

# CHAPTER I

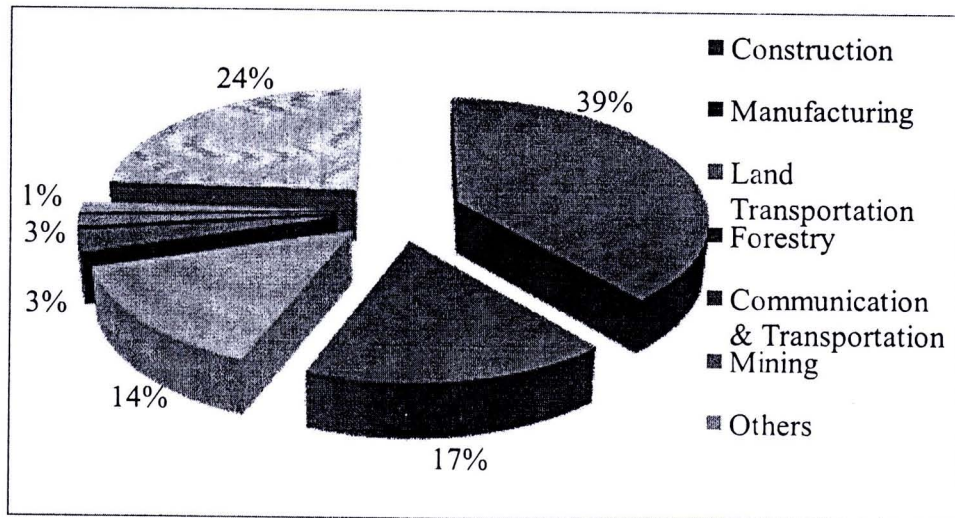
## INTRODUCTION

### 1.1 Background

The construction is one of the most important industries both economically and socially. It contributes to Gross Domestic Product (GDP) and impacts on the working population in almost countries, from industrialized as United State, United Kingdom, Australia to developing countries as Thailand, Vietnam. The construction industry contribute to GDP in several countries such as 10% in United State (2008), 7.4% in United Kingdom , 7% in Australia (2007), 10% in Thailand (2003) and 9% in Vietnam . In the United State, the construction industry employed 7 million workers in October 2008, provided jobs for crowded worker. In Vietnam, construction industry is being break out developing stage, contributes 9% of GDP and attracts a great investment achieve US\$ 3 billion in 2004. Vietnam is considered as the most potentiality developing market.

Despite of dramatic growth of the construction industry in recent decades, the industry encounters with several problems related to unsafe workplaces and has the highest accident records, includes 38.7% of total fatal accidents in general industry (Figure 1.1). The number of accidents was increased as the growth of the construction industry. For example, the US construction industry in 1999 reported the largest number of workplace fatalities compared to any other industries, accounted for 1,190 deaths included 21% of total 5,461 deaths in all industries. In Australia, between 1989 and 1992, 256 people were fatally injured, 10.4 per 100,000 workers. The construction industry's rate of occupational injury and disease is 44.7 per 1,000 persons, which is nearly twice the all-industry rate. The same situation in UK, in 2005, 118 fatal injuries was happened, made up 8.6 per 100,000 workers while this value of all-industry was only 2.7 per 100,000 . In developing countries, accident problems in construction are more dangerous, the value of accident is higher than developed countries because of inexperience and poor quality in safety management. In Thailand, 2003-2005 rate of accident was constant around 29.18 per 1,000 while rate of death per 100,000 people increased 11.60 in 2004. Construction worker has 14% of total death and 24% of total permanent disability (Tapanawat, 2010). The similar condition with Thailand is Vietnam, the data from Bureau of Labor Statistics in Vietnam in 2007 shows that the number of accidents and fatal accident are increasing yearly, there were 536 cases accident and 76 fatally in juried, included 12% of all. In general, it's an evident truth that the number of occupational injury is increased go

together with economic development. Therefore, the research topics related to safety is an urgent and should be put as the first mission.



