

Safety Climate and Safety Behavior: Is There Any Relationship Between Them

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ABSTRACT

Although the construction industry is known for its significant contribution to the global workforce, it is equipped with a large number of accidents cannot be ignored. Various studies have tried to determine the impact of safety climate (SC) on labor safety behavior (SB), but the relationship between SC and labor SB has not yet been concluded. This study therefore reviews related research on SC and SB in an attempt to clarify the relationship between the two. Research findings could be summarized as follows: (1) The relationship between SC and SB is different in various industries. For example, there is no significant relationship between SC and SB in the manufacturing industry, but it is not the case in the construction industry; (2) SC and SB can be divided into multiple dimensions; however, each individual dimension of SC and SB both have their own relationship, which means that the specific relationship of each individual dimension between the two is worthy of further exploration; (3) SC can predict SB, but limited studies explores the predictive relationship between SC and SB. Nor of study investigate the predictive ability of SC and SB. Thus, how to use the SC to predict SB is an important topic to be realized.

Keywords: construction industry, safety climate, safety behavior, literature review

摘要

儘管營建業因對全球勞動力的顯著貢獻而聞名，但其大量工安事故的事實也是不容忽視。各種研究試圖確定安全氛圍對勞工安全行為的影響，安全氛圍與勞工安全行為間之關係卻仍未有定論。本研究因此針對安全氛圍和安全行為的相關研究進行回顧評論，企圖釐清兩者間之關係。本研究獲致幾項如下結論：(1)許多國家的不同工業領域，安全氛圍與安全行為之關係不盡相同。例如，安全氛圍與安全行為在製造業無顯著關係，但在營建業卻存在相關性；(2)安全氛圍與安全行為可分為多個維度；但是，安全氛圍的每一個單獨維度與安全行為都有自身的關係，意味著兩者間每一個體維度的特定關係值得進一步探究；(3)安全氛圍可預測安全行為，然而目前仍少有研究明確建立安全氛圍與安全行為間的預測關係，亦未考慮安全氛圍對安全行為的預測能力。因此，如何採用安全氛圍預測安全行為深入探究。

關鍵字：營建業、安全氛圍、安全行為、文獻回顧

I. INTRODUCTION

Over the years, the construction industry has been noted for its significant contribution of about 7% to the global workforce (International Labour Organization (ILO), 2005; Lingard, 2013). However, the industry is also notorious for large occurrences of accidents which result in injuries, illnesses, as well as, accounts for about 30-40% of global work-related deaths (Sunindijo *et al.*, 2011). These accidents come with both direct and indirect cost (Fang and Wu, 2013), with the annual economic losses estimated at over 1.2 trillion US dollars (Yilmaz *et al.*, 2015).

The awareness of the importance of organizational factors in construction safety management has prompted an increasing interest in safety climate (SC), lately. Generally speaking, SC is used to explain organizational factors (such as McDonald *et al.*, 2000) or as a part of organizational factors (Hetherington *et al.*, 2006) and is often used as a leading indicator of unsafe behavior and accidents (Zohar, 2010). A number of researchers have tried to determine the impact of SC on workers' occupational safety behavior (SB) (e.g. Neal, 2000; Mohamed, 2002; Zhou *et al.*, 2008.). While some of the studies found that there is a direct relationship between SC and SB (as in, Hon *et al.*, 2014; Seo *et al.*, 2015.), other studies identified no direct relationship between SC and actual SB (e.g., Glendon and Litherland, 2001; Cooper *et al.*, 2004).

There is no consensus on the relationship between SC and SB in the academic world. Some scholars believe that SC and SB's perception of field personnel is an important leading factor related to the study of the relationship between SC and SB. Some scholars have concluded that when it comes to safety phenomena, SB at construction sites is closely related to workers' perceptions and beliefs (Mohamed, 2002). A thorough understanding of the field workers' perception of the difference between SC and SB will have a certain impact on further determining the relationship between SC and SB.

