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# Exploring the perceived influence of safety management practices on project performance in the construction industry

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ABSTRACT

Although safety management is known to be vital to construction projects, very few studies have solicited views from construction practitioners about their perceptions of which safety management practices (SMPs) are important to construction projects and related to project performance. An empirical study was undertaken in Hong Kong in order to shed more light on this topic. In the study, the importance levels of 15 popular SMPs and five project performance criteria were rated by 232 respondents. An exploratory factor analysis was conducted, and three SMP categories – information, process, and committees – were extracted. Of these three categories, safety management process was perceived by the construction practitioners as being the most important, followed by safety management information and committees. Moreover, the effect of the three SMP categories on a composite project performance variable was tested using hierarchical regression analysis. Results indicate that the "information" and "committees" categories were associated with project performance positively and significantly. One of the major conclusions of the study is that the construction industry has paid relatively less attention to safety management committees, which were empirically analyzed as having a strong perceived impact on project performance. In order to improve project performance, construction companies should promote the criticality of safety management committees.



## 1. Introduction

The construction industry has long been considered to have high injury and fatality rates. For example, the US construction industry has a very high fatality rate of workers (Abudayyeh et al., 2006). In the UK construction industry, reported injuries continue to place the safety issue as a prime concern though fatal accidents were seen to fall recently to around 90 deaths per annum (Cameron and Duff, 2007a). Although the accident rate in the construction industry of Hong Kong is argued to decline in recent years due to improved safety measures, it still remains higher than that of other developed countries (Choudhry et al., 2009). Notably, many of these work-related deaths and injuries are preventable. As Williams (2000) advised, site safety should be enhanced since construction projects have become more complicated in recent times. Construction sites are crowded with workers who undertake numerous high risk duties such as operating at height and outdoors and with heavy machinery and equipment (Tam et al., 2004). Owing to the expected positive correlation between poor safety and injuries (not to mention the escalating costs of injuries), it is crucial to promote safe construction.

Human performance is arguably linked with safety (Bottani et al., 2009). Human errors are one of the major underlying causes of industrial accidents, and are perhaps the core component of various safety problems in high risk facilities (Jacobs and Haber, 1994; Llory, 1992). Hinze's (1996) Distraction Theory suggests that workers who are distracted by physical hazards or mental diversions are at increased risk of accidents. One school of thought has established the Accident Causation Theory, which pinpoints the importance of error identification (human, site management, project management, or policy errors) in accident prevention (Suraji et al., 2001). Mitropoulos and Cupido (2009) also suggest that production practices can prevent production errors. Therefore, it is believed that safety practices can prevent human errors, thereby reducing the likelihood of accidents if these practices were shaped by the guiding principle and its associated strategies focusing on avoiding construction errors and rework.

The negative impacts of work related accidents call for the necessity to reposition the management role in safety practices. Although accidents caused by the uncertain environment may not be easily avoided, it is however possible to regulate and improve current safety management to safeguard workers from artificial work re-

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lated hazards by instilling positive employee behavior (e.g., avoidance of premature acts, awareness of safety work) driven by an effective management system (Bottani et al., 2009; Krause, 1993). As Wilson and Koehn (2000) underlined, safety management is a method of manipulating on-site safety policies, procedures, and practices relating to a construction project. It entails a dynamic process accommodating small or large adjustments made to site operations in order for workers to work properly without facing unexpected disruptions to a construction project. Emphasis is placed on how accidents in a project can be reduced by effective safety management (Suraji et al., 2001). If safety performance can be enhanced, companies would benefit through improved performance (Jaselskis et al., 1996).

Although a safety management system has been found to improve safety performance (Bottani et al., 2009), most construction projects do not establish such a system on site (Benjaoran and Bhokha, 2010). As Häkkinen (1995) mentioned, a lack of commitment to safety management may lead to reduced safety awareness. Managing construction activities safely assures the success of the construction project. This is especially the case if organizations seek improvement in project performance by reducing the number of on-site accidents. Project performance is the measure of the extent to which a project is successfully completed. Thus, safety management has become an integral part of project management. However, recent construction safety research has been undertaken to mainly study the effect of factors on safety performance (e.g., Abudayyeh et al., 2006; Choudhry et al., 2009; El-Mashaleh et al., 2010; Yung, 2009; Zou and Zhang, 2009), explore the role of different parties, such as designers and owners, on site safety (e.g., Huang and Hinze, 2006; Seo and Choi, 2008), and examine the effectiveness of safety programs (e.g., Hallowell, 2010). The key safety management practices (SMPs) that lead to the desired project performance have not been empirically identified. In the study by Fernández-Muñiz et al. (2009), a safety management system that comprises elements of policy, incentives, training, communication, control, and planning was found to be significantly related to safety, competitiveness, and economic-financial performance. This further supports the proposition that the relationship between SMPs and project performance is worthy of investigation.