**Figure 1.1 Fatal accidents by industry in year 2000 (2001)**

The great number of accidents in construction has awakened those who concerned from owner, contractor, subcontractor, and designer. Accident damages are extra considerable, they include both direct and indirect damages such as project budget, time and especially human life, further impact to economic losses. Accident damages was studied and concluded that total costs for solving construction accidents was estimated from 7.9% to 15.0% of total project budget (Everett and Frank, 1996). Furthermore, amount of 3.5% of total project budget was used to pay for workers' compensation cause from construction accident (Coble, Hinze et al., 2000). However, there are other effects from accident in which contractors have not been concerned such as OSHA cost, decrease employee morale, less of future work etc. In US construction industry estimation, accident costs were at US\$11.5 billion in 2002, including 15% of the total costs for accident in all industries. In Australia, accident and deaths cost \$109 million a year and almost 50,000 weeks of lost working time. On the other sides, injuries of construction worker have an adverse impact on productivity in the industry. The impact is further felt when the injured worker's crew is less productive as a result of the injury. Furthermore, the accident may reduce the attractive competition of construction company, decrease of clients' interest and obliterate reputation of company.

Nowadays safety is found as a critical issue in managing construction projects. Many construction project attempts to improve construction operation by protecting welfare of



employees, providing a safe work environment and controlling construction costs. Safety is one of the most important requirements which are considered in contract, bidding and the contractor selection.

Because of safety's importance, many researches have been carried out to explore the methods for improving the safety in construction site. These topics are very extensive explorations including overall fields in construction safety management such as occupational health, technology application, safety law, organizational safety culture, safety climate, safety performance, training, partner's attitude and behavior. These researches contributed an extra great part in reducing accident in construction. Although many research studies were explored, there are still much injuries occur every day in every country. It means that the future study of construction safety is still needed. Therefore, it's still an urgent and important mission to solve safety problem in construction site.

## 1.2 Statement of Problems

Many researchers and practitioners have explored various techniques to reduce construction accidents and deaths (Bentley, Hughes et al. 1995; Hadikusumo and Rowlinson 2003; Panagiotis, Tariq et al. 2005). Although they may be well developed but it is difficult to achieve continuous improvement on safety performance in construction industry. The main reason is that construction environment has many special characteristics such as decentralization, high mobility. It also depends on weather condition and uncertainty of work condition (Arditi, Lee et al. 2007; Chan and Au, 2007). Another reason is that safety performance in construction is more relevant to human factors (Fang, Chen et al., 2006). Therefore, if a construction company expects to achieve higher level of safety performance, it needs consider improving safety culture or safety climate (Mearns, Whitaker et al., 2003; Xie, 2003). Understanding of safety climate can help us to control and decrease the unsafe workplace. The earliest paper on safety climate was conducted by Keenan in 1951 (Guldenmund, 2000). Until now, there are a lot of definitions of safety climate. Its meaning can be explicit or implicit. Safety climate was defined as a "*summary of molar perceptions that employees share about their work environments*" (Zohar, 1980). Another definition from Cox and Cox (1991) gave that "*safety cultures reflect the attitudes, beliefs, perceptions, and values that employees share in relation to safety*". A number of studies have been conducted to describe and construct the dimension of safety climate because of its major; each author has a different way to represent this concept. Zohar (1980) as the first person explored dimensions of safety climate. According to the result from factor analysis, eight factors related to safety

climate dimensions included safety training, work pace on safety, safety committee, safety officer, safe conduct on promotion, level of risk at the work place, management attitudes to safety, and the safe conduct on social status (Zohar, 1980). Other researchers described the safety climate such as Sawacha (1999), Flin (2000), Glendon and Litherland (2001) and Guldenmund (2000). There are many research studies about safety climate in construction industry. Their previous studies may have some differences in concepts, models, and dimensions but generally no one can disclaim the role of management factor and supervisor is one of them.

