

Empirical Analysis of the Impacts of Safety Motivation and Safety Climate on Safety Behaviour

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Abstract

Safety is a major concern for construction companies, as it is a source of substantial direct and indirect costs. In some countries, the rate of total workplace injuries from construction activities can be as high as at least 50%. This is undoubtedly a serious matter warranting urgent attention. In the past decade, interest in the nature of 'safety climate' and its role in predicting occupational accidents and injuries has increased. However, research findings regarding the relationships between safety climate and other key outcomes constructs such as safety behaviours and safety outcomes are to some extent inconsistent. Recent safety climate literature suggests that examining the role of safety motivation may help provide a better explanation on such relationships. In view of this, the authors of this paper have developed a conceptual model depicting the relationships between three main constructs: Safety Motivation, Safety Climate, and Safety Behaviour. In particular, the model hypothesises that Safety Climate has a mediating role on the relationship between Safety Motivation and Safety Behaviour. The aim of the research study presented in this paper was to empirically assess the proposed conceptual model within the context of Saudi Construction Industry. To achieve this, a questionnaire was developed through a critical review of literature and was pilot tested with a number of safety management experts. A survey was then administered in Saudi Arabia targeting project managers, site managers, site engineers and supervisors at construction workplaces. In total, 430 sets of questionnaire were distributed and 265 valid responses returned. Based on this dataset, a series of statistical analyses were performed including basic descriptive analysis, Exploratory and Confirmatory Factor Analyses as well as Structural Equation Modelling (SEM). The results from the analysis support that Safety Climate fully mediated the relationship between Safety Motivation and Safety Behaviour, within the context of Saudi Construction Industry.

Keyword: Safety Climate, Safety Behaviour, Safety Motivation, Construction, Saudi Arabia

1. Introduction

The National Safety Council (NSC) estimates that the construction industry employs about 6% of the industry workforce; however, on average, it is responsible for approximately 21%

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of all industrial deaths (Rechenthin 2004). In fact, it is documented that the construction industry has the highest rate of accidents of all industries as well as the highest rate of disabling injuries and fatalities (Hinze 1997). As reported by Bomel (2001), up to 40% of accidents occur in the construction industry in Japan, 50% in Ireland and 25% in the United Kingdom. In some developing countries such as Saudi Arabia, around 51% of total workplace injuries occurred in the construction sector (General Organization for Social Insurance 2010). Safety has thus become one of the primary concerns among construction organisations as well as construction researchers.

Traditionally, safety research has focused on identifying individual attributes, such as personality traits or attitudes which are associated with accident-proneness (Sutherland and Cooper 1991). However, major disasters, such as Piper Alpha and Chernobyl, have illustrated the importance of work climates and management practices as contributors to system failure (Reason 1990). Consequently, increasing attention has been paid to the role of the work environment and management practices as determinants of safety in the workplace (Barling et al, 2003). Much of this research has focused on the concept of safety climate (Neal and Griffin 2006). Although the safety climate literature has examined the link between safety climate and safety behaviour, and with accidents; there remains a number of conceptual and practical difficulties associated with the relationship between both constructs (Neal and Griffin 2006). Some researchers have suggested that examining the role of safety motivation may help provide a better explanation on the link between safety climate and safety behaviour as well as other associated outcomes (Clarke, 2006).

The primary aim of this paper is to develop and empirically test a conceptual model that integrates safety motivation, safety climate and individual safety behaviour to produce an improved integrative model of construction workplace safety, as well as to provide an appropriate measure for safety motivation in the workplace. In particular, the model proposes that workers' safety climate is a key mechanism through which safety motivation leverages individual safety behaviour.

