A Macroergonomics Approach to Examining Safety Climate in the Trucking Industry

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1. Introduction

Meta-analyses have shown that safety climate is a valid predictor of accidents and injuries (Beus, Payne, Bergman, & Arthur, 2010; Christian, Bradley, Wallace, & Burke, 2009). The next logical step is to focus on how to change safety climate through systematically designed organizational interventions. Murphy, Robertson, and Carayon (2014) have argued for the employment of a work systems approach to examine organizations in detail to determine where deficiencies may lie, especially with respect to technical or hazard-related issues. Through the framework of sociotechnical systems theory, macroergonomics seeks to design fully "harmonized" work systems to improve organizational performance and effectiveness (Kleiner, 2004). As first proposed by Murphy et al. (2014), a macroergonomics framework and safety climate theory can be integrated to guide the analysis and design of work systems to decrease negative safety outcomes and improve organizational performance.

This project was guided by one specific aim: Design a methodology that extends the construct of safety climate beyond safety climate scores themselves in order to explore the organizational context relating to those scores using a systems approach.

2. Methods

This study is an extension of an investigation of safety climate in lone workers in eight trucking companies (Huang, et al., 2013). For the current study, two of the eight companies were recruited for a systems analysis. Kleiner’s (2004, 2006) Macroergonomic Analysis and Design (MEAD) framework can be used to analyze and design a safe and productive work system. We used this framework to determine what specific sociotechnical factors could help to elucidate the underlying mechanisms of safety climate in two trucking companies.

2.1 Step 1: Initial Scanning of the Organization

Identity statements (e.g., mission, vision, principles), collected prior to initial site visits, were reviewed to better understand the context of the trucking organizations as well as to focus on pertinent information during the interviews.

Step 2: Identify Key Item(s) in Trucking Safety Climate Scale

Item response theory (IRT) analysis was used on the full set of safety climate data from Huang et al. (2013). Items that correctly discriminated between low safety climate companies and high safety climate companies while also being items that workers judged to be both the biggest problem areas and best safety attributes in their specific organizations were identified. Those items were used throughout the interviews to tease apart issues being discussed by key informants.

2.2 Step 3: Conduct Key Informant Interviews

Key informants (2 senior executives, 4 safety personnel, 4 direct supervisors, 10 drivers, 4 driver trainers, and 4 owner-operators) were recruited from two trucking companies. One-hour interviews occurred during normal business hours. Two researchers and one research assistant were present during each interview to ask questions and take notes. All interviews were audio-recorded and later transcribed for analysis. The interviews involved the use of the following tools: (a) the critical incident technique, which allows participants to report from memory extreme incidents that are more accurately specified than average incidents and (b)
the contextual inquiry technique, an iterative process in which researchers interact with key informants to create a dialog where current work practices, system practices, and associated experiences are discussed in order to produce a functional role diagram illustrating key informants’ job functions in relation to the system.

2.3 Step 4: Analysis of Data Using Mapping

Affinity mapping is an inductive procedure that was used to qualitatively analyze the interview data. There were no predetermined categories; categories were created during the data analysis process and themes were identified as they emerged to create a description of the system to be used in conjunction with the functional role diagrams.

2.4 Step 5: Validation of System Maps

Themes and functional role diagrams were validated through an iterative process in which researchers presented the themes and diagrams to key informants. Key informants (1 senior executive, 3 safety personnel, 6 direct supervisors, 4 drivers, 3 driver trainers, and 2 maintenance personnel) from the same two companies either agreed or suggested changes. The discussions occurred until there was consensus, and consensus signaled the endpoint of this study.

3. Results

There were 19 themes that emerged from the process, ranging from the need for active listening and getting meaningful feedback to the impact of onboard technology that can be helpful, lacking, or even hazardous. Functional role diagrams were created depicting the roles of each key personnel, who they worked with to get their job done, and what type of communication mechanisms were present and where the communication took place.

4. Discussion

Little research has examined safety climate in relation to other work system components and how they both influence safety outcomes. While safety climate is a general measure of the overall importance of safety in a workplace, it does not allow for a fine-grained analysis of where the deficits lie. Macroergonomics allows for that fine-grained analysis through an examination of the work system as a whole. The present study broadens the scope of possible intervention areas by using a systems approach that takes not only social areas like communication into consideration, but also technology design and external factors, such as regulatory and economic pressures.

References