Construction is classified as a cooperative environment. It needs coordinated closely by many parties as owner, contractor, sub-contractor, designer, consultant and project manager. To reduce and eliminate construction accidents, there are a lot of researches who explore their role and demonstrate parties' role. The contractor is the key player to control site safety (Levitt and Samelson, 1993; Hinze, 1997). Sub-contractor can be influenced by general contractor to implement the safety at construction site (Richard S. Baldwin, 2000; Jimmie and John, 2003). Designers also can reduce safety hazards in the working procedure if they notice it during the decision making stage such as choosing standard. The safety can be encouraged by the process of writing contract (Jimmie and Francis, 1992; Gambatese and Hinze, 1999). The owner is one of important party to manage and reduce the accident when they select the contractor, contractual safety requirement or participate in safety management during project execution (Gambatese and Hinze, 1999; Huang and Hinze, 2006). The role of project manager is considered in many papers, they are the most important party in construction safety (Levitt and Samelson, 1993; Huang, Chen et al., 2004; Clarke, 2006). In the construction site, three management levels can be directly impacted on the safety management. These three levels are top manager, supervisor/foreman and worker. It should be pointed that the top provide a vision and policy on safety while middle manager plays the essential role to serve the top management policy. Worker level is seen as the third level who has a main role and directly gets impact on safety in construction (Lingard, 1995; Brown, Willis et al., 2000). Previous studies about the causes affecting the safety management mentions about manager and worker however few mentions about the role of middle person—the supervisor. Therefore, the research about this middle level is necessary to explore the relationship with construction site safety.

When safety is more and more important in construction site, the role of supervisor is more and more appreciated. A successful safety program starts at the very top of the organization. All project stakeholders such as owners, top executives, and middle managers must be committed to safety. The supervisor is the key person of the program



because they represent top manager and daily contact with the employees. Even when the construction project has a safety engineer or a safety director, the supervisor is still responsible for ensuring that safety directives are carried out. In addition, supervisor may shapes the employees' attitude toward safety (Ludden and Capozzoli, 2000). From supervisor practice, employees know what should do in safety status. A good behavior in safety supervisor is very important to the success of safety management.

The safety behavior is considered as one of the significant causes affecting safety performance in construction site. Cooper and Phillips (2004) took a safety climate measure in the manufacturing sector at the beginning of a behavioral safety initiative. After one year they found that employees perceived the importance of safety training that could be applied to predict the actual level of safety behavior. Zhou (2008) studied a method by applying the technique to give more insight into the influence of safety climate and personal experience factors on safety behavior, and identifying strategies to control the factors that have the most impact on safety behavior in complex construction scenarios. Some are studied about safety behavior such as Cox (2004), Lingard and Steve (1998), Duff, Robertson et al. (1994), Prussia, Brownb et al. (2003), DeJoy (1996). But these researches focused on worker level only, they tried to identify the factors can effect the worker behavior to change their behavior more positive safety as in Lingard (1995), Brown, Willis et al. (2000), Langford, Rowlinson et al. (2000).

Few studies were explored about supervisor related to safety behavior. Based on the study by Fang (2006), supervisor was mentioned as one of the employees in construction site. He explored the relationships between safety climate and safety behavior. Another study by Clarke (2006) also examined the relationship between safety attitudes and unsafe behavior and accidents. This study expected to examine all level in a car manufacturing plant from workers, supervisors and managers. However, the sampling was obtained only from workers and managers and didn't mention about supervisor. Huang (2004) examined the presumed benefits of safety policies and the roles of two organizational variables, supervisor safety support and employee safety control, on safety outcomes and satisfaction with the company. Supervisor is one of the managements that create a positive safety climate, directly through the interaction with the employees. The supervisor safety roles also was emphasized in general industry (Börjesson, 2008). Another study by Fung (2005) investigated the relationship between people's behaviors, attitudes and perceptions towards safety culture and to compare safety culture divergences among three levels of construction personnel: top management, supervisory staff and frontline worker by conducting safety culture survey. According to Dov Zohar

(2003), workers' safety behavior was significant influencing from supervisory safety-oriented and this influence may cause changing of safety climate scores.

