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Cross-validation of an employee safety climate model in Malaysia

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ABSTRACT

Problem: Whilst substantial research has investigated the nature of safety climate, and its importance as a leading indicator of organisational safety, much of this research has been conducted with Western industrial samples. The current study focuses on the cross-validation of a safety climate model in the non-Western industrial context of Malaysian manufacturing. *Method:* The first-order factorial validity of Cheyne et al.'s (1998) [Cheyne, A., Cox, S., Oliver, A., Tomas, J.M., 1998. Modelling safety climate in the prediction of levels of safety activity. Work and Stress, 12(3), 255-271] model was tested, using confirmatory factor analysis, in a Malaysian sample. *Results:* Results showed that the model fit indices were below accepted levels, indicating that the original Cheyne et al. (1998) safety climate model was not supported. An alternative three-factor model was developed using exploratory factor analysis. *Discussion:* Although these findings are not consistent with previously reported cross-validation studies, we argue that previous studies have focused on validation across Western samples, and that the current study demonstrates the need to take account of cultural factors in the development of safety climate models intended for use in non-Western contexts. *Impact on industry:* The results have important implications for the transferability of existing safety climate models across cultures (for example, in global organisations) and highlight the need for future research to examine cross-cultural issues in relation to safety climate.

Over three decades of research have led to general consensus on the importance of safety climate as a 'leading indicator' of organisational safety (Zohar, 2010) and a significant correlate of employees' safety-related behaviour in the workplace (Christian, Bradley, Wallace, & Burke, 2009; Clarke, 2006). Nevertheless, there has been little agreement on critical theoretical and practical issues, including debate as to whether the underlying structure of safety climate is generic or context-specific (Coyle, Sleeman, & Adams, 1995; Ginsburg et al., 2009). Although there is evidence that safety climate may generalize across employment groups (e.g., Cheyne, Tomas, Cox, & Oliver, 2003), organisations (e.g., Mearns, Whitaker, & Flin, 2001), and industries (e.g., Hahn & Murphy, 2008), there has been limited attention given to generalization across national cultures. Of particular concern is the extent to which safety climate instruments developed in the West transfer successfully to non-Western cultures. The focus of the current study is the cross-validation of a safety climate instrument, developed and validated across Western countries, in the developing Eastern country of Malaysia. The study will contribute to the theoretical debate, as well as providing evidence for the use of safety climate instruments across countries for benchmarking. This should prove particularly valuable for international organisations, which need to perform to consistently high safety standards in all their operations across the globe.

Empirical support for the generic nature of safety climate can be drawn from evidence of common underlying themes across studies (Clarke, 2000; Flin, Mearns, O'Connor, & Bryden, 2000) and successful attempts to develop and validate safety climate instruments (Seo, Torabi, Blair, & Ellis, 2004; Tharaldsen, Olsen, & Rundmo, 2008). Theoretical developments have demonstrated general agreement on the nature of safety climate, which reflects the priority given to safety in relation to competing goals, such as productivity (Zohar, 2010). Consequently, safety climate instruments share broad principles in their design approach, representing issues reflective of safety matters in the context of the study. However, relevant safety issues vary substantially between studies, ranging from global scales representing a single factor to measures with up to sixteen different dimensions (Flin et al., 2000). Glendon and Litherland (2001) argue that inconsistencies across safety climate dimensions are due to the fact that various questionnaires, samples and methodologies were used by different researchers. Previous research has encountered difficulty in finding common first-order factors across studies, even using the same instrument; for instance, both Brown and Holmes (1986), and Dedobbeleer and Beland (1991), failed to replicate the first-order factor structure reported by Zohar (1980) using exploratory factor analysis. Whilst

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this might suggest that the first-order structure of safety climate instruments is context-dependent, reviews have found evidence of commonality across instruments, with themes related to management, safety systems and workplace risk most frequently measured (Clarke, 2000; Flin et al., 2000; Guldenmund, 2000). More recently, several studies have shown that they can successfully replicate previously reported first-order structures, using confirmatory factor analysis (Fullarton & Stokes, 2007; Seo et al., 2004; Tharaldsen et al., 2008). For example, Seo et al. (2004) developed a five-factor model using one half of their sample of US grain workers and replicated the model using the other half of the sample; Tharaldsen et al. (2008) found acceptable levels of fit for a five-factor model for Norwegian offshore oil and gas workers sampled at one time point and again two years later.

Although there is some evidence that safety climate instruments have been cross-validated successfully, much of this evidence is drawn from comparisons across culturally similar countries. Research conducted in the healthcare sector has examined the extent to which a climate for patient safety demonstrates stability across different national healthcare systems. The hospital patient safety survey, which was developed in the US, has been tested in a number of countries, including Norway (Olsen, 2010), the Netherlands (Smits, Christiaans-Dingelhoff, Wagner, Wal, & Groenewegen, 2008), the UK (Waterson, Griffiths, Stride, Murphy, & Hignett, 2010) and Switzerland (Pfeiffer & Manser, 2010). Findings have been mixed, but most studies were unable to replicate the original structure, without some amendment to the number of factors. It may be the case that differences between culturally similar countries can be explained by differences in health and safety regulation, education, training, and employment practices (Spangenbergen et al., 2003). It should also be noted that where studies have previously cross-validated safety climate instruments, samples have been drawn from Western countries (e.g., Cheyne et al., 1998; Janssens, Brett, & Smith, 1995; Tomás, Cheyne, & Oliver, 2011). Therefore, we have limited understanding of the transferability of existing safety climate theory, and associated instruments, to non-Western cultures.