2. Conceptual model development

In safety literature, essential background knowledge is generally provided in relation to how safety climate is associated with safety outcomes. One shortcoming apparent in the literature is the lack of comprehensible and consistent construct definitions and conceptualisations, in both the predictor and criterion sides (Clarke and Robertson 2005). The existing inconsistencies between studies and empirical findings are not in line with theoretical predictions. Even though there have been efforts to overcome this problem in particular domains, no study to date has comprehensively addressed the deficiencies (Christian et al. 2009). Moreover, the literature regarding safety climate and safety behaviour reveals that safety motivation (SM) plays a part in these relationships (Clarke 2010). These observations led to the development of a theoretical framework addressing three constructs: safety motivation (SM), safety climate (SC), and safety behaviour (SB) (see Figure 1).

In particular, the framework hypothesises that SM has a primary influence on SC and SB. Moreover SC impacts safety behaviour directly and it should be noted that the mediating

effect of safety climate between safety motivation and safety behaviour has never been tested within the construction context. The following sections provide details of each of the model's constructs.

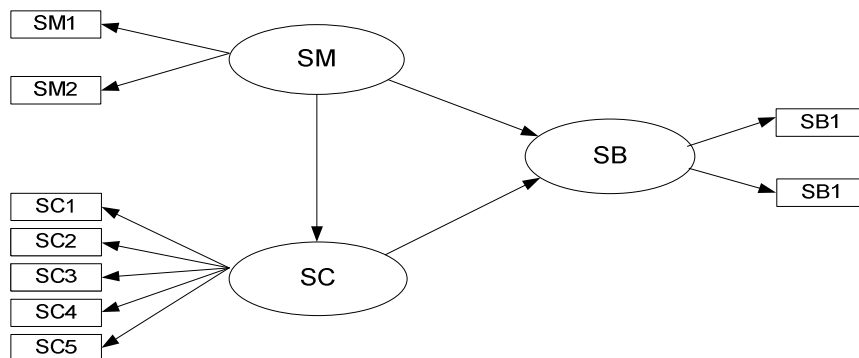


Figure 1: The conceptual model

2.1 Safety motivation (SM) construct

The study of motivation is the study of action (Eccles and Wigfield 2002). Motivation has been defined as “the set of psychological processes that cause the initiation, direction, intensity, and persistence of behaviour” (Fey 2005). Another definition refers to inner factors that drive action and to outside factors that can act as inducements to action (Locke and Latham 2004; Moynihan and Pandey 2007). Motivation, in general, is intention to do something, and can be intrinsic or extrinsic (Locke and Latham 2004). A careful literature review of safety motivation reveals a number of theories focusing on the differences between intrinsic and extrinsic motivation. When individuals are intrinsically motivated, they engage in an activity since they are interested in and enjoy the activity. When extrinsically motivated, individuals connect with activities for instrumental or other reasons, such as receiving a reward. The theories presented in the following paragraphs focus on the question of why (Eccles and Wigfield 2002).

Intrinsic motivation theory argues that extrinsic incentives and pressures can weaken motivation to perform even inherently interesting activities. However, Deci et al. (1999) expanded the extrinsic-intrinsic motivation dichotomy in their argument of internalisation the process of transferring the regulation of behaviour from outside to inside the individual. When individuals are self-determined, their motives for engaging in behaviour are completely internalized. Deci and colleagues defined several levels in the process of moving from external to internalised regulation. These are: “external”, “introjected”, “identified” and “integrated”. External level refers to the regulation coming from outside the individual; introjected level represents internal regulation, based on feelings that one has to do the behaviour; identified level indicates internal regulation based on the utility of that behaviour, and integrated level refers to regulation based on what the individual thinks is valuable and significant to themselves (Deci et al., 1999).