Basing supervisor's activities and roles, there is no doubt about supervisor's importance in successful project, especially in reducing accident rate. Supervisor's behavior strongly impacts on the workplace safety at construction site. So if we understand what factors and know how factors affect their behavior in safety, the accidents in construction site can be obviously reduced. Therefore, a development model of factors influencing supervisor's behavior on safety action is necessary and important.

### **1.3 Research Objectives**

From the above research problem, following research objectives will then be addressed:

- Explore the current supervisor's behavior on safety action at construction site
- Identify factors influencing supervisor's behavior on safety action
- Establish a model for explaining supervisor's behavior on safety action at construction site through the relationship between these factors, behavioral intention and behavior.

### **1.4 Research Scopes**

This research is conducted under several scopes. At first this research only focuses on building projects in which it has some special characteristics comparing to infrastructure projects or industrial projects. Second, the sample will be collected in Vietnam construction site. It may be a case study of developing country in Southeast Asia only.

### **1.5 Research Methodology**

The research methodology is designed to explore the factors that affect supervisor behavior and to develop model for explaining factors influencing supervisor behavior on safety action at construction site. Research methodology consists of several steps, which are:

- Systemization knowledge related to topic from literature review;
- Selection and design of data collection tools, questionnaires
- Data collection include pilot study and large-scale study
  - Selection of sites and samples; and
  - Data collection process



- Data analysis:
  - Descriptive analysis techniques are analyzed to explore respondents' characteristics and current behavior of supervisor in Chapter 4.
  - Factor analysis is used to explore initial factors influencing supervisor behavior on safety action. More details of factor analysis can be found in Chapter 5 and 6.
  - Structural Equation Modeling (SEM) technique is applied to analyze data and develop the explaining model. More details on SEM methods can be found in Chapter 5 and Chapter 6.

## 1.6 Research Outline

The thesis presents the whole research process and findings, and is organized as follows.

Chapter 1 provides a background of the research process and contributions, including the background to the research, the research problems, the research objectives, the research scopes and limitations, the methodology, and contributions.

Chapter 2 discusses the research issues, presents a literature review of safety, safety management, supervisor role and responsibility in safety, and safety behavior theories, and sets out the research questions.

Chapter 3 details the research method and the envisaged outcome for each stage of the research. Specifically, this chapter describes the utilized research instruments, data collection methods, data analysis techniques and desired research outcomes.

Chapter 4 presents a detailed discussion on the research methodology and findings. It includes the choice of research approaches and assumptions, the survey data collection methods, the analysis of current supervisor behavior, and the relationship between behavioral intention and behavior for assert the theories.

Chapter 5 focuses on data analysis that explores factors influencing supervisor's behavior on safety action. Then it presents the development of perception model for explaining relationship between these factors and their behavior by using SEM. All of factors explored in this chapter based on supervisor's perception.

Chapter 6 details the same methodology with chapter 5. It includes exploring factors from factor analysis and then develops model for explaining supervisors' behavior. But data collection for each factor is obtained from supervisors' practice such as supervisors

themselves, real practice of construction company, construction site, characteristics of current working project.

Chapter 7 presents the research conclusions and implications, summaries the main findings of the research, explores the implications for theory, methodology and practice of the findings, addresses the research limitations and highlights the potential areas for the future study.

### **1.7 Research Benefits**

The results show the current status of supervisor's behavior in safety action in construction site. It will help the project parties more understand about factors influencing supervisors' behavior. This study will also establish an explaining model for company who expects to improve their supervisor safety role. In addition, the explaining model from this research can support the company in selection suitable supervisor staff in conformable construction sites which are different characteristics and requirements. Furthermore, perception model and practice model are developed concurrently. It can help us not only understand what supervisors' perception but also how their current practice on safety at construction site.