The aim of the current study was to cross-validate the Cheyne et al. (1998) safety climate model in a Malaysian sample. The original study was able to demonstrate that the five-factor model was stable across four different manufacturing plants based in the UK and France. The five factors were named as: safety management; personal involvement; communication; individual responsibility; and, safety standards and goals. In another study conducted by the same researchers in different manufacturing companies, Cheyne, Oliver, Tomas, and Cox (2002) also reported that the model was extremely parsimonious and model fit was considered satisfactory. Using Cheyne et al.'s (1998) safety climate model, Pousette, Larsson, and Torner (2008) reported that it had been successfully replicated in the Swedish construction industry, which is quite different in terms of industrial context and setting. Pousette et al. (2008) reported that the safety climate model generalised over different social contexts and argued that the safety climate scales were suitable for use in longitudinal studies. The CFA results showed good model fit [χ^2 (491) = 2113, p < .001; NFI = .98; CFI = .98; RMSEA = .064], with the five factors renamed as: management safety priority; safety management; safety communication; workgroup safety involvement; and, safety motivation. The five-factor model was also supported in a sample of Spanish employees, drawn across a variety of industries including manufacturing, healthcare and the service sector (Tomás et al., 2011). The study found that the five-factor model was superior to alternative models and reported good model fit [χ^2 (314) = 1372, p < .001; GFI = .88; CFI = .92; RMSEA = .052].

Safety climate research to date has been conducted predominantly in developed Western countries such as UK, US, Australia, Canada and Europe (including Scandinavian countries). Very limited work on safety management has been conducted in Eastern countries, such as Malaysia. Malaysia is a developing country, moving on from a standard setting (2004-2010) towards an enforcement level (2011-2015) in terms of health and safety (Malaysian Department of Occupational Safety and Health, DOSH, 2009). Manufacturing has been reported as the largest and most consistent industrial sector for workplace accidents in Malaysia, accounting for more than one third of occupational accidents since 2001 (DOSH, 2010). The aim of the current study is to test the factorial validity of Cheyne et al. (1998) safety climate factor structure, through a cross-validation study in a Malaysian manufacturing sample. Given its successful record of validation across countries, it was hypothesized that the original five-factor model would be validated using the current sample.

1. Methodology

1.1. Instrument

For the purpose of this study, the safety climate survey developed by Cheyne et al. (1998) was used. This comprised 30 items representing five first-order factors: safety management (14 items, for example "my line manager listens to my concerns about safety and health"); personal involvement (5 items, for example "everyone plays an active role in safety matters"); communication (5 items, for example "there are good communications here about safety issues which affect me"); individual responsibility (3 items, for example "I look out for others' safety"); and, safety standards and goals (3 items, for example "minor/trivial accidents are tolerated as part of the job"). As the participants' first language was Malay, the questionnaire was translated into the Malay language, using the back translation technique (Brislin, 1970). Firstly, two Malay language experts were assigned to translate the questionnaire from the English version to Malay. Then, the Malay version was translated to English by two language experts and finally a panel evaluated the translated measurements and validated the most appropriate version to be used for the present study.

The 30 items of the translated safety climate questionnaire were pilot tested (along with other questions related to the participants' background) with a sample of 50 employees from one of the departments of the manufacturing plant under study. The pilot study participants were informed that no individual response would be identifiable and all data would be treated as confidential and anonymous. A total of 50 employees returned the pilot questionnaire (100% response rate). Cronbach's α was calculated for each of the scales to test internal consistency. Each of the subscales had satisfactory reliability (safety management, α = .84; personal involvement, α = .71; communication, α = .85; safety standards and goals, α = .79), with the exception of the individual responsibility subscale (α = .47). This result is similar to the study conducted by Cheyne et al. (1998), which reported a low Cronbach alpha for the individual responsibility scale. The research conducted by Pousette et al. (2008) also suggested the individual responsibility scale was better presented as an individual level variable related to safety motivation, rather than an element of safety climate. Based on the pilot study results and previous research findings, the individual responsibility subscale was removed from the questionnaire.

The final Safety Climate Questionnaire consisted of 27 items and was represented by four dimensions (Safety Management, 14 items; Communication, 5 items; Safety Standards and Goals, 3 items; Personal Involvement, 5 items). A five-point Likert scale was used to respond to those items (1 = Strongly Disagree, 5 = Strongly Agree). Descriptive data for the questionnaire are provided in Table 1.

1.2. Participants

Participants for this study were production workers from a Malaysian-based electric and electronic manufacturing plant. Permission for the study was gained from the senior management of the company, via the human resource manager, who organised the administration of the survey. A total of 400 production workers, representing two departments in the organisation were surveyed, and 330 questionnaires were returned (a response rate of 83%). All respondents who completed the questionnaire were given a token of appreciation in the form of a