all the construction workers are working under different sub-contractors to perform various trades of construction works. It means that workers from different sub-contractors are required to cooperate and work together. Therefore, workers not familiar with the work site environment and the trade scope of works may leave behind many potential hazards because the workers may not have experience or competency to identify the hazards. Furthermore, the majority of construction workers are foreign workers with low level of education background who come from various countries and cultures make the safety compliance more difficult to achieve in the construction industry.

The construction industry on average has higher rate of occupational injury than most other industries (Harper and Koehn, 1998). It is also known that construction is the most dangerous of industries due to its unique nature (Suazo and Jaselskis, 1993).

According to Kartam (1997), construction accidents caused many human tragedies, contribute to a lack of motivation in construction workers, disrupt construction processes, delay progress, and adversely affect the cost, productivity, and reputation of the construction industry. Expenses, such as medical costs, increased workers compensation insurance and property damage are regularly incurred.

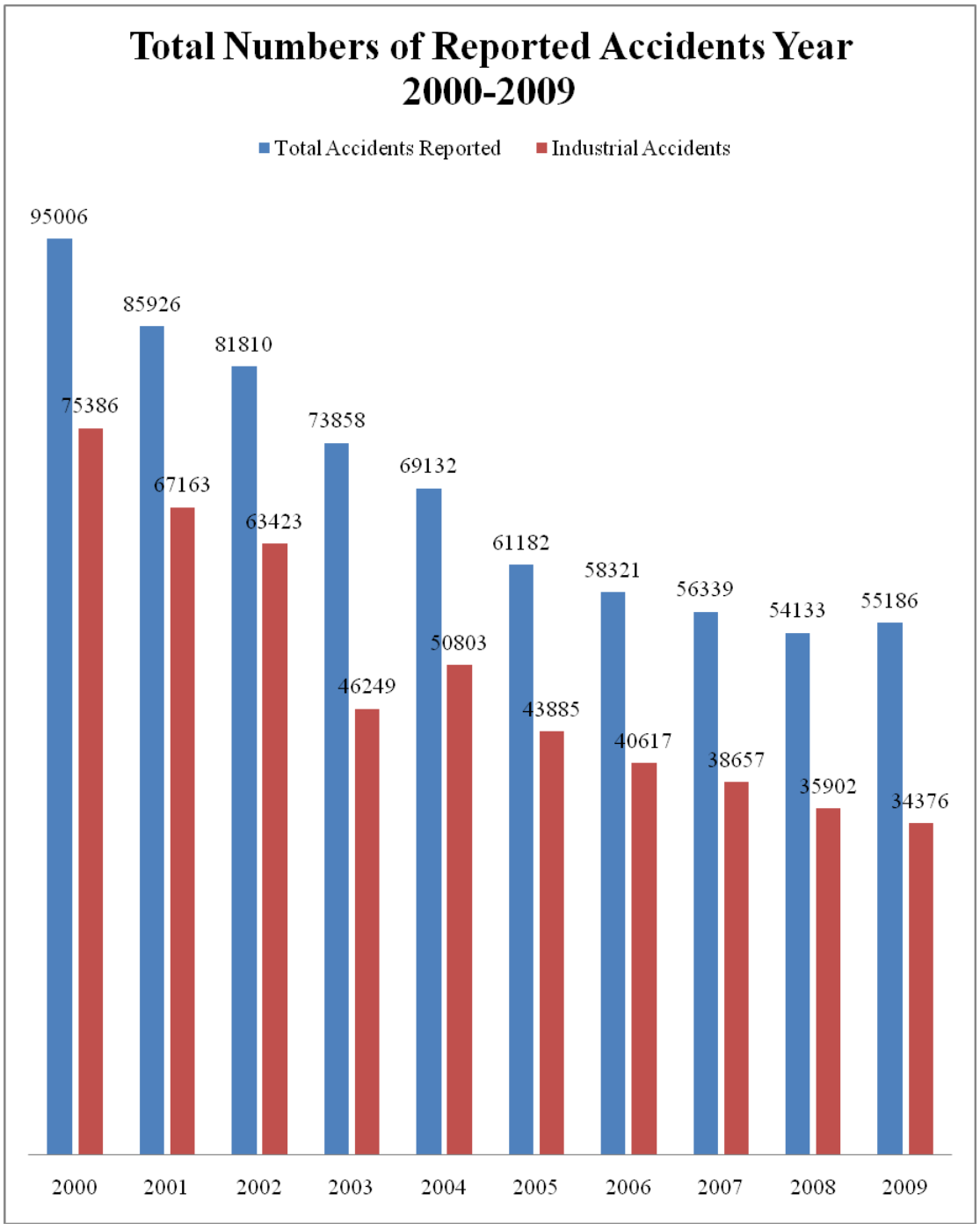
Hinze (1997) stated that there has been a lot of research showing that danger in construction sites can be controlled and accidents can be prevented by the usage of construction safety programs. In developing and developed countries, comprehensive safety programs should be implemented at construction sites in order to reduce accident rates.