II. SC RESEARCH IN CONSTRUCTION

According to the Dictionary of Terms Used in the Safety Profession, "Safety is a general term mainly used to denote an acceptable level of risk relative to avoiding to avoid harm or to be harmed at a lower probability."(ASSE). Climate on the other hand refers to the vision or emotion formed in a specific environment. The SC concept was first proposed and defined by Zohar (1980) as "a unified understanding of organizational security" and "reflects the consensus of employees on the relative importance of safe behaviors. In addition, "SC is related to a common understanding of safety policies, procedures and practices" (Zohar, 2003).

Many researchers have continued to explore new research directions for SC in the construction industry after a similar study by Beland and Dedobbeleer (1991). Two models are obvious in a summary of two mainstream research directions by Shen *et al.* (2015a). These are (a) psychometric indicators of psychological SC, and (b) factor structure of SC scale and the predictive relationship between SC and related results. It is imperative to establish a conceptual framework for the formation of psychological SC due to the lack of exploration of the formation of psychological SC in current research on SC in the construction industry (Shen *et al.*, 2015a; Shen *et al.*, 2015b).

Several studies on SC have confirmed the crucial role of SC in improving safety performance. Some researchers tried to link SC to safety performance (e.g. Pousette *et al.*, 2008; Choudhry *et al.*, 2009; Lingard *et al.*, 2010a, 2012). A survey by Choudhry *et al.*

(2009) on construction sites in Hong Kong, identified the structural factors of the standard and evaluated the relationship between the standard and the company's internal safety performance. Again, Lingard *et al.* (2012) established the perception of safety expectations of the supervisors completely mediates the relationship between the top management's perception of safety commitments and the work group injury incidence.

Lingard *et al.* (2009, 2010a, 2010b, 2011) studied the sustainable development of the Australian construction industry at the group level, and conducted a multi-level analysis to emphasize that sustainable development not only regulates the safety behavior of workers but also improves the safety performance of the organization. They also emphasized the role of SC in regulating the safety behavior of workers as well as improving the organizational safety performance.

III. SB RESEARCH IN CONSTRUCTION

Behavior is defined as everything a person does and is observable and measurable (Vijayakumar, 2007; Zin, 2012). SB refers to actions taken for self-protection, such as observing safety regulations to prevent danger to self or others (Neal *et al.*, 2000; Seo, 2015).

Griffin and Neal (2000) divide SB into compliance and participation. Compliance refers to the core safety activities that individuals must perform to maintain workplace safety. These actions include observing tag out and lockout procedures and wearing personal protective equipment. Safety participation mainly deals with activities such as voluntary safety participation in activities and meetings. These behaviors may help to develop an environment that supports safety either directly or indirectly (Griffin and Neal, 2000). Shin *et al.* (2014) proposed a worker mental process model based on system dynamics SD; that can enhance our understanding and analysis of the complex feedback mechanism between workers' safety attitudes and their SBs. Ali and Goh (2015) proposed a hybrid simulation framework to integrate SB concept into the construction simulation model.

Zhang (2016) recognized and verified the causal link between contributing factors and construction worker SB (CWSB) goals. The results from the path coefficient analysis show that management-oriented supervision, system and leadership have had a significant positive impact on CWSB, while the status of psychologists and workplace conditions have had a significant negative impact. The individual worker differences between workers SB are not statistically significant. In the related research of Chen *et al.* (2012), based on the research of BBS, designed BBS experimental courses for Chinese construction companies. A safety index (SI) trend chart was established and SI was used to evaluate its safety behavior and trend. The results revealed an outstanding BBS performance in accident prevention, and the safety index of test employees increased by 15% compared to the baseline observed in the experiment.

Li *et al.* (2015) introduced a proactive behavior-based safety (PBBS) approach to improve construction safety. The experiment results portrayed an improved PBBS on construction accident prevention and the Safety Index (SI) of the two project teams by 36.07% and 44.70% respectively. Choudhry (2014) established an important role of BBS in increasing the worker SB of the construction safety management. A survey results of Choudhry and Fang (2008) show that workers participate in unsafe behaviors due to the following factors: lack of safety awareness; to exhibit of being 'tough guys'; work pressure; co-worker attitudes; and other organizational, economic and psychological factors.

