# PROMOTING EMPLOYEE SAFETY PERFORMANCE IN THE CHINESE CONSTRUCTION INDUSTRY

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In the construction industry, safety leadership has been widely recognised as an indispensable factor that affects organisational safety performance. However, in China specifically, research on safety leadership in the construction domain is not adequately developed. This paper examines the role of organisational leadership in promoting safety performance, as moderated by safety climate. The study adopts quantitative research method through questionnaire survey with 106 construction professionals leading or participating in safety management work in the Chinese construction sectors. The results show that exerting certain leadership strategies that encourage construction stakeholders to comply with safety practices will improve safety performance. At a moment when the whole industry is suffering from momentous safety challenges, transformation is required; these findings are intended to guide construction managers in their commitment to programme safety management. The study reinforces the interaction between upper layer and lower layer employees thereby improving the safety performance via improvements in the safety climate. In addition to being rooted in the full-range leadership model, this paper considered the impo rtant (and often ignored) characteristics of Chinese culture. The study recommends the early involvement of contractors in the design process and considers site hazards when making design decisions.

Keywords: safety leadership, safety performance, safety climate, China

## INTRODUCTION

Construction is considered a high-risk industry, as workers engage in many activities that expose them to serious hazards: working at height, operating lifting equipment, controlling vehicles and other activities (HSC, 2001). Because of these inherent risks and complexity, accidents occur frequently in the construction industry, leading to undesirable consequences such as project delays, budget excess, and even loss of life (Soltanzadeh *et al.,* 2017). Poor safety performance in the construction sector has attracted widespread concerns, but despite this attention, the frequency of incidents in developing countries still remains high (Haslam *et al.,* 2005). Since 2008, the total number of accidents in the construction industry in China has exceeded that of the coal mining industry, ranking it as the sector with the highest accident rate for nine

Opoku, A, Zhao, S, Lok, K L, Chen, C and Umar, T (2020) Promoting Employee Safety Performance in the Chinese Construction Industry *In:* Scott, L and Neilson, C J (Eds) *Proceedings of the 36th Annual ARCOM Conference,* 7-8 September 2020, UK, Association of Researchers in Construction Management, 285-294

consecutive years; further, the total number of construction accidents in China increased by 4.3% in 2018 (COSHA, 2018). Previous studies on the factors affecting poor safety performance identified various layers as illustrated in Figure 1 **(**Howell *et al.,* 2002; Haslam *et al.,* 2005; Khosravi *et al.,* 2014).