Due to high incidence of accidents on construction sites (Choudhry et al., 2009; Teo et al., 2005), the present research is intended to examine if the perceived importance of SMPs would affect project performance. The cognitive theory supports the view that perception is positively related to performance because perception shapes behavior, which in turn drives performance (O'Reily, 1973). It is expected that if one perceives that a safety practice is important, he or she will pay more attention to it, and that will result in fewer accidents and better project performance. Hence, this study sought to address three research questions: (1) which safety management practices (SMPs) are perceived by construction participants as relevant to construction projects? (2) To what extent are these practices essential to project performance? (3) What suggestions can be provided for effective safety management? For these questions, three research objectives are derived respectively: (1) to explore which categories of SMPs (derived through factor analysis) are perceived to be important to construction projects, (2) to examine which categories of SMPs are positively and significantly related to project performance, and (3) to reveal any potential improvement for the current SMPs in the construction industry and offer implications for other industries. In an effort to address the third research objective, findings from the first two research objectives are cross-examined. Detailed analytical strategies are presented in later paragraphs.

**Table 1**
Importance levels of safety management practices.

| Safety management practice | Mean value | Standard deviation |
|---|---|---|
| Written safety policy | 3.69 | 0.93 |
| Accident investigation and report | 3.68 | 0.93 |
| Safety records | 3.68 | 0.86 |
| Safety manual | 3.67 | 0.87 |
| Safety checklist | 3.63 | 0.85 |
| Accident statistical analysis | 3.46 | 0.85 |
| Formal safety organization structure | 3.40 | 0.79 |
| Safe inspection | 4.03 | 0.79 |
| Safety training scheme | 3.86 | 0.81 |
| Safe work practices | 3.75 | 0.84 |
| Safety meeting | 3.68 | 0.85 |
| Safety audit | 3.45 | 0.90 |
| Safe promotion | 3.36 | 0.92 |
| Safety committee at project/site level | 3.56 | 0.81 |
| Safety committee at company level | 3.43 | 0.87 |

*Note*: $n = 232$.

## 2. Research method

### 2.1. Survey

A survey was administered in Hong Kong. Prior to conducting the survey, the exploratory study approach was adopted to select local general practices. Given the exploratory nature of the study, such an approach was appropriate to generate the tested model specifying the hypothesized relationships (Cavana et al., 2001). Based on a review of the existing literature (e.g., Barraza et al., 2004; Cheng et al., 2000, 2007; Jannadi and Bu-Khamsin, 2002; Langford et al., 2000; Sawacha et al., 1999; Teo et al., 2005; Toole, 2002; Wang et al., 2006) and the comments from eight construction professionals, the present research identified 15 SMPs (see Table 1) and five project performance criteria (quality, cost, time, scope of work, and profit), which were perceived to be general. Broader variables are more useful in general studies as they are easy to be understood (Greenhaus et al., 1990; Viswesvaran et al., 1996). Despite safety having been seen as a project performance criterion (e.g., Barraza et al., 2004), it was excluded due to its tacit relationship with SMPs. The exclusion of it could help to explore the effect of SMPs on other project performance criteria.

### 2.2. Questionnaire administration and sampling method

A pilot test was administered to the same group of construction professionals to clarify and refine the questionnaire. By incorporating their comments, a final questionnaire was devised that consisted of three sections – questions regarding the background of the respondents, measures of the SMPs, and measures of the project performance criteria. The final paper-and-pencil questionnaire was then sent to 15 companies involved in construction projects, and these companies asked their employees to complete the questionnaire. The types of companies included clients, contractors, consultants, and subcontractors. From a total of 772 questionnaires distributed, there were 235 responses, of which three were removed due to incomplete data. As a result, 232 responses were used for subsequent analyses, representing a response rate of 30%.

### 2.3. Profile of the respondents

An analysis of the demographic profile of the respondents revealed that an overwhelming majority (90.5%) were male. Almost half of the respondents (49.1%) were in the age group of "25–34", followed by "35–44" (23.7%), "at least 45" (14.2%) and "less than 25" (12.9%). Although 44% of the respondents had less than a year of experience of their current position, almost 73% had more than 2 years of work experience. The companies, where the final