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Does company size matter? Validation of an integrative model of safety behavior across small and large construction companies

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ABSTRACT

Introduction: Previous safety climate studies primarily focused on either large construction companies or the construction industry as a whole, while little is known about whether company size has significant effects on workers' understanding of safety climate measures and relationships between safety climate factors and safety behavior. Thus, this study aims to: (a) test the measurement equivalence (ME) of a safety climate measure across workers from small and large companies; (b) investigate if company size alters the causal structure of the integrative model developed by Guo et al. (2016). *Method*: Data were collected from 253 construction workers in New Zealand using a safety climate measure. This study used multi-group confirmatory factor analyses (MCFA) to test the measurement equivalence of the safety climate measure and structure invariance of the integrative model. *Results*: Results indicate that workers from small and large companies understood the safety climate measure in a similar manner. In addition, it was suggested that company size does not change the causal structure and mediational processes of the integrative model. *Conclusions*: Both measurement equivalence of the safety climate measure and structural invariance of the integrative model were supported by this study. *Practical applications*: Findings of this study provided strong support for a meaningful use of the safety climate measure across construction companies in different sizes. Safety behavior promotion strategies designed based on the integrative model may be well suited for both large and small companies.

1. Introduction

In recent years, safety climate has become a popular topic among safety researchers and practitioners in the construction industry (Choudhry, Fang, & Lingard, 2009; Fang, Chen, & Wong, 2006; Hon, Chan, & Yam, 2012; Lingard, Cooke, & Blismas, 2012; Mohamed, 2002; Zhou, Fang, & Mohamed, 2010). Despite its popularity, previous safety climate studies in the construction industry primarily focused on either large companies or the industry as a whole, while little is known about whether workers from small and large companies understand and respond to a safety climate measure in an equivalent manner and whether the relationship between safety climate and safety performance is the same across the two groups. This issue becomes important considering the fact that small businesses dominate the construction industry in many countries, such as Australia (Lingard & Holmes, 2001), United States (U.S. Census Bureau, 2011), and New Zealand (Ministry of Businesses Innovation & Employment, 2014). Compared with large construction companies, small ones face distinct challenges and barriers in managing safety. For example, from an economic point of view, they are more financially fragile, with tight profit margins and limited market share (Lamm, 1999). As a result, they are less willing to invest time and economic resources on health and safety (Champoux & Brun, 2003; Guo, Yiu, & González, 2015a,b; Lamm, 1999; Masi & Cagno, 2015). In any competitive economies, small firms' first priority is to survive. Due to the financial constraints, safety is often marginalized as they tend to put emphasis on client satisfaction, workloads, and cash flow that are vital for business success (Guo et al., 2015a,b). Ample evidence exists suggesting that safety performance of small businesses is poorer than that of larger ones (Champoux & Brun, 2003). A logical inference is that safety climate in small businesses is lower than that in larger ones. However, a different picture was drawn by other researchers. For example, Baek, Bae, Ham, and Singh (2008) conducted a questionnaire study and found that the level of safety climate was not different by company (or plant) size. This statement is supported by Rodrigues, Arezes, and Leão (2015), who pointed out that the level of safety climate is not dependent on company size. In addition, Sørensen, Hasle, and Bach (2007) reviewed 16 scientific articles studying differences in safety risk between small and large enterprises and found that the differences are mainly measured in relation to the rate

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of lost workdays, injuries, fatalities, or the quality of the organization health and safety management system. Legg, Olsen, Laird, and Hasle (2015) pointed out that the psychosocial work environment of small enterprises is not necessarily lower than that of large ones. Several researchers (Hasle & Limborg, 2006; Sørensen et al., 2007) even claimed that the psychosocial work environment in small enterprises is better than larger ones. These inconsistent findings may cause confusion over the effects of company size on safety climate and workers' safety behavior.

Another concern is the method used to compare safety climate across different groups. Previous studies (Cooper & Phillips, 2004; Idris, Dollard, Coward, & Dormann, 2012; Lu & Shang, 2005; Ma & Yuan, 2009; Vinodkumar & Bhasi, 2009) adopted common statistical tools, such as ANOVA and *t*-test, to compare specific differences of safety climate between various groups. However, these tools may not be appropriate for testing group difference due to a possible lack of measurement equivalence (ME) across groups. ME refers to the extent to which a measure or construct has the same meaning and measurement implications across groups (Vandenberg & Lance, 2000). In order to avoid the limitation, recent efforts were made to test ME before differences in safety climate were meaningfully compared (e.g., Barbaranelli, Petitta, & Probst, 2015; Cigularov, Adams, Gittleman, Haile, & Chen, 2013; Cigularov, Lancaster, Chen, Gittleman, & Haile, 2013; Lee, Huang, Murphy, Robertson, & Garabet, 2016). Despite this, no efforts were made to examine the systematic differences in the level of safety climate between small and large construction companies.