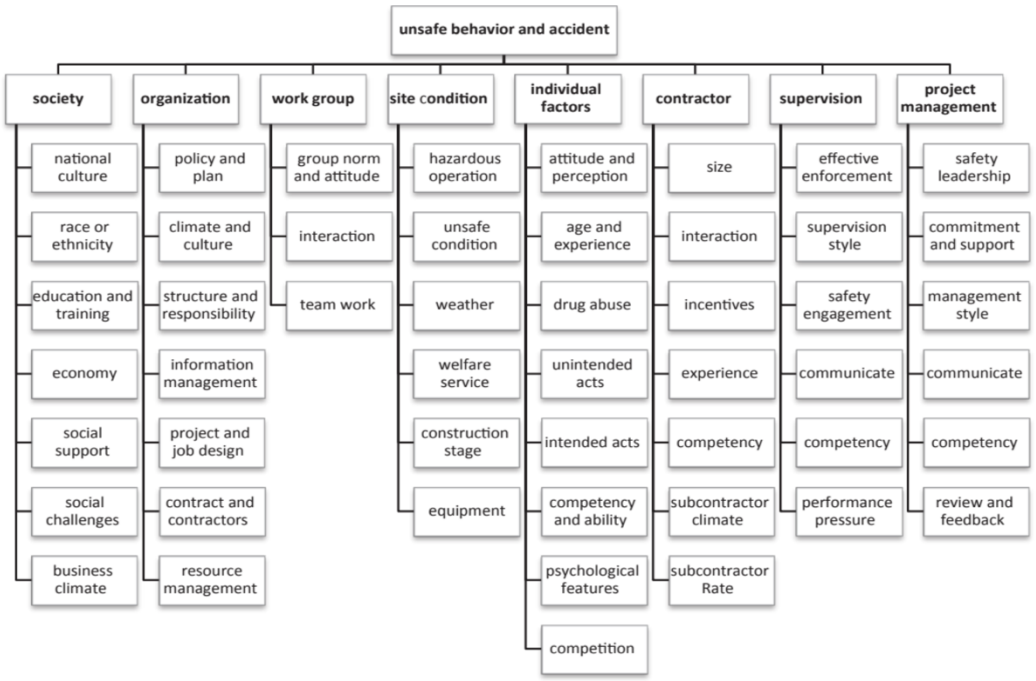


*Figure 1: Primary elements leading to unsafety behaviour and accidents*

Safety management is a practice that is meant to ensure the on-site safety of a construction project to reduce accidents (Wilson and Koehn, 2000). Safety climate is a representation of the attitudes, perceptions, and values that employees convey on the subject of safety (Wu *et al.,* 2017; Umar and Wamuziri, 2017). Effective leadership actions are intended to strengthen the interaction between managers and employees to ensure the smooth implementation of policies and practices. On the other hand, by establishing sound safety policies, visions, incentives, reward systems, and exerting an altruistic spirit, safety leaders can do much more than promoting a favourable safety climate; they can also improve safety performance (Wu *et al.,* 2015). An altruistic attitude as a form of ethical leadership encourages employees to behave in a mutually beneficial manner (Gao, 2016).

Employees who display altruistic attitudes will consider the interests of their leaders. The most effective way for employees to meet the interests of their leaders is to adhere to various rules and regulations and implement the orders issued by the leaders to improve their own safety compliance behaviour. Again, an altruistic attitude will enable employees account for the interests of their colleagues and maintain the safety of the entire group by complying with safety rules (Mayer *et al.,* 2010). Previous studies have demonstrated the impact of safety leadership on safety performance (Barling *et al.,* 2002; Clarke, 2013; Wu *et al.,* 2017; Umar, 2017). In China, the safety management of the construction industry is mainly dominated by clients, as the program leader of clients serves the role of safety policymaker and decision-makers (Gao, 2016). Therefore, the top manager of clients is considered to have the greatest impact on the safety of the enterprise. Considering the influence of Chinese traditional culture on program management, this study aims to provide empirical

evidence on how different Chinese leadership behaviours affect the safety climate and safety performance of construction projects.

## LITERATURE REVIEW

Concomitantly, research into safety leadership in the OHS literature has also become a significant portion of construction safety management. Initially, leadership research evolved from the trait-perspective to a behavioural-perspective, after which it turned to the contingency-perspective over the last century. Leadership is "an interaction between two or more members of a group. That often involves different perceptions and expectations of the members. Leadership occurs when one group member modifies the motivation and competencies of others in the group" (Bass, 1990: 24). In other words, leadership is a process of exerting influence, which means a person possesses the capability to seek the backup of others for the accomplishment of a joint mission (Chemers, 2002). Accordingly, the concept of safety leadership is like that of leadership in that safety leadership is an interactive process in which leaders exert their influences on others to accomplish safety objectives in the context of environmental, organisational, and personal factors (Wu, 2005).

### Safety Leadership, Safety Climate and Performance

Safe leadership can be regarded as a multi-dimensional variable, conceptualising its various dimensions can provide insight into some of the distinctive personal behaviours of safety leaders, and then explore which leadership behaviour conducive to better organisational performance (Wu, 2005). For example, Blair (2003) posited four key points to identifying aspects of safety leadership and establishing organisational safety excellence. The practices of safety leadership are as follows: setting up a clear target, confirming exemplary behaviours, creating cultures of excellence, and steering the right employees towards the right courses of action. The standpoint of Blair (2003) is to remind managers to focus more on leading by building a platform for communication, establish and change organisational safety climate, instead of strict monitoring.

Safety climate is a significant indicator that can reflect the effect safety leadership, generally, to the culture and perception of safety in a working environment (Du and Sun, 2012). In the field of OHS, Zohar first proposed the specific concept of safety climate, which has been approved by most professionals and widely used by numerous researchers. As noted by Zohar (1980), safety climate reflects common perceptions of subordinates about the organisational safety value and safety status. As for the dimension of safety climate, Zohar (1980) divides safety climate into seven sub-dimensions through a many practical investigations. For example, management attitudes towards safety, the risk level of the working environment, and the status of safety officers. Subsequently, Brown and Holmes (1986) argued that managers' emphasis on safety and employees' risk perception are the most important factors influencing corporate safety climate. In addition to safety commitments of the top management, safety commitments and actions at all levels, such as "employees' safety commitments, perceived risk, and emergency response" are significant aspects of the safety climate scale (Wu *et al.,* 2007, 99).

