



Developing an inter-organizational safety climate instrument for the construction industry



Lance W. Saunders^{a,*}, Brian M. Kleiner^b, Andrew P. McCoy^c, Kimberly P. Ellis^d, Tonya Smith-Jackson^e, Christian Wernz^f

^a Grado Department of Industrial & Systems Engineering, Virginia Tech, 519B Whittemore Hall, MC 0118, Blacksburg, VA 24061, United States

^b Myers-Lawson School of Construction, Industrial & Systems Engineering, Virginia Tech, 519B Whittemore Hall, MC 0118, Blacksburg, VA 24061, United States

^c Department of Building Construction, Virginia Tech, 410B Bishop-Favro Hall, Blacksburg, VA 24061, United States

^d Grado Department of Industrial & Systems Engineering, Virginia Tech, 109 Durham Hall, MC 0118, Blacksburg, VA 24061, United States

^e Department of Industrial & Systems Engineering, North Carolina A&T University, 408 McNair Hall, 1601 East Market Street, Greensboro, NC 27411, United States

^f Grado Department of Industrial & Systems Engineering, Virginia Tech, 205 Durham Hall, MC 0118, Blacksburg, VA 24061, United States

ARTICLE INFO

Article history:

Received 4 August 2015

Received in revised form 10 April 2017

Accepted 12 April 2017

Keywords:

Occupational safety and health

Design for safety

Construction safety

Safety climate

Supply chain

Work systems

ABSTRACT

In the construction industry, recent literature has promoted a design for safety approach that discusses the benefits of considering safety from the very start of the project lifecycle. With this approach, non-construction personnel, such as owners and designers, need to work alongside constructors and subcontractors to consider safety during design and procurement stages of a project. This is a difficult process, particularly with the degree of fragmentation in the industry. Safety climate survey instruments have been developed to identify these sources of fragmentation among stakeholder groups, but most of these tools are directed toward on-site construction personnel. This paper describes the development of an inter-organizational safety climate instrument for measuring attitudes toward safety of construction industry stakeholders including owners, designers, construction managers, and subcontractors. Overall, the measurement model demonstrated a good fit with the data based on a confirmatory factor analysis. Therefore, the survey instrument provides a useful tool for researchers and practitioners to identify the sources of fragmentation in attitudes of construction project personnel toward worker safety that can affect occupational health and safety within the industry.

© 2017 Published by Elsevier Ltd.

1. Introduction

The alignment of stakeholder attitudes toward safety is an important predictor of safe work behavior on construction sites (Lingard et al., 2009; Mohamed, 2002). The objective of this research was to develop and evaluate a safety climate survey instrument that can be used to measure the strength of the alignment of safety attitudes for key stakeholders at all stages of a construction project. Systemic improvements of construction worker safety such as this can be difficult to implement due to the fragmented nature of the industry (Cheng et al., 2010; Vrijhoef and Koskela, 2000), which results because the construction work system is complex and involves multiple organizations such as owners, designers, construction managers, and sub-contractors. From a safety perspective, all these parties have an important impact,

yet are often not aligned regarding who is ultimately responsible for worker safety (Behm, 2005). These organizations can align to provide a safer working environment (Gambatese et al., 2005; Huang, 2003), but these efforts are often inhibited by long project durations and organizations typically working with different partners from project to project (Segerstedt and Olofsson, 2010; Bankvall et al., 2010). In addition, stakeholders such as owners and designers in the United States (US) often see involvement in safety-related issues as a liability risk and therefore avoid specifying construction means and methods (Behm, 2005).

To address this fragmentation, the construction work system should be assessed as a network of organizations involved in “upstream and downstream flows of products, services, finances, and/or information from a source to a customer” (Mentzer et al., 2001 p. 4). In a construction worker safety context, safety decisions made upstream, such as identifying and controlling potential hazards during design, have positive effects downstream on project level safety performance (Lingard et al., 2014). Thus, safety should be a focus of upstream activities, such as design, along with

* Corresponding author at: 9506 Downing Street, Henrico, VA 23238, United States.

E-mail address: lwsaunders@vcu.edu (L.W. Saunders).

downstream activities, such as construction, and mechanisms to improve the focus on safety beyond the site level would be a practical tool for managers.

Audit systems, such as the Construction-CHASE tool, have sought to address the importance of assessing safety beyond the site level (Booth et al., 1990). This consideration does not consistently occur in the US because safety is generally managed using behavior-based approaches such as workers following safety procedures or wearing personal protective equipment (Manuele, 2003). These behavior-based interventions are important to safety management, but construction site hazards are most effectively and economically avoided when they are anticipated and controlled as early in the construction lifecycle as possible (Manuele, 2003; Lingard et al., 2015). Fragmentation occurs because stakeholders driving many project decisions early in the lifecycle, such as owners and designers, are often resistant to becoming involved in the safety decision-making process (Behm, 2005). This avoidance can prevent the technical expertise of these stakeholders from being fully translated into occupational safety and health (OSH) interventions (Godfrey and Lindgard, 2007). A means to identify why this misalignment occurs regarding stakeholder safety attitudes could provide a pathway for identifying work system improvements to reduce misalignment and improve safety performance (Kleiner, 2006).