Construction industry is heavily relying upon training and skills of the workers which the workers are learning through experience and the knowledge are handed down from one generation of workers to another. Therefore, the unsafe act or unsafe condition and the working culture are also passed down and it slowly becomes part of the organization culture.

In most of the construction site, the storage space is limited and holding cost of the building materials is high. Hence, the concept of “Just in Time” is used in the

construction site. It means the building materials for different trades are delivered when the material is needed and the storage of building materials is minimized to avoid double handling. Unlike in a factory, all the material can be transported by using forklift or overhead crane and conveyors to deliver to the production floor. On construction site, most of the major building materials are moved by heavy machinery and only light and small size material is handled by hand. These constant flows of building material across the construction site become a significant source of potential accidents or injuries to workers if it is not properly supervised and controlled.

The constantly changing site conditions and workers in construction sites, the temporary nature of the site facilities, the attitudes and practices to rush for meeting deadline and maximizing the productivity have made the construction site a very hazardous workplace. According to Malaysian Social Security Organization (SOCSO) Industrial Accidents Report 2009 as shown in Figure 1.1, in the year 2009 more than fifty thousand accidents happened, and more than twelve thousand cases are permanently disabled, and one thousand two hundred fatalities from industrial accidents (SOCSO, 2009).



Source: SOCSO Annual Report 2009

Figure 1.1 Total Numbers of Reported Accidents Year 2000-2009

Further improvements in safety have been driven by the rising costs of worker's compensation claims and product liability insurances, as well as the rapidly rising

costs of medical care. Both insurance and medical costs have been rising at a substantially higher rate than other costs of business and have been eating into corporate profits (Krause, 1995).

According to SOCSO (2009) Annual Report, the total cost of compensation of disablement and dependent benefits in year 2009 is RM538 million as shown in Table 1.1.

Table 1.1 SOCSO Compensation Costs of Disablement & Dependent Benefits

ITEM	1997 (RM) Mil.	1998 (RM) Mil.	1999 (RM) Mil.	2000 (RM) Mil.	2001 (RM) Mil.	2002 (RM) Mil.	2003 (RM) Mil.	2004 (RM) Mil.	2005 (RM) Mil.	2006 (RM) Mil.	2007 (RM) Mil.	2008 (RM) Mil.	2009 (RM) Mil.
Temporary Disablement	**57.3**	**54.4**	**57.7**	**68.6**	**66.2**	**63.2**	**61.9**	**71.1**	**67.8**	**71.8**	**85.2**	**94**	**104**
Permanent Disablement	**131**	**152**	**146**	**178**	**168**	**167**	**147**	**154**	**172**	**170**	**188**	**215**	**275**
Dependent Benefits	**62.3**	**57.3**	**70.6**	**82.1**	**87.1**	**103**	**107**	**115**	**122**	**133**	**142**	**151**	**160**
TOTAL	**250**	**263**	**274**	**329**	**321**	**333**	**316**	**340**	**361**	**375**	**415**	**460**	**539**