Safety performance refers to the actual outcomes of safety systems in the workplace (Hinze *et al.,* 2013). The conventional method of evaluating safety performance is through measurement and statistical analysis of accident-related data (including the incident frequency of injuries and ill-health, accident costs). These data-points are

often referred to as traceability or lag indicators (Sgourou *et al.,* 2010). It is easier for managers and employees to understand these indicators. However, these are often insufficient at measuring the failure reasons of system and revealing cause-effect relationships that may provoke system melioration (Wu *et al.,* 2015).

Cooper and Phillips (2004) argue that safety performance should be assessed using indicators such as the number of safe and unsafe behaviours of employees, incident rates, and the frequency of employee-participation in safety training. An objective safety performance evaluation (SPE) framework was devised by Ng *et al. (*2005) at an organisational level and project level to evaluate the safety performance of construction contractors. SPE accounts for several critical factors, including administrative and management commitment, safety education and training, safety supervision and inspection, accident record, and hazard management.

## DATA COLLECTION AND ANALYIS

A quantitative research methodology with a questionnaire survey was adopted for this study; questionnaire adopted Wu's (2005) measurement scale of safety leadership practices. This model can determine the specific content of safety inspiration, safety policy, safety reward and punishment, and safety vision. The safety performance model explains the relationship between the crucial safety factors or variables such as safety leadership, safety climate and performance. The questionnaire adopts a five-point Likert scale (from 1=strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree). The study involves 106 professional construction practitioners (i.e. frontline workers, project managers, and safety managers) who either lead or participate in safety management work in the Chinese construction sectors. The questionnaire was distributed through online channels. The specific approach was to upload the questionnaire to a professional website (i.c.www.wjx.cn), which was sent to the respondents.

The questionnaire was sent to 120 respondents and 106 were received with response rate of approximately 88%. Cronbach's alpha (α) is statistical analysis was used to measure the reliability of questionnaire and the results is shown in Table 1.

| Scale | Number of Items | Cronbach's Alpha | KMO |
|---|---|---|---|
| Safety Inspiration | 4 | 0.893 | 0.702 |
| Safety Vision | 3 | 0.8052 | 0.653 |
| Safety Policy | 3 | 0.8317 | 0.715 |
| Safety Reward and Punishment | 4 | 0.8061 | 0.752 |
| Altruism | 3 | 0.8624 | 0.718 |
| Safety Leadership | 17 | 0.8735 | 0.755 |
| Safety Climate | 11 | 0.8304 | 0.702 |
| Safety Compliance | 4 | 0.6781 | 0.633 |
| Safety Participation | 5 | 0.7226 | 0.681 |
| Safety Performance | 9 | 0.7775 | 0.692 |
| All | 37 | 0.9282 | 0.732 |

*Table 1 Reliability and validity analysis of questionnaire scales*

In general, Cronbach's α beyond 0.6 is a standard that suggests that the result is acceptable, and the data are reliable. Cronbach's α exceeds 0.8, indicating that the data has a high degree of reliability data (Cronbach, 1951). The value of Cronbach's α for all items is 0.**9282(**N=37), which reflecting a significant reliability of final data.

For example, Cronbach's α of safety leadership, safety climate, as well as safety performance are 0.8735 (N=17), 0.8304 (N=11), and 0.7775 (N=9) respectively. The Kaiser-Meyer-Olkin (KMO) index was used to estimate the validity of the questionnaire data. Typically, 0.6 is a standard number that regarded to be the baseline for data validity. In this study, KMO values are as high as 0.732 which indicates the highly effective and accurate of data. High validity refers to the extent to which the method can accurately reflect the true characteristics of the research object (Klenke *et al.,* 2016).

## RESULTS

Even though the number of respondents (N=106), each dimension contains a different number of variables and cannot be directly compared with the total or average score of each dimension. Therefore, the total score of dimensions was divided by the number of questions and finding the average score for each dimension. As shown in Table 2, the mean value of safety leadership is 4.13, with the highest mean value of safety reward and punishment (4.63) and the lowest mean value of safety vision (3.07). To sum up, the mean values of all safety leadership part are greater than the neutral value of 3, which indicates that project leader's well-implemented safety practices and respondents are highly satisfied with their safety leadership actions. The mean values of safety climate and safety performance are 4.10 and 4.19, respectively, demonstrating that the safety performance of employee and safety climate of organisations are generally satisfactory. Furthermore, the mean value of safety performance shows that employees are actively participated in safety activities (3.93) and consciously abide by the safety policies and regulations (4.53).