Safety culture can provide this means, and is defined as the underlying values, attitudes, and beliefs shared by an organization's employees as they relate to safety (Choudhry et al., 2007; Guldenmund, 2000). Each organization in the construction work system has a unique safety culture that contributes to a project's overall safety culture, and the construct has been used to explain gaps in safety attitudes between stakeholders within the construction industry (Cox and Cheyne, 2000; Lee and Harrison, 2000; McDonald et al., 2000). Misalignment of safety attitudes may have a negative impact on OSH performance (Gambatese et al., 2005), and thus safety culture is an appropriate way in which to assess stakeholder alignment at the work system level.

The construct of safety climate is used to measure safety culture for a group of stakeholders at a given point in time, and is displayed through outcomes such as safety documentation, rules, and attitudes of employees toward safety (Guldenmund, 2000; Dingsdag et al., 2008). These outcomes are measurable through methods such as survey instruments, which is why safety climate is often used as a proxy measure for safety culture (Flin et al., 2000; Gittleman et al., 2010), and can be used to measure differences in attitudes at the organizational level (Dov, 2008). More specifically, safety climate can be divided into discrete constructs that measure the strength of individual factors influencing safety attitudes and thus identify specific differences between organizations in the construction supply chain.

Existing safety climate instruments specific to the construction industry are generally tailored to specific stakeholder groups, such as architects and engineers or construction site personnel. Thus, an instrument that is applicable to all key stakeholders would advance the construction safety climate literature. The research question that this paper addresses is whether a single measurement model can reliably measure safety climate differences between key sub-groups in the construction work system. Such an instrument would add to the construction safety literature, and provide a tool for practitioners to identify improvement opportunities for reducing misalignment between construction project partners.

In this paper, the existing safety climate literature is synthesized to develop a measurement model for identifying safety attitude differences between key construction project stakeholders. The resulting safety climate instrument is presented along with the results of a confirmatory factor analysis (CFA) based on a

sample of US construction industry owners, designers, construction managers and sub-contractors. Finally, a discussion of the results is given to support the validity and reliability of the instrument.

2. Safety climate literature review

Safety climate is intended to measure group level attitudes (Glick, 1985; Pousette et al., 2008), and has been used to explain inter-group differences between sub-groups within an organization and between organizations within an industry (Cox and Cheyne, 2000; Lee and Harrison, 2000; McDonald et al., 2000; Zohar and Luria, 2005). Studies have also shown why some sectors within an industry, such as road construction, performed better on OSH as compared to others, and illustrated the positive impact of increased group-level safety climate on safety performance (Lingard et al., 2009). Safety climate measurement tools have been used to propose strategies to bridge gaps in safety culture based on inter-group differences identified using a safety climate measurement tool (Mason and Simpson, 1995; Budworth, 1997). Thus, there is sufficient literature to suggest that a safety climate survey instrument is a valid mechanism for measuring inter-group differences in safety attitudes between key stakeholders in the construction work system.

More specifically, safety climate instruments have been used within the construction industry to identify the strength of differences within sub-groups of personnel for multiple constructs. These samples included construction workers, safety managers, and upper management separately (Mohamed, 2002), and relied on data collected from different organizations to analyze safety climate by role at the industry level (Abudayyeh et al., 2006; Gillen et al., 2002; Siu et al., 2004). Thus, a safety climate survey instrument is an appropriate tool to analyze sub-groups of employees at the industry level categorized by organizational type. A robust tool that measures differences without relying on separate instruments for each subgroup would be a theoretical contribution to the construction industry safety climate literature.

Mohamed's (2002) safety climate instrument is based on a measurement model developed through an extensive literature review. The measurement model's constructs, as shown in Fig. 1, together describe the elements of safety climate for the construction industry, and was tested using a sample of workers at 10 different organizations at 6 different sites. This model provides the components of safety that could differ among organizations in the construction work system, and shows strong similarity to measurement models developed by Glendon and Litherland (2001), and by Fang et al. (2006) for construction safety climate instruments.

Mohamed's (2002) instrument, as well as the Glendon and Litherland (2001) and Fang et al. (2006) instruments, were only evaluated using responses from construction site personnel. These instruments contain items specific to personnel typically involved in construction site activities, and may not be applicable for other types of stakeholders. For example, asking an architect whether their management praises them for 'working safely' might not be as relevant as asking if they are praised for considering construction worker safety in their work. Thus, a generalized instrument focusing on potential risks (in addition to construction site hazards) would be more relevant to a wider range of stakeholders.

The Mohamed (2002) measurement model, if generalized, provides a foundation for an instrument targeted at the entire construction work system. The development of a holistic instrument also aligns with Zohar (2010), who discussed the need for more focused, inter-organizational safety climate instruments to measure sub-group differences at the work system level. An inter-organizational tool would also be of theoretical and practical use to the design for safety literature by increasing the understanding

Download English Version:

<https://daneshyari.com/en/article/4981206>

Download Persian Version:

<https://daneshyari.com/article/4981206>

[Daneshyari.com](https://daneshyari.com)