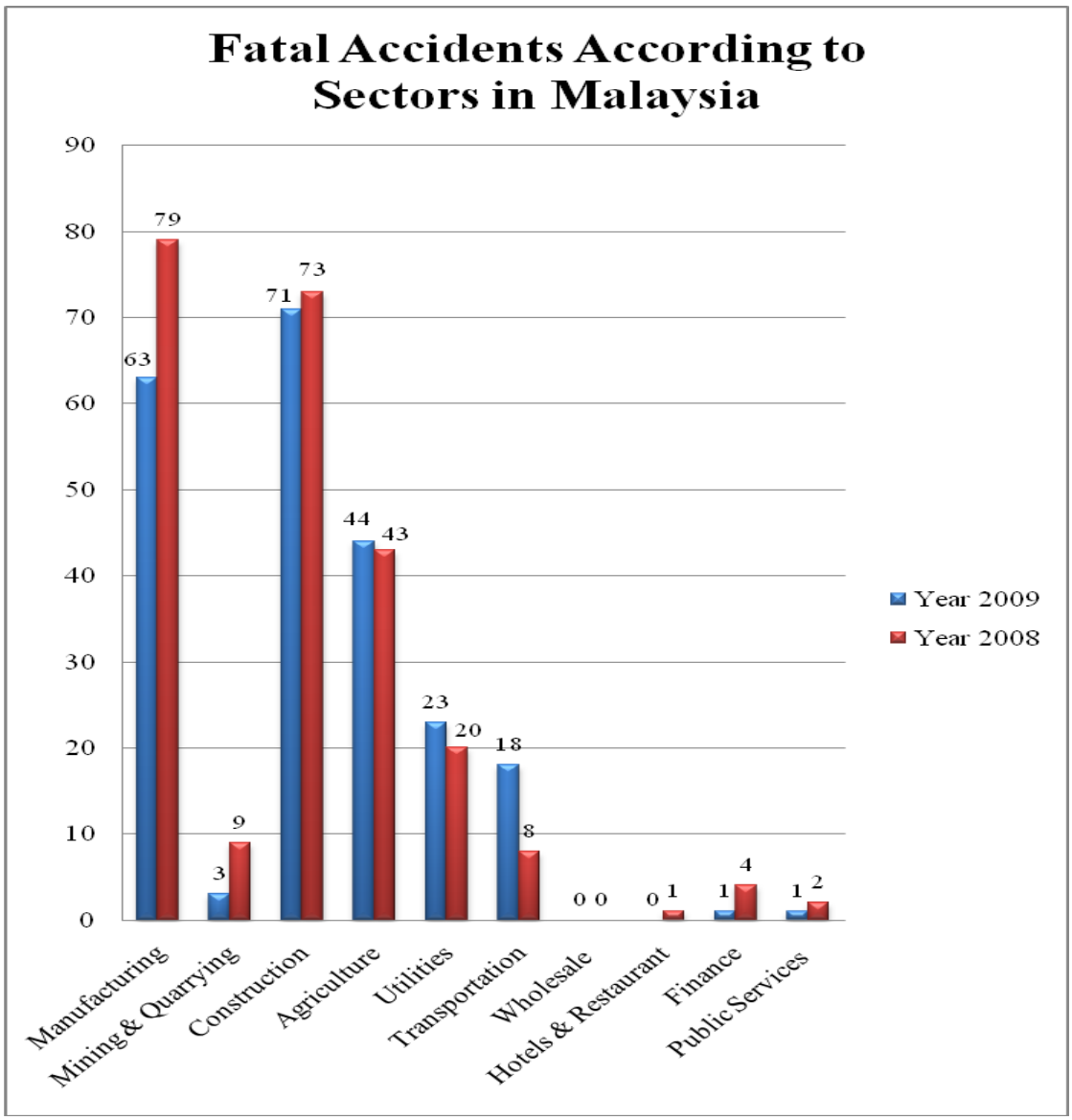
Source: SOCSO Annual Report 2009

Safety climate at construction site is a complex phenomenon. In Malaysia, the risk of a fatality in construction industry is five times more likely than in a manufacturing industry and the major injuries is two and a half time higher (SOCSO, 2009). Construction industry is the most high risk sector if compared with other sectors which contributed the highest fatal accidents rate with 71 people were killed in year 2009 as shown in Table 1.2 below.