| Scale | N | Mean | Std. | Median |
|---|---|---|---|---|
| Safety Leadership | 106 | 4.13 | 0.48 | 4.24 |
| Safety Inspiration | 106 | 4.61 | 0.66 | 5 |
| Safety Vision | 106 | 3.07 | 0.76 | 3 |
| Safety Policy | 106 | 3.69 | 0.81 | 3.67 |
| Safety Reward and Punishment | 106 | 4.63 | 0.58 | 4.75 |
| Altruism | 106 | 4.35 | 0.77 | 4.67 |
| Safety Climate | 106 | 4.10 | 0.61 | 4.18 |
| Safety Performance | 106 | 4.19 | 0.57 | 4.33 |
| Safety Compliance | 106 | 4.53 | 0.53 | 4.75 |
| Safety Participation | 106 | 3.93 | 0.75 | 4 |

*Table 2: Descriptive statistics of all scales*

Correlation analysis is used to measure the strength of interrelationship between Safety leadership and performance. The results of Table 3 provide strong support for the significant and positive correlation between safety-specific leadership practices and safety manifestation as the correlation coefficient between those two variables is 0.809 ($p<0.05$), reaching a significant level of 0.05. This result shows that program managers enable to enhance organisational safety performance by actively promoting leadership actions. Safety leadership is positively related to safety performance. As dimensions of safety leadership, safety inspiration ($R=0.660$, $p<0.05$), vision ($R=0.372$, $p<0.05$), policy($R=0.587$, $p<0.05$), reward and punishment($R=0.728$, $p<0.05$) and altruism($R=0.378$, $p<0.05$) are positively correlated with safety performance.

The results suggest that leadership behaviours have a positive impact on employees' perceptions, attitudes and behaviours of safety. As mentioned above, an organisation with high performance of safety is more likely to possess a leader who influences employees through his leadership measures, leadership styles, and commitment (Pilbeam *et al.,* 2016). Regarding the relationship between safety climate and safety performance ($R=0.646$, $p<0.05$), it presents a dominant positive correlation. Similarly, there is a positive correlation between safety participation ($R=0.398$, $p<0.05$), compliance ($R=0.664$, $p<0.05$) and safe climate (Table 3).

| | Leader-ship | Inspira-tion | Vision | Policy | Reward | Altruism | Climate | Perfor-mance | Comp-liance | Parti-cipation |
|---|---|---|---|---|---|---|---|---|---|---|
| Leadership | 1 | 0.837** | 0.475** | 0.645** | 0.845** | 0.568** | 0.632** | 0.809** | 0.739** | 0.694** |
| Inspiration | 0.837** | 1 | 0.211* | 0.305** | 0.799** | 0.467** | 0.453** | 0.660** | 0.592** | 0.573** |
| Vision | 0.475** | 0.211* | 1 | 0.360** | 0.119526 | -0.05148 | 0.508** | 0.372** | 0.098622 | 0.457** |
| Policy | 0.645** | 0.305** | 0.360** | 1 | 0.459** | 0.05555 | 0.594** | 0.587** | 0.480** | 0.535** |
| Reward | 0.845** | 0.799** | 0.119526 | 0.459** | 1 | 0.454** | 0.461** | 0.728** | 0.802** | 0.546** |
| Altruism | 0.568** | 0.467** | -0.05148 | 0.05555 | 0.454** | 1 | 0.118663 | 0.378** | 0.516** | 0.227* |
| Climate | 0.632** | 0.453** | 0.508** | 0.594** | 0.461** | 0.118663 | 1 | 0.646** | 0.398** | 0.664** |
| Performance | 0.809** | 0.660** | 0.372** | 0.587** | 0.728** | 0.378** | 0.646** | 1 | 0.780** | 0.934** |
| Compliance | 0.739** | 0.592** | 0.098622 | 0.480** | 0.802** | 0.516** | 0.398** | 0.780** | 1 | 0.506** |
| Participation | 0.694** | 0.573** | 0.457** | 0.535** | 0.546** | 0.227* | 0.664** | 0.934** | 0.506** | 1 |

Note: *p<0.05 **p<0.01

*Table 3: Correlation coefficients (Safety leadership, climate and performance)*

This dataset is congruent with the results concluded by Kapp (2012), that is, safety climate is a leading indicator of safety outcomes. The safety performance of an organisation with a favourable safety climate is often ideal. Establishing a harmonious safety climate is inseparable from satisfactory safety performance and ripe safety management systems.