Current study is an extension of the integrative model of safety behavior developed by Guo, Yiu, and González (2016) and Guo, Yiu, González, and Goh (2016). The integrative model of safety behavior illustrates that management commitment to safety was the antecedent of social support and production pressure, which in turn were antecedents of safety knowledge, safety motivation, safety participation, and safety compliance. The effects of management on the workers' safety knowledge and safety motivation are fully mediated by social support and production pressure. This paper aims to: (a) test the measurement equivalence (ME) of the safety climate measure developed by Guo, Yiu, and González (2016) and Guo, Yiu, González, et al. (2016) across workers from small and large companies; (b) compare the level of safety climate perceptions between workers from the two groups; and (c) test the structural invariance of the integrative model developed by Guo, Yiu, and González (2016) and Guo, Yiu, González, et al. (2016) across the two groups and investigate whether company size changes the mediational processes in the model.

2. Literature review

The concept of safety climate was originally developed by Zohar (1980) from the broader concept of organizational climate. Organizational climate is a set of properties (e.g., leadership, roles, and communication) of the work environment, perceived by the employees, which is assumed to have a strong impact on individual behavior and performance (DeJoy, 2005; Fishbein & Ajzen, 2010). As a specific form of organizational climate, safety climate refers to individuals' shared perceptions of the values, attitudes, beliefs, rules, and procedures that pertain to an organization's safety at a specific moment in time.

In an organization, workers' safety behavior is often affected by people at different organizational levels (e.g., top management and supervisor level). It is not uncommon that safety policies established by top management are not effectively implemented by supervisors. Studies (Zohar, 2000; Zohar & Luria, 2005) indicated that significant group-level variations of safety climate exist within a single organizational. As a result, Zohar (2008) suggested that safety climate be understood within a multi-level framework in which organization- and group-level safety climate are distinct perceptions with different referent objects. Because of the difference, safety climate must be measured separately at the organization- and group-level. In addition, Christian, Bradley, Wallace, and Burke (2009) differentiated safety climate into group safety climate and individual/psychological safety climate. Individual/psychological safety climate refers to individual perceptions of safety-related policies, practices, and procedures that affect safety behavior and outcomes. When the perceptions are shared among individuals in a work unit or group, a shared group safety climate emerges.

Interests in safety climate from the construction industry can be traced back to the 1990s. Dedobbeleer and Béland (1991) developed a two-factor safety climate measure for the construction industry, which includes management's commitment to safety and workers' involvement in safety. Glendon and Litherland (2001) conducted a study to identify factor structure of safety climate, investigate the relationship between safety climate and safety performance, and compare sub-group differences in safety climate scores. A six-factor safety climate measure was identified, which includes: communication and support, adequacy of procedures, work pressure, personal protective equipment, relationships, and safety rules. The study did not find any relationship between safety climate and safety performance. Results also indicated that differences in "relationships" and "safety rules" were identified between job types (i.e., construction and maintenance). Fang et al. (2006) identified a 15-factor structure of safety climate based on 4,719 completed questionnaires collected in Hong Kong. Similarly, Choudhry et al. (2009) conducted a factor analysis based on 1,120 completed safety climate questionnaires and identified 2 factors: management commitment and employee involvement and inappropriate safety procedures and work practices. Despite the inconsistencies in the factor structure of safety climate, there has been ample evidence suggesting that there is a statistically significant relationship between safety climate and safety outcomes (Choudhry et al., 2009; Fang et al., 2006; Kapp, 2012; Liao, Lei, Xue, & Fang, 2013; Lingard et al., 2012; Mohamed, 2002).

Furthermore, efforts were made to understand the relationship between safety climate factors and safety behavior of construction workers. For example, Guo, Yiu, and González (2016) and Guo, Yiu, González, et al. (2016) developed and validated an integrative model of safety behavior. This model captured the relations among key safety climate factors at macro (i.e., management safety commitment) and micro (i.e., social support and production pressure) organizational level and individual factors (i.e., safety knowledge and safety motivation) affect workers' safety behavior.

Particular efforts were made to identify differences in safety climate across groups. For example, Gillen, Baltz, Gassel, Kirsch, and Vaccaro (2002) found that various worker groups (e.g., blue-collar vs. white-collar, and union vs. non-union) view safety climate in diverse ways. In addition, Dong, Wang, and Goldenhar (2016) examined the difference in safety perceptions between small and large construction companies and found that workers in smaller firms were less likely than those in larger ones to agree the importance of health and safety to management.

In order to avoid the limitations of traditional statistical tools, such as ANOVA and *t*-test, researchers tested measurement equivalence (ME) of safety climate measures across groups. For example, Cigularov, Adams, et al. (2013) and Cigularov, Lancaster, et al. (2013) examined whether the meaning and level of safety climate differ across 10 construction trade groups. Results indicated that workers from different trade groups understand the safety climate measure in the same way and that significant mean differences were found between trades. Similarly, Cigularov, Adams, et al. (2013) and Cigularov, Lancaster, et al. (2013) tested the cross-ethnic validity of a safety climate measure across Hispanic and White Non-Hispanic construction workers. Results suggested that the same pattern of factors and equivalent factor loadings adequately represented the safety climate items across the two groups. More recently, Barbaranelli et al. (2015) used a multi-group confirmatory factor analytic approach to test the Griffin and Neal (2000) model of safety climate across employees from Italy and the United States. Results supported strict invariance across the two groups

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