Table 1.2 Fatal Accidents According to Sectors in Malaysia

Type Sectors	Year 2009	Year 2008
Manufacturing	63	79
Mining & Quarrying	3	9
Construction	**71**	**73**
Agriculture, Forestry & Fishing	44	43
Utilities	23	20
Transportation	18	8
Wholesale & Retail Trades	0	0
Hotels & Restaurant	0	1
Finance, Insurance & Real Estate	1	4
Public Services & Statutory Body	1	2

Source: SOCSO Annual Report 2009



Source: SOCSO Annual Report 2009

Figure 1.2 Fatal Accidents According to Sectors in Malaysia

Accidents happen at work due to lack of knowledge, supervision, and training and also caused by careless and unsafe act. Unsafe behaviour is the most significant factor in causing site accidents and poor safety culture in construction (Blockley, 1995).

From the statistics published by SOCSO in year 2009, there are 154 accidents reported per 10,000 workers for all industries compared to 314 accidents reported per 10,000 workers in year 1999, which is an increase of about 51% of the accidents rate. 80% of the accidents are contributed by the Small and Medium Industries (SMI). The increase of the accidents could be caused by many factors and the main factor is the SMI are not taking effective control measures and preventive action to prevent accidents happening at their workplaces. The accidents and illnesses incur losses to the economy of the country. Based on Statistics Department records for the year 2009, statistics showed that the direct cost of accidents is amounting to RM2 billion which is equal to 0.5% of Malaysian Gross Domestic Product (GDP) and the indirect cost would be even higher.

1.2 Problem Statement

Construction industry has important contributions to national economy but the construction sites contributed the highest accidents, incidents, injuries and fatalities around the world (Hinze, 1997). The Social Security Organization (SOCSO) of Malaysia year 2009 annual report statistics shows the costs of work-related injuries suffered at an average cost of RM1.2 million per death and RM120,000 per

permanent disability. It documents 1231 occupational deaths in 2009 and the national loss of RM1.4 billion. The situation of occupational injuries and accidents rate in construction industry in Malaysia is serious and research in this area is urgently needed.

Statistics provided by SOCSO (2009) shows that, despite scientific and system progress, working conditions in Malaysia have not changed to such a degree as to significantly reduce the problem of occupational injuries. Workers are not only paying the highest price of safety and health in work place, they also are giving impact on social and economic costs. Construction industry which tends to have a low awareness of implementing long term safety practices and safety issues usually has the least priority due to cost cutting (Biggs et al., 2005), thus safety factors which contribute the greatest impact on effective safety management system should be given priority study.

In Malaysia, Occupational Safety and Health Act (OSHA) was enacted in year 1994. The Act requires employers and employees to understand and implement the requirements which is called self regulated act. Consequently, every employer in Malaysia shall implement safety management system in order to comply with the OSHA requirements.

The major problem of the employers is after having implemented the safety management system, the fatalities accidents are still happening and organization safety performance is still very poor, especially in construction sector which is

inherently more hazardous than others. Construction sector has the highest death rate compared to other sector in Malaysia (SOCSO, 2009). The construction fatality rate is five times higher than other sectors as discussed early and remained virtually unchanged from 2000-2009. This situation, complicated by a hard-to-reach employer and employee population, presents unique challenges for studying safety management system as per required by OSHA and improve the safety performance of the organization.

The relationship between safety climate and safety performance is well established and a few studies have reported positive correlation between safety climate with safety practice and accidents (Cox and Cox, 2001; Mohamed, 2002; Clarke, 2006). Neal and Griffin (2000) also found that safety climate influences safety performance.

Unless identified which factors have the greatest impact on health and safety, the safety management system compliance auditing will have little impact on an organization's overall safety performance (Makin and Winder, 2008). Safety management system is therefore rather more than just a ''paper system'' of policies and procedures (Mearns et al., 2003). Very little attention has been paid to define what constitutes an effective safety management system (Santos-Reyes and Beard, 2002). Safety climate is linked to safety performance and more research or model is needed to validate the relationship (Choudhry et al., 2008).

Based on the above literature and discussion, it appears that under the current challenging construction sites environment faced by contractor, the safety climate has

become an important factor that influences the safety performance. With the existence of safety management system it does not mean that will achieve good safety performance. Safety climate will play very important role between safety management system and safety performance. Hence, it is worthwhile to study the impact of the safety management system on safety performance which is fully mediated by the safety climate. Considering the emphasis of the safety climate and its impact on safety performance, it would be reasonable to adopt the following problem statement for this research: To what extent does the safety management system (SMS) affect the safety performance, and whether the safety climate (SC) would fully mediate this relationship?