The effects of the harsh working environment in the Chinese construction industry are more likely to impact frontline workers who are often neglected by managers. Further, occupational injuries are responsible for many project delays, financial burdens, and human costs. Despite the generally accepted opinions determined that leadership is one of the important driving factors of good safety performance. The literature review identified five dimensions of leadership practice in line with the historical and cultural realities of the Chinese construction industry. These five leadership practices are the independent variables: safety inspiration, vision, reward and punishment, policy and altruism. Likewise, the safety behaviours of workers are further divided into two aspects: safety compliance and safety participation, both which serve as dependent variables. More importantly, understanding the relationship of safety leadership, safety performance as well as safety climate formed the basis of this study and the rationality of the relationship is proved by the results.

Again, a multiple linear regression analysis was performed to explore the contributory factors affecting safety compliance and participation. Multiple linear regression aims to evaluate the connection between two or more independent variables and a single continuous dependent variable by fitting a linear equation. When the p-value that corresponds to the F-value is less than 0.05, then at least one of the independent variables has an influence on the dependent variable. In the test where the dependent variable is safety compliance, the corresponding p-value is less than 0.05 when F=34.91 as shown in Table 4.

| Variables | Unstandardized Coefficients | | Standardized Coefficients | t | p-value |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| (Constant) | 0.881 | 0.308 | | 2.863 | 0.005 |
| Inspiration | -0.150 | 0.078 | -0.186 | -1.928 | 0.057 |
| Vision | 0.002 | 0.043 | 0.003 | 0.051 | 0.959 |
| Policy | 0.111 | 0.044 | 0.168 | 2.509 | 0.014 |
| Reward | 0.711 | 0.097 | 0.767 | 7.348 | 0.000 |
| Altruism | 0.168 | 0.044 | 0.242 | 3.805 | 0.000 |

*Note: F=34.913 p=0.00 R2=0.714*

*Table 4: Influencing factors of safety compliance*

The most critical analysis can be conducted to directly examine the relationship between the five independent variables and the dependent variables. An important criterion for estimating whether there is an influence relationship is to observe the p value if it's less than 0.05, this independent variable has an impact on the dependent variable.

After determining that there is an impact relationship, it is necessary to confirm the direction of influence; positive or negative influence relationship by the value B or Beta. It is positive when B or Beta is greater than 0, vice versa. As indicated in Table 4, policy ($p=0.014<0.05$, Beta=0.168), reward ($p=0.000<0.05$, Beta=0.767) and altruism ($p=0.000<0.05$, Beta=0.242), have the positive regression relationship with safety compliance. In other words, safety rules and procedures, rewards for efforts beyond standard requirements, as well as concerns for the collective interests and overall organisational safety, lead employees to comply with safety rules and policies. To be more specific, higher levels of transactional leadership can directly trigger employees to comply with existing organisational safety procedures. As Clark (2013) suggests that transactional leadership measures will facilitate workers to strictly comply with safety policies and regulations and timely prevent hazardous events. Likewise, Mayer (2010) deeply discussed that ethical leadership practices (i.e. altruism) can greatly promote safety compliance of employees and improve their misconduct. While, inspiration ($p=0.057>0.05$) and vision ($p=0.959>0.05$) have no significant regression correlation with compliance. This consequence indicates that no matter what supportive incentives the leader implements, employees are supposed to comply with the rules and regulations concerning safety procedures, which is an obligation and necessity of them to keep their contractual relationship. Punishment or even dismissal will be taken if their behaviours are in contravention of the regulations and rules. To the contrary, safety inspirations that encourage employees to work on

assignments not regulated in the contract could arouse their motivations (Fernández-Muñiz, 2017).

## CONCLUSION

The paper explores the role of safety leadership actions in enhancing organisational safety performance with a specific focus on the Chinese construction sector. More importantly, understanding the relationship of safety leadership, safety performance as well as safety climate formed the basis of the research. From the micro perspective, this study showed how leadership actions exert influence on employee safety participation and compliance in a multifaceted way including incentives, punishment or other methods. The results further show that safety inspiration and safety vison have a positive effect on safety participation, but that they do not affect safety compliance in a significant way. Safety compliance, on the other hand, is conditioned by policies, reward, punishment, and altruistic spirit. Subsequently, it can be seen that perceived safety climate mediates the correlation between safety-specific leadership behaviour and occupational safety performance. Overall, this study expounds on the influential path of leaders' actions on employees' safety participation and compliance from both theoretical and empirical aspects. In terms of limitation to the study, this paper is concerned with the safety leadership of program managers (i.e. client leadership influence) and ignores the influences of other levels of safety leadership, including project managers or construction managers of tier 1 contractors and subcontractor supervisors. The study recommends that, project managers should require constructors to participate in the design process and consider site hazards when making design decisions. Early contractor involvement is important because of they have comprehensive understanding of the construction site than the designer.

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