Based on the Operant Conditioning Theory, Weiss (1990) developed four tools that managers can apply to motivate high performance and prevent workers from engaging in other behaviours detracting from organisational effectiveness. These tools are: positive reinforcement, negative reinforcement, extinction, and punishment. These tools were tested by Teo et al. (2005) and the findings showed that only three tools can help workers who “do not care” about working safely to be more safety-aware. The first tool is positive reinforcement, which gives workers outcomes (positive reinforcers) they desire when they perform organisationally functional behaviours. Secondly, negative reinforcement eliminates or removes undesired outcomes (negative reinforcers) once the functional behaviour is performed. Hence, to motivate workers to perform their jobs in a safe manner, managers may criticise or threaten workers. Once the workers work in a safe manner, they stop receiving the undesired outcomes. Whenever possible, positive reinforcements should be used, as negative reinforcements make the workplace unpleasant and may cause subordinates to resent managers and try to get back at them (Jones and George 2003). The third tool is punishment, which involves administering an undesired or negative consequence when dysfunctional behaviour occurs. In regards to job safety, punishments can include pay cuts, temporary suspensions, demotions, and firings. Punishments and negative reinforcements are different. Negative reinforcement is used to encourage workers to work in a safe manner, while punishment is used to stop unsafe work behaviour. When the workers work in a safe manner, the negative reinforcement is removed. In the case of punishment, it is administered when unsafe work behaviour is performed. The above theories can be summarised in relation to the two major sources of motivation: intrinsic and extrinsic. Intrinsic motivation refers to behaviours that happen in the absence of external control, whereas extrinsic motivators are external motivation sources, when individuals believe that the behaviours they engage in will lead to certain outcomes such as pay and praise (Nirmala 2005). Intrinsic motivation does not mean, however, that a person will not seek rewards. Thus, safety motivation scales should measure both intrinsic and extrinsic motivation. The aim for understanding the nature of motivation is to measure safety motivation appropriately, and to discover the impact of motivation on the relationship on safety climate and worker safety behaviour, in order to predict and control human behaviour in workplace. Table 1 describes the dimensions of safety motivation along with description and associated references.

In the current study, it is proposed that workers' safety motivation is a key variable having a direct impact on both workplace safety climate and individual behaviour. A desired safe behaviour in workplace is usually uncomfortable and inconvenient (Geller 2010). Without safety climate and individual motivation, shortcuts may unavoidably be taken. The motivation has to be linked to required actions for the outcome to be achieved (Gershwin 1994) which is safety climate in the current study. The motivation alone does not produce the positive change unless there is an appropriate safety climate to maintain safe manner and no reversion to unsafe behaviour especially in the developing countries. This goes along with person-organization fit concept which is one of the most popular areas of research in the general management and organizational field. This domain captures the congruence between the characteristics of individuals and the characteristics of organizations (Bright 2007). Thus as the congruence between individuals who have the value and motivation toward safety and the construction safety

climate, will drive workers behaviour to become more safe and committed. Individuals are only expected to allocate discretionary effort when they believe that their individual interests are aligned with those of the company will make a reciprocal investment in their well-being. Therefore, workers safety motivation will work when there is a constructive safety climate (Vroom 1964).

Table 1: Operational details of the ‘Safety Motivation’ construct

Dimensions	Description	References
Intrinsic Motivation (SM1)	Intrinsic motivation refers to desired behaviors that happen in the absence of external control.	Moynihan and Pandey, 2007; Neal and Griffin, 2006; Vinodkumar and Bhasi, 2010.
Extrinsic Motivation (SM2)	Extrinsic motivators are external motivation sources; individuals believe that the behaviors they engage in will lead to certain desired outcomes.	Teo et al., 2005; Vinodkumar and Bhasi, 2010.

2.2 Safety climate (SC) construct

During the last two decades, safety climate has been researched in three principal ways: (1) designing psychometric measurement tools and determining their underlying factor structures; (2) developing and examining theoretical models of safety climate to find out determinants of safety behaviour; and (3) examining the relationship between safety climate perceptions and actual safety outcomes (Cooper and Phillips 2004). One of the objectives of this study is to measure safety climate perceptions and develop and test theoretical models of safety climate to ascertain determinants of safety behaviour and accidents.