Research on occupational safety has developed considerably in many disciplines, with the main objective of eliminating from the workplace as many dangers and risks as possible. The present study examines the potential of full mediating effect of safety climate between the safety management system and safety performance. Greater awareness of how this relationship works is the main purpose of this study finding through the potential intervention of safety climate which could improve the safety performance in the workplace.

1.3 Research Objectives

The purpose of this research is to study the impact of implementing safety management system on the safety performance in the Malaysian construction industry. This study also examines the relationship among implementation of safety

management system, safety climate and safety performance. The research objectives also investigate safety climate in the role of full mediator between the safety management system and safety performance.

The research objectives of the study are:

1. To identify relationship between safety management system and safety climate, safety climate and safety performance, and safety management system and safety performance in construction sites.

2. To identify safety climate as full mediator role between the relationship of safety management system and safety performance.

3. To develop a conceptual relationship model among safety management system, safety climate and safety performance.

This study hope that its findings can contribute to the limited literature in this area and address some of the controversial issues over the importance of safety climate in the workplace and to answer why implementation of safety management system does not significantly improve safety performance.

1.4 Research Questions

1. What is the relationship between safety management system and safety climate, safety climate and safety performance, and safety management system and safety performance?
2. Does safety climate fully mediate in the relationship between safety management system and safety performance?

3. What is the conceptual relationship model among safety management system, safety climate and safety performance?

1.5 Scope of the Study

In addressing the problem statement and the research questions of this study, it is necessary to cover those issues highlighted by Guldenmund (2000), regarding theoretical development and a proposed model for safety climate. Since the focus of the study is on safety climate's full mediating role on safety management system and safety performance, the scope of the study included the following areas:

(a) The theoretical development as well as the applied research done on safety management system and safety climate in the construction sites;

(b) Safety climate research, studies, and the emerging safety management system that attempt to examine the impact of safety climate on the safety performance at the construction sites.

1.6 Significance of the Study

Basically, this study proposes a conceptual relationship model which included three basic variables, namely safety management system, safety climate and safety performance. Based on this model, this study extends previous work from Fernandez-Fernandez-Muniz et al. (2007), Dedobbeleer and Beland (1991), Glendon and Litherland, (2001), Flin et al. (2000), Alexander and William (1986), and Wu et al. (2007).

Firstly, it examined the relationships between the different dimensions of the safety management system and safety performance. Secondly, the study also examined the mediating effect of safety climate on the relationships between safety management system and safety performance. Thirdly, the study will explore the model among safety management system, safety climate and safety performance by using Structural Equation Modeling.

This study has several important theoretical contributions. For instance, it examined the relationship of safety management system and safety performance, safety management system and safety climate, and safety climate and safety performance at a multiple dimensional perspectives. The study adopted a multiple source inputs and examined data source from the skilled worker, foremen, engineer, senior engineer and manager perspectives.

From the application perspective, it is indeed important to understand the relationship between the safety management system and safety performance, and how safety climate influenced the safety performance, because it can provide additional inputs to the organization's safety management system strategy as well as their overall safety outcomes. More importantly, such empirical findings will help to reinforce the importance and convince the management regarding the safety climate in adopting a more integrated and systematic safety management system.

1.7 Organization of Subsequent Chapters

The subsequent chapters are organized in the following manner:

Chapter 2 consists of a literature review on development of safety climate research, safety management system, safety performance, relationship and research gap.

Chapter 3 covers the theoretical framework and formulation of hypotheses for the study and outlines the research methodology in terms the sampling procedure, measures of the variables, and the statistical analyses adopted to analyze the data sample and instrumentation.

Chapter 4 provides the results with of the statistical analysis and discussion. It consists of sample profile, goodness of measures, Confirmatory Factor Analysis, Structural Equation Modeling and hypothesis testing.

