Safety Science 76 (2015) 121–132

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/ssci

Does a people-oriented safety culture strengthen miners' rule-following behavior? The role of mine supplies-miners' needs congruence

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ARTICLE INFO

Article history:
Received 29 March 2014
Received in revised form 7 December 2014
Accepted 22 February 2015
Available online 19 March 2015

Keywords:
Coal mine ESC–MN congruence
Coal mine LSC–MN congruence
Safety culture
Safety rule-following behavior

ABSTRACT

The construction of a people-oriented safety culture is the key method to strengthen miners' rule-following behavior (RFB) and decrease the probability of accidents in mines. Beginning with two forms of the inner composition of safety culture, this study dissects the theoretical connotations of espoused and lived safety cultures. Based on the distinction between the types of safety regulatory frameworks, such as intrinsic and extrinsic RFB, we studied previous theories (social exchange theory and person-organization fit theory) and analyzed the role of two forms of safety culture and supplies-needs congruence on miners' RFB. Using quadratic polynomial regression with response surface analysis, we drew upon a survey of 276 miners in large state-owned coal mines in China to analyze the influence of coal mine espoused safety culture–miners' needs (ESC–MN) congruence on miners' RFB and discussed the mediating role of lived safety culture–miners' needs (LSC–MN) congruence. Our findings demonstrate that coal mine ESC–MN congruence has strong non-linear effects on both intrinsic and extrinsic RFB, and that the mediating role of LSC–MN congruence is strong toward intrinsic, but not toward extrinsic, RFB. Additionally, our study brings up the definition of fit congruence in coal mine ESC–MN and calculates its range of applicability to the actual needs of miners. Based on our research results, we present suggestions for further research on coal mine safety management.

1. Introduction

A safety regulatory framework plays an important role in avoiding accidents in coal mines and acts as a guide, a standard, and an aid to the control of miners' safety behavior. However, of all the direct factors that lead to severe coal mine accidents, the human factor accounts for 94.09% of them (Chen et al., 2012). Moreover, according to other studies, 55.37% of accidents are directly due to violations of regulations (Chen et al., 2007), which highlights the importance in coal mine safety management of guiding and stressing the importance of miners' safety rule-following behavior (RFB). To meet the long-term goals related to accident prevention, managers of coal mines need to ensure that miners follow the regulatory framework. This requires a focus on person-oriented safety culture construction, supporting the safety culture, and meeting miners' mental, economic, and fitness needs. However, the construction of a safety culture cannot guarantee that it will be fully implemented. To make the safety regulatory framework operate in practice, guiding and inspiring employees' RFB is necessary. Because of the considerable influence of large state-owned coal minesand their importance to the development of the national mining industry, we focused our study on these enterprises.

1.1. Safety culture theory

The term 'safety culture' emerged in scientific debates on safety largely after the Chernobyl disaster in 1986. The Nuclear Safety Advisory Group in the International Atomic Energy Agency considered that an unhealthy safety culture in nuclear power stations was to blame for the disaster. Currently, safety culture is considered to be a concept of great importance (Cox and Cox, 1991; Geller, 1994; Guldenmund, 2000; Zohar, 2010; Wang and Liu, 2012; Edwards et al., 2013). Recently, there have been a number of studies in which the independent and dependent variables were safety cultures. In addition, a growing number of researches discuss about concept connotations and models of safety culture (Guldenmund, 2000; Parker et al., 2006; Nielsen, 2014). The focus

Abbreviations: ESC, espoused safety culture; ESC–MN, espoused safety culture–miners' needs; ERFB, extrinsic rule-following behavior; IRFB, intrinsic rule-following behavior; LSC, lived safety culture; LSC–MN, lived safety culture–miners' needs; MN, miners' needs; RFB, rule-following behavior.

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http://dx.doi.org/10.1016/j.ssci.2015.02.018
0925-7535/

on these topics has been growing (Guldenmund, 2000; Choudhry et al., 2007; Edwards et al., 2013) and has involved railways, construction, aviation (Atak and Kingma, 2011; Wang and Liu, 2012; Biggs et al., 2013; Fu and Chan, 2014), and other industries. However, a widely accepted concept of safety culture and its structural model have yet to appear (Guldenmund, 2000; Hopkins, 2006). Edwards et al. (2013) suggested that "*Organizational culture can be described using traditional views of culture drawn from the anthropology and cultural psychology literature. The safety culture literature rarely ventures beyond organizational culture into discussions of these more traditional concepts of culture.*" In other words, one reason that agreements have yet to be reached on the concept of safety culture and its structural model is that it has remained debatable whether or not to analyze safety culture within or beyond the organizational culture framework.