Many researchers have studied the factors which contribute to project safety success within various industries. The majority of these researches were conducted in high hazard industrial sectors, including transport, power generation, offshore oil and gas production, manufacturing, and construction. The results are presented thematically, under the headings managerial factors, supervisory factors, workforce factors, and other system factors (e.g. Yule 2003). These research studies concentrated on identifying factors associated with successful safety performance in organisations. In fact, the inconsistencies in identified safety climate factors could be due to the diversity of questionnaires, samples and methodologies used by different researchers. On the other hand, even when the same questionnaire was used, different factors were still found (Glendon and Litherland 2001). Therefore, it can be concluded that dimensions of safety climate differ from industry to industry, and from county to county (Fang et al. 2006), hence no universal set of safety climate factors. However, a number of similarities can be found between different safety climate research studies. Based on the literature synthesis particularly from the three recent investigations by Fang et al. (2006) and Choudhry et al. (2009), the present paper conceptualises safety climate as consisting of the following dimensions: worker perceptions of management’s commitment and communication; worker appreciation of risk; worker

competence; work pressure; and worker perception of safety rules and procedures (see Table 2).

Neal et al. (2000) pointed out that several research studies emphasising the relationship between safety climate and safety behaviour reported a positive effect. One of the key assumptions of the present study is that the link between safety climate and safety behaviour is a direct relationship. Mohamed's (2002) research findings make certain that safe work behaviours are influenced by existing safety climates on construction sites. These results suggest that safety climate and safety behaviour are directly and positively associated.

Table 2: Operational details of the 'Safety Climate' construct

Dimension	Description	References
Management Commitment and Communication (SC1)	The frequency and quality of communication and how keen the management is to improve safety performance.	Mohamed, 2002; Fang et al., 2006; Neal and Griffin, 2006; Vinodkumar and Bhasi, 2010
Competence (SC2)	The effectiveness of safety training, skills and qualifications of relevance to safety issues.	Mohamed, 2002; Fang et al., 2006; Vinodkumar and Bhasi, 2010.
Personal Appreciation of Risk (SC3)	An individual's subjective assessment of acceptable risk in the workplace.	Mohamed, 2002; Fang et al., 2006.
Work Pressure (SC4)	The level to which workers feel under pressure to complete work, and the amount of time to plan and perform work safely.	Glendon et al., 1994; Flin et al., 2000; Mohamed, 2002; Fang et al., 2006.
Safety Rules and Procedures (SC5)	The availability of safety equipment and facilities to carry out the job safely and the effectiveness of safety inspections and emergency procedures.	Flin et al., 2000; Mohamed, 2002; Fang et al., 2006.

2.3 Safety Behaviour (SB) construct

Safety Behaviour (SB) has two components describing the actual performance of individuals at work. Borman and Motowidlo (1993) proposed two main components of performance: task performance and contextual performance. These two parts of performance can be used to differentiate SB in the workplace. First, based on definitions of task performance, this current study uses the term safety compliance to describe the core safety activities which need to be carried out by individuals to maintain workplace safety, such as wearing personal protective equipment. Second, based on definitions of contextual performance, safety participation is used to describe behaviours such as participating in voluntary safety activities or attending safety meetings. Safety participation behaviours may not directly contribute to workplace safety, but they do help to develop an environment that supports safety (Griffin and Neal

2000). The Borman and Motowidlo's (1993) concept was used by Griffin and Neal (2000) to examine the relationship between safety climate and safety behaviour. Table 3 summarises the two dimensions of the safety behaviour construct, along with their descriptions, and associated references.

Table 3: Operational details of the 'Safety Behaviour' construct

Dimensions	Description	References
Safety compliance (SB1)	Self-measure of performance of safety related behaviors.	Neal and Griffin, 2006; Vinodkumar and Bhasi, 2010.
Safety participation (SB2)	Self-measure of involvement in safety support activities.	Neal and Griffin, 2006; Vinodkumar and Bhasi, 2010.

3. Research design

A quantitative research method was selected to examine the proposed conceptual model. A questionnaire survey was used in order to assist the collection of data from individuals at construction sites. All model constructs were measured using a five-point Likert-type response format. Items, relating to each of the constructs, were used in the form of statements to measure individual constructs under investigation. The different statements used in developing the questionnaire were drawn upon scales that had been previously used by researchers (Choudhry et al. 2009; Mohamed 2002; Vinodkumar and Bhasi 2010). Participants were asked to rate the statements using a five point Likert-type scale (from 1= "strongly disagree" to 5="strongly agree").