Lastly, chapter 5 covers the conclusion of the findings, discussions, contributions, limitations of the study, and recommendations for future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Given the scope of this study, there is a need to draw upon a wide and yet interrelated literature from the areas of safety management system (SMS), safety climate (SC), and safety performance (SP). With the increasing application of safety management system in the construction sites especially in the areas of safety climate, there is corresponding increase in number of applied research done by several researchers throughout the years. Thus, safety climate will provide another source for the literature review in safety management system.

The literature review starts with an overview on the history of safety climate research and its current state of affair, which there are many different researches with difference factors in safety climate. Therefore, the review shall discuss on the role of safety management system and safety climate and how it's effect on safety performance such as accidents rate and injuries rate. This shall be followed by a review on the safety management system, safety climate and safety performance factors. Subsequently, the review shall describe the concept of safety climate and its role in the safety management system and safety performance. Finally, the theoretical framework and the proposed hypotheses for the study shall be presented and discussed in chapter 3.

2.2 Definitions of Key Terms

Before proceeding, it is important to define and understand some of the key terms related to the constructs that will be adopted in this research.

2.2.1 Safety Management System (SMS)

Safety management system can be defined as a coordinated, comprehensive set of processes designed to direct and control resources to optimally manage safety. It takes unrelated processes and builds them into one coherent structure to achieve a higher level of safety performance, making safety management an integral part of overall risk management. Safety management system is based on leadership and accountability. It requires proactive hazard identification, risk management, information control, auditing and training. It also includes incident and accident investigation and analysis (IHST, 2007).

Safety management system is an organized approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures (BIAL, 2007). A safety management system can be understood as a set of policies, strategies, practices, procedures, roles and functions associated with safety (Kirwan, 1997).

2.2.2 Safety Climate (SC)

According to Cooper and Philips (2004), safety climate refers to the degree of employees' belief on the priority given to organizational safety performance, and safety climate measurement that can provide as early warning of potential safety system failure. Zohar (2003) concluded that safety climate is conceptualized as employees' shared perceptions pertaining to safety practices, policies, and procedures and importance on safety conduct of work.

According to Wiegmann and Shappell (2001), safety climate is a psychological phenomenon, which is usually defined as the perceptions of the state of safety at a particular time. Safety climate is closely concerned with intangible issues such as situational and environmental factors. Safety climate is a temporal phenomenon, a snapshot of safety culture, relatively unstable and subject to change.

According to Flin et al. (2000), safety climate is the surface features of the safety culture discerned from the workforce's attitudes and perceptions at a given point in time. Safety climate should be conceptualized as a higher order factor comprised of more specific first order factors. First order factors of safety climate should reflect perceptions of safety related policies, procedures and rewards. The higher order factor of safety climate should reflect the extent to which employees believe that safety is valued within the organization (Griffin and Neal, 2000).

Mearns et al. (2003) defined safety climate as a snapshot of employees' perceptions of the current environment or prevailing conditions, which impact upon safety. Cox and Flin (1998) stated that safety climate is regarded as a safety culture manifestation in behaviour expressed in the attitude of employees.

Zohar (1980) defined safety climate as a construct that captures employees' perceptions of the role that safety plays within the organization. Gonzalez-Roma et al. (1999) described safety climate as measure reflecting the workforce's perception of safety and attitudes toward safety within the organizational environment.

Cheyne et al. (1998) defined safety climate as a temporal state measure of culture, which is reflected in the shared perceptions of the employee at a discrete point in time. Flin et al. (1998) commented that safety climate refers to the perceived state of safety of a particular place at a particular time. It is therefore relatively unstable and subject to change depending on features of the operating environment.

Hofmann and Stezer (1996) stated the definition of safety climate as perceptions regarding management's commitment to safety and worker's involvement in safety related activities. Dedobbeleer and Beland (1991) stated that safety climate is viewed as an individual attribute, which is composed of two factors; they are management's commitment to safety and workers' involvement in safety. Zohar (1980) defined safety climate as a particular type of organizational climate, can vary from highly positive to a neutral level, and its average level reflects the safety climate in an organization.

2.2.3 Safety Performance (SP)

Safety performance can be described as a self-reported rate of accident and occupational injuries (Siu et al., 2004). Huang et al. (2006) have studied safety performance in many workplaces, such as the manufacturing industry, building industry, service industry, and transport industry. They defined safety performance as employee safety control and self-reported occupational injury.