Researchers have proposed a total safety culture model (Geller, 1996), a reciprocal safety culture model (Cooper, 2000), a safety culture interaction model (Fang and Wu, 2013), and other models that emphasize the reciprocity or interaction among people, their behavior, and the environment in the safety culture system. These models clarify the relationships in the internal structure of a safety culture but they ignore the relationship between theory and practice. In the traditional studies of the structure of organizational culture, Hawkins (2007) argued that the establishment of an organizational culture cannot promise its implementation, and that two forms (espoused culture and lived culture) may exist. The espoused culture embodies the culture that is conveyed in the physical characterization of the organization and its cultural activities, such as the organizational system or oral signs. On the other hand, the lived culture is the pattern of actual behavior in an organization, such as organization members' words and deeds, the methods used to process errors, and the ways in which decision-making, coordination, and communication are handled. Similarly, according to the Action Theory, Argyris and Schon (1978) proposed two types of human behavior: espoused theory and theory in use. Espoused theory is what people claim to follow whereas theory in use is inferred from real human action.

This study affirms the perspective of Edwards et al. (2013) that we should look outside of the organizational culture framework to examine the concept and structure of the safety culture, make use of the traditions of the cultural connotation, and directly use the root cause analysis method when analyzing safety culture. Safety culture is not just a subset of organizational culture; it is an independent cultural form that has different cultural characteristics. Also, according to Hawkins (2007) and Argyris and Schon (1978) there may be a safety culture sub-system consisting of an espoused safety culture (ESC) and a lived safety culture (LSC). These sub-systems suggest that the establishment of a safety culture does not equal its execution, explaining the theoretical reason for the differences that exist in safety culture theory and practical application.

1.2. Coal mine ESC, LSC, and miners' needs

In recent years, great importance has been attached in China to people-oriented management in mines, and a series of relevant rules and regulations have been issued. An example of these is the 'seven stipulations on coal mines and barmasters to protect the safety of miners', issued in January 2013. This proclamation highlights the people-oriented culture of 'relying on miners, all for the miners' best'. People-oriented management is also taken very seriously at the enterprise level, where people-oriented culture construction is the key aspect. The implementation of a safety culture in coal mining enterprises has experienced many problems, such as those at the Babao coal mine in Jilin Province. The management at this mine had never failed to advocate people-oriented management and the mine won the 'Safety Culture Enterprise' prize, and yet it suffered from five mine explosions in March 2013, resulting in 36 people killed and 12 injured. According to the later enquiry, three explosions without casualties had occurred right before the first major accident so the Jilin provincial government banned all personnel from going down into the mine. However, the mine leaders ignored this instruction and forced miners to go down the mine for economic reasons, which resulted in the serious casualties that occurred in the subsequent explosions. Thus, it is reasonable to conclude that the espoused people-oriented management of this mine was not effectively implemented. Two kinds of culture clearly existed at the mine: LSC and ESC.

The concept put forward by Edwards (1996) has a similar theme to the people oriented safety culture. These concepts were summarized as 'organization supplies-personal needs' in 'person-environment' fit theory. This theory asserts that some resources that can be catered for in the work environment, such as organizational support, can be provided by the employer to meet the needs of the employees.

Others have stated that organizational culture is a key environmental variable and that the existence of interactions, such as reciprocal interactions between organizations and individuals, affect employees' safety behavior (Bandura, 1986; Cooper, 2000; Fang and Wu, 2013). Moreover, the degree of congruence between the organizational culture and individuals' values will affect their level of compliance (Typer and Blader, 2005) with the organization's systems. Thus, we may infer that the organizational culture supplied by the employer needs to match with the people-oriented ESC and LSC, as this match with the miners' needs (MN) may also affect the miners' RFB. What is more, due to the difference in two types of cultural pattern connotation, the congruence level with miners' desires may vary in their influence on following behavior. However, most existing studies just explore the impact of coal mine safety culture on safety behavior (Griffin and Neal, 2000; Glendon and Litherland, 2001; Wu et al., 2010). Research exploring the two types of safety culture and finding their effects on RFB from the viewpoint of organization supplies-personal needs congruence is rare.

People-oriented safety culture embodies the cultural congruence of organization supplies-personal needs between mines and miners, and what differs from the individual-organization cultural fit of O'Reilly et al. (1991) is that the former emphasizes the cultural complementarity between the mine owner and the miner while the latter attaches great importance to the cultural consistency between the individual and the organization. When ESC or LSC is examined in the context of mines, a difference exists compared to traditional organizational culture. Schein (1990) considered the presence of organizational culture as one way to achieve the strategic objectives of the organization, but the establishment of a mine ESC aims not only at realizing coal mine safety and economic goals, but also at catering to national or industrial microcosmic and macroscopic security system requirements, maintaining a social image, and other purposes. This is mainly reflected in files, systems, and activities in the form of claims. Because the mine manager is an agent of the mine or a competent department and the lower-level manager acts as a connection point between executive and lower-level staff, the primary-level administrator will play a key role when ESC converts to LSC. Thus, it is reasonable to assume that a lower level administrator's degree of implementation reflects the view of the mine LSC. The LSC from the perspective of coal supply is actually the cultural characteristics reflected in mine managers' statements and actions at work, the mode in which they handle conflicts and crises, as well as their decision-making, coordination, communication, and other actions. Thus, it is clear that the connotation that the ESC conveys is 'what the organization should look like', while the LSC expresses 'what it