The scales were further developed by including complimentary additions of new items and some items were reworded and rephrased to suit local working practices and culture. The contents of this draft questionnaire were discussed with senior safety professionals from Saudi construction industries and senior professors in engineering management studies to ensure face validity. After considering each item in detail, required changes were made by simplifying, rewording, removing and replacing some of them.

Descriptive statistics and reliability of the studied variables were firstly analysed. Confirmatory factor analysis (CFA) was then employed to verify the validity of the five safety management practices (management commitment and communication, competence, personal appreciation of risk, work pressure, safety rules and procedures), two components of safety behaviour (safety compliance and safety participation) and two components of safety motivation (intrinsic motivation and extrinsic motivation). The Structural Equation Modelling (SEM) technique was used to conduct the path analyses to test the relationship between the model constructs and the goodness of fit of the model. SPSS 20 with AMOS 19 software was used for all the basic descriptive analyses, CFA and path analysis. The study employed the following model fit indices: normed chi-square (χ^2/df); goodness-of-fit index (GFI); comparative fit index (CFI); incremental fit index (IFI); and root mean square error of approximation (RMSEA). To be considered as having an adequate fit with the data, all the

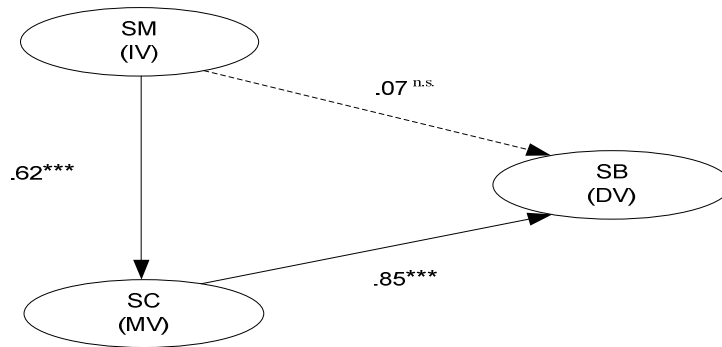
indices of the model should meet the following criteria: $\chi^2/df < 3.0$; GFI, CFI, and IFI > 0.90 ; and RMSEA < 0.08 (Hair et al., 2006).

4. Analysis results and discussion

The survey was conducted with Saudi Construction Industry (SCI) during Feb and May 2012. The study sample targeted only individuals in the construction workplaces (supervisors, engineers from main contractors as well as subcontractors). In total, 430 survey packages containing a questionnaire, an introductory letter, and an incentive were sent out via email. Of the 430 surveys sent, 295 usable questionnaires were returned thus achieving a response rate of 68.6%. The majority of the respondents were site engineers (44.4%) and project managers (29.8%) aged between 31- 40 (35.9%) and 31-40 (30.2%) with a bachelor's degree (76.3%) and Master's degree (22%). Most of them were employed in engineering firms, 29% were in civil and infrastructure projects, 20.5% in residential building and 18.7% in urban development with a size ranging from small-to-medium (100-2000 employees, 49.8%) to large (>2000 employees, 50.2%). Overall, the respondents were considered a good representation of the survey population.

The measurement model (a CFA model) depicts a series of relationships that suggest how measured variables represent a construct that is not measured directly (Hair et al., 2006). In this study, the measurement model was developed by integrating the individual CFA models of all the constructs into a single model. The CFA results of constructs are adequate, the factor loadings, ranging from 0.48 to 0.86, and were all significant at $p < 0.001$ level, suggesting convergent validity. All the correlation coefficients among constructs, ranging from 0.67 to 0.83, were less than 0.850, thus supporting the discriminant validity of the constructs. Finally, since the model fit indices proved to be good, unidimensionality was established.