Thus, safety performance can be defined as the safety consequences as a results of the safety treatment based on the outcome of the safety system and it is judged by the reduction of risk exposure and subsequent outcomes.

2.3 History of Research and Review of Key Studies

2.3.1 Theory of Planned Behaviour

Abdelhamid and Everett (2000) introduced accident investigation techniques and reporting system in construction to identify what type of accidents occurs, and how they occur. Heinrich (1969) presented the accident causation theory that the interaction between man and machine, the relation between severity and frequency, the reasons for unsafe acts, the role of management in accident prevention, the cost of accidents, and the effect of safety on efficiency were interlinked.

Heinrich et al. (1980) defines accident prevention as an integrated program with a series of coordinated activities and directed to the control of unsafe personal performance and unsafe conditions, based on individual certain knowledge, attitudes, and abilities. Petersen (1971) described the work of Heinrich as people are the fundamental reason behind accidents and management has the ability and is responsible for the prevention of accidents. Petersen (1971) stressed that there were needs to improve inspection procedures, and training, make better assignment of responsibilities, and pre-task planning by supervisors in order to avoid accidents.

Theory of Planned Behaviour is a theory about the link between attitudes and behaviour. It was proposed by Ajzen (1991) as an extension of the theory of reasoned action. It is one of the most predictive persuasion theories. It has been applied to studies of the relations among beliefs, attitudes, behavioural intentions and behaviours in various fields. Hence, the beliefs concept stated in the Theory of Planned Behaviour is similar to Griffin and Neal (2000) statement where they mentioned about safety climate should reflect the extent of employee's belief on safety.

The Theory of Planned Behaviour was developed from the Theory of Reasoned Action, which was proposed by Martin Fishbein together with Ajzen in 1975. According to the Theory of Reasoned Action, if people evaluated the suggested behaviour as positive attitude, and if they wanted them to perform the behaviour as subjective norm, this will result in a higher intention and they are more likely to do so.

High relationship between behavioural intention and actual behaviour has also been proposed as results of some studies do not show that behavioural intention always leads to actual behaviour because of circumstantial limitations. Behavioural intention not only determines behaviour where an individual's control over the behaviour, it should introduce the Theory of Planned Behaviour by adding a new component, perceived behavioural control (Ajzen, 1987). Hence, Ajzen (1987) extended the Theory of Reasoned Action to cover volitional behaviours for predicting behavioural intention and actual behaviour.

The Theory of Planned Behaviour specifies the nature of relationships between beliefs and attitudes. According to this model, people's evaluations or attitudes toward behaviour are determined by their accessible beliefs about the behaviour, where a belief is defined as the subjective probability that the behaviour will produce a certain outcome. Specifically, the evaluation of each outcome contributes to the attitude in direct proportion to the person's subjective possibility that the behaviour produces the outcome in question (Ajzen and Fishbein, 1975).

The Theory of Planned Behaviour is the combination of attitude toward the behaviour, subjective norm, and perceived behavioural control and behavioural intention (Ajzen, 2002). In particular, perceived behavioural control is presumed to not only affect actual behaviour directly, but also affect it indirectly through behavioural intention (Zimmerman and Kitsantas, 2005).

As a general rule, the more favourable the attitude towards behaviour and subjective norm, and the greater the perceived behavioural control, the stronger the person's intention to perform the behaviour in question should be. Finally, given a sufficient degree of actual control over the behaviour, people are expected to carry out their intentions when the opportunity arises (Ajzen, 2002).

The theory of planned behaviour postulates that human action is guided by three kinds of considerations; there are attitude toward behaviour, subjective norm, and perceived behavioural control (Ajzen and Fishbein, 1975). In order to evaluate safety behaviour using the Theory of Planned Behaviour, a method of measuring each of the three constructs was required. Five factors have been chosen through safety climate meta-analysis for the consideration as part of the proposed safety climate instrument. Hence, The Theory of Planned Behaviour has been link with safety management system and safety climate as shown in Table 2.1 below.