IV. RELATIONSHIP BETWEEN SC AND SB

The relationship between organizational factors and SB was proposed by Zohar (1980), who found that a strong SC can improve the effectiveness of safety education programs and reduce accident rates (Seo, 2015). Cooper *et al.* (2004), taking manufacturing employees as the research object, established a limited empirical connection between SC perception and actual SB. In the grain industry, Seo (2005) found that perceived SC is the best predictor of SB's contribution to unsafe work behavior. A survey results of Jiang *et al.* (2010) showed that SC and PCSK/B have a significant cross-level interaction on SB at the unit level, that is, the stronger the SC, the stronger the influence of PCSK/B on SB.

A model developed by Al-Haadir *et al.* (2013) revealed a significant negative relationship between RMAA SC and incidence of self-reported near misses and injuries, and significant positive relationships between RMAA SC, safety participation and safety compliance respectively. Similarly, Mohamed (2002) studied the relationship between SC and safe work behavior and the empirical results show that there is a significant relationship (positive correlation) between SC and safe work behavior. In relation to the construction industry, Larson *et al.* (2008) indicated that psychological climate can directly or indirectly affect SB. According to the results of Zhou *et al.* (2008), safety behaviors are more sensitive to SC factors such as management commitment and colleagues' influence, but less sensitive to personal experience factors such as work experience and education experience.

Several studies divided SC and SB into several different dimensions, and explored the relationship between them. Fugas *et al.* (2012) identified that the relationship between organizational SC and active SB is mediated by colleagues' descriptive norms and attitudes towards safety. Guo (2016) developed and tested an integrated model of construction worker SB and the results showed that SB is affected by management safety commitment, social support, production pressure and personal factors (including safety knowledge and safety motivation). Shin *et al.* (2015) established a model that uses statistical data and assumptions obtained from construction workers to quantify safety variables and worker SB (indicator). The results show that SB of construction workers is directly affected by communication and training, which is an observed variable of SC.

Pousette *et al.* (2008) tested the predictive effectiveness of SC relative to SB and it was established that SC can significantly predict self-reported SB after seven months. Kines *et al.* (2011) developed the Nordic Questionnaire (NOSACQ-50) which was found to be a reliable tool for measuring SC, and it can effectively predict safety motivation, perceived safety level and self-assessment SB. Tholén *et al.* (2013) used a forward-looking longitudinal multi-level research design to examine the social and psychological conditions in the process of highway tunnel construction, and the causal relationship between SC and SB. The results showed that individuals' perception of SC has a causal relationship with each SB, but they also found some evidence of a reverse relationship, in which SB affects SC.

V. CONCLUSIONS

Both SC and SB showed a significant positive relationship, in terms of safety commitment, safety attitude and communication. Similarly, safety training, safety participation and SB dimension of SB is highly correlated. In addition to providing safety-related guidelines, caring for on-site employees and understanding their needs can also

enhance employees' recognition of the organization. On-site management personnel should conduct safety inspections and on-site inspections, and pay attention to the physical and mental conditions of on-site personnel. Therefore, it is very important to make all personnel on site aware of their own safety and safety-related regulations. It is also important to make all personnel understand the correct use of PPP to further improve the mentality of all labor workers. In turn, this may make them have a positive attitude towards the concept of work safety in the workplace. All personnel are still strongly encouraged to show concern about their safety issues. Doing so will help reduce the cognitive differences between on-site managers and employees through communication.

There are number of studies focusing on SC and SB. The summary of existing research revealed the following:

- (1)The conclusions drawn on the relationship between SC and SB vary across different industrial fields in many countries. Some studies have shown no significant relationship between SC and SB in the manufacturing industry, while most studies in the construction industry showed that a correlation exist between SC and SB.
- (2)SC and SB can be divided into multiple dimensions; however, each individual dimension of SC has its own relationship with SB. Therefore, the specific relationship of each individual dimension between the two should be studied to avoid extensively constructing the relationship between the two.
- (3)It was found that SC can significantly predict self-reported SB. However, currently, few studies have clearly established the predictive relationship between SC and SB, nor have they considered SC's predictive ability on SB. Therefore, the study of SC predicting SB is worthy of attention and needs further exploration.

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