Following the CFA, SEM was performed to preliminary evaluate the fit of the conceptual model as well as the hypothesised relationships between the constructs. The fit indices of the conceptual model were considered to ensure the model explains the data well. Figure 2 shows the results for the model with standardised path coefficients. Overall, the fit indices of the model proved to be satisfactory: $\chi^2 = 63.42$; $df = 21$; $\chi^2/df = 2.48$; GFI = 0.96; CFI = 0.96; IFI = 0.96; and RMSEA = 0.08.



$\chi^2 = 63.425$; $df = 21$; $\chi^2/df = 2.48$; GFI = 0.96; IFI = 0.96; TLI = 0.93; CFI = 0.96; and RMSEA = 0.08

*** $p < 0.001$; ^{n.s.} Not significant at $p < 0.05$ level.

Figure 2: Final model with standardised path coefficients

According to the path coefficients, safety motivation appears to have a good and positive influence on safety climate in Saudi construction workplace (0.62, $p < 0.001$). Safety climate for construction workplace at Saudi context (0.85, $p < 0.001$) is shown to have a strong positive influence on safety behaviour. However, the safety motivation construct does not appear to have a direct influence on the safety behaviour with the presence of safety climate. According to Baron and Kenny (1986) and Bennett (2000), a mediator is a variable that indicates how the association occurs between independent and dependent variables. A mediator effect is only tested when there is a significant direct effect between the independent variable and the dependent variable, but there is an opportunity that a mediator variable theoretically occurs "between" the two variables. A mediator effect exists if the following conditions are met: (1) variations in the independent variable (in this case, SM) predict variations in the mediator variable (SC), (2) variations in the mediator variable (SC) predict variations in the dependent variable (SB), and (3) When the relations between IV and both MV and DV are controlled for in the model, the direct relationship between the IV and the DV becomes non-significant. Having met these conditions, it can be established that SC fully mediates the relationship between SM and SB within the context of this study.

The above analysis results indicate that the developed conceptual model is fully supported by the data, which confirmed the direct link between the safety climate at Saudi construction workplace and individual safety behaviours. Moreover, the results supported that safety climate mediates the influence of individual safety motivation on safety behaviour in construction workplace. Bright (2007) suggested that individuals are attracted to workplace settings that are most compatible with their characteristics. Using this line of reasoning, it can be argued that individuals at construction workplace with safety motivation interest would not work appropriately in a safe manner unless these workplaces contain safe working conditions that support their safety motives. This is consistent with Neal et al.'s (2000) findings that safety motivation had a weak effect on safety behaviour, and safety climate exerted a direct effect on behaviour which was unexpected in their study. Furthermore, Neal and Griffin (2006), contrary to their hypotheses, found that safety motivation was not associated with subsequent changes in safety compliance, which is a part of safety

behaviour in their study. The results suggest that interventions specifically aimed at improving safety behaviour using a range of safety motivation techniques (both intrinsic and extrinsic) will be more effective when they are carried out within the context of a positive safety climate.

5. Conclusion

This paper presents a study attempting to examine a conceptual model proposing that the Safety Climate (SC) will mediate the relationship between Safety Motivation (SM) and the Safety Behaviour (SB) of individuals in Saudi construction workplace. The study was carried out using a quantitative method design integrating questionnaire survey. The model derived from the SEM analysis of the survey data indicates that safety climate appears to play a key role to safety behaviour by mediating the relationships between both safety motivation and behaviour. The study demonstrates that general safety motivation can influence perceptions of safety climate, and that these perceptions of safety climate in turn influence safety behaviour. The motivation alone does not produce the change unless there is an appropriate safety climate to maintain safe manner and no reversion to unsafe behaviour. These findings provide valuable guidance for researchers and practitioners trying to identify the mechanisms by which they can improve safety in the workplace. In particular, a construction workplace in the Saudi context should place an emphasis on creating safety climate as it is the main player that leverages the use of safety motivation to achieve desired safety behaviour.

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