Table 2.1 Theory of Planned Behaviour Connect with SMS and SC

#	Theory Of Planned Behaviour	Operational Definition	Safety Management System Factor	Safety Climate Factor
1	Perceived Behavioural Control	The value expectancy the individual has for the behaviour. Favourable behaviours have desirable consequences, and unfavourable attitudes towards behaviours have undesirable consequences.	Policy, Worker's Incentive & Internal Control	Rules, Work Pressure
2	Subjective Norm	Normative beliefs are concerned with the likelihood that important referent individuals or groups approve or disapprove of performing a given behaviour. The individual's motivation to comply with the referent	-	Risk Justification

		is considered to develop an overall global measure.		
3	Attitude Towards the Behaviour	The more resources and opportunities individuals believe they possess, and the fewer obstacles or impediments they anticipate, the greater their perceived control over the behaviour.	Training	Employer Commitment, Employee Involvement

2.3.2 Safety Management System

Many researchers attribute this weak management commitment to the general belief that preventive measures require expenditures that have nothing to do with the company's production objectives, and competitiveness. In fact, accidents have adverse effects in terms of decreases in productivity and quality, and deterioration of the company's public image and goodwill. It is for this reason that a good occupational safety management system can have a positive effect not only on accident rates, but also on competitiveness variables and financial performance. It is therefore a good opportunity for those organizations that take up the challenge and adopt safety management system in their organization (Rechenthin, 2004).

The occupational safety management system managing risks in an integrated way with the organization's operations has become increasingly important in recent years because it not only cuts accident rates but can also improve the firm's productivity and economic and financial results (O'Toole, 2002).

The importance of controlling the risk of processes due to the increasing serious

accidents in recent years, process safety is now recognized as an important aspect of the organization for avoiding human and financial losses. The analysis of the literature reveals the importance of management, organizational and cultural factors in the accident generation process (Brown et al., 2000; Hofmann and Stetzer, 1996; Mearns et al., 2003; Zohar, 1980). The Chernobyl nuclear disaster in 1986 demonstrated the importance of these factors, and gave the attention to the safety culture (Pidgeon and O'Leary, 2000).

Safety culture is manifested in the safety climate and the safety management system implemented in the organization (Cooper, 2000; Kennedy and Kirwan, 1998; Mearns et al., 2003). However, the literature has focused more on measuring the attitudes and perceptions of employees about the importance attached by their organization to safety. There are studies that emphasize the importance of safety management system, and describe how to implement them (Hale et al., 1997; Mitchison and Papadakis, 1999), but there are very few works providing a specific tool to measure the degree of implementation of the policies and practices making up this management system in organizations. As a result, this study will analyze the safety management system that has been relatively neglected in the literature. This management process provides the basis for identifying a set of variables that would be used as an instrument to measure the degree of implementation of safety management system.

The safety management system can be defined as the set of persons, resources, policies and procedures that interact in an organized way to reduce damages and losses generated in the workplace. In order for this system to be effective and achieve

a sustained reduction in the accident rate, it must be integrated into the daily work of the organization and encourage both the safe behaviour of the workers and their involvement. It is essential that the top management be strongly committed to the safety management system. Likewise, this system must be comprehensive; taking into account its interaction with quality management system and environmental management system and it must be based on the philosophy of continuous improvement, leading towards corporate excellence. Safety management system is a multidimensional construct which we are going to discuss as following. Firstly, a safety policy reflects the organization's principles and values in this area. Secondly, promote workers' involvement in safety activities, by means of direct incentives or by consulting them on aspects relating to their well-being at work. Thirdly, provide employee training to ensure they can carry out their jobs in the healthiest and safest way. Furthermore, communication and transfer of information about the risks to workers is to ensure the safe way to work. Lastly is the planning of actions to be carried out in order to avoid accidents occurring and able to respond quickly in case of emergency (Fernandez-Muniz et al., 2007).

Researchers have paid little attention to defining what exactly constitutes an effective safety management system. Safety management systems is integrated mechanisms in organizations designed to control the risks that can affect workers' safety and it also to ensure the company can easily comply with the relevant legislation. A good safety management system should be fully integrated into the organization and be a cohesive system, consisting of policies, strategies and procedures that provide internal consistency and harmonisation (Santos-Reyes and Beard, 2002). Guastello (1993)