



Original Article

Knowledge Management and Safety Compliance in a High-Risk Distributed Organizational System



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ABSTRACT

Background: In a safety perspective, efficient knowledge management is important for learning purposes and thus to prevent errors from occurring repeatedly. The relationship between knowledge exchange among employees and safety behavior may be of particular importance in distributed organizational systems where similar high-risk activities take place at several locations. This study develops and tests hypotheses concerning the relationship between knowledge exchange systems usage, knowledge exchange in the organizational system, and safety compliance.

Methods: The operational context of the study is petroleum drilling and well operations involving distributed high-risk activities. The hypotheses are tested by use of survey data collected from a large petroleum operator company and eight of its main contractors.

Results: The results show that safety compliance is influenced by use of knowledge exchange systems and degree of knowledge exchange in the organizational system, both within and between units. System usage is the most important predictor, and safety compliance seems to be more strongly related to knowledge exchange within units than knowledge exchange between units.

Conclusion: Overall, the study shows that knowledge management is central for safety behavior.

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1. Introduction

It is widely recognized that human behavior is important for the safety level within complex work systems [1–6]. In this respect, Neal et al [7] emphasize the role of safety compliance, which involves employees “adhering to safety procedures and carrying out work in a safe manner” (p. 101). The significance of safety compliance has been confirmed by numerous accident and incident investigations in several high-risk industries identifying a lack of compliance with regulations, rules, and governing procedures as a central contributing factor [8]. Much research has for this reason been occupied with investigating the impact of individual, organizational, and environmental factors on the level of safety compliance in diverse work contexts and industries (e.g., [9–18]).

Collection of experiences about incidents and non-conformances, and distribution of this knowledge throughout the organizational system are important in order to exchange lessons learned and prevent errors from occurring repeatedly [19,20]—that is, keeping the employees up-to-date on potential challenging

situations and facilitating the application of previous experiences in order to improve work processes are central for safety and health at work. Such knowledge exchange can take place through a number of different mechanisms, and use of information and communication technologies represents, in this regard, one means for collection of experiences and dissemination of knowledge. Use of knowledge exchange systems or electronic knowledge repositories to improve the processes of transfer and reuse of existing knowledge has become commonplace in many organizations [21,22]. Research has shown that such systems have the potential to facilitate knowledge exchange by making it easy and relevant for employees to store, transfer, and use knowledge [21,23–26].

Knowledge management by use of knowledge exchange systems may therefore be essential in a safety perspective, particularly in the context of high-risk distributed organizational systems where similar work operations take place at different locations, and where exchange of experiences may be difficult to achieve by use of relational/personal channels. In spite of this, the role of knowledge exchange systems in distributed organizational systems has received

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little attention in safety research. This paper aims at making a contribution to close this research gap, and investigates the relationships between safety compliance, knowledge exchange in the organizational system, and use of knowledge exchange systems.

1.1. Theory and hypotheses

1.1.1. Knowledge exchange and safety compliance

Safety compliance is considered to be a central component of safety behavior at work [27], and refers to the core activities that employees should carry out to maintain workplace safety, including adherence to standard work procedures and regulations [7,28]. Violations of such regulations and procedures describing safe or approved methods of performing a particular task or job may occur intentionally or unintentionally [29]. Violations of the former type are deliberate actions that take place when employees know of the rules/regulations but choose not to adhere to them, whereas violations of the latter type occur because of a lack of knowledge or awareness of the rules/regulations [30].

This understanding of safety compliance is based on the broader concept of task performance proposed by Borman and Motowidlo [31] and Campbell et al [32], which represents one of two components (the other is contextual performance) describing the work performance of individuals [33]. In addition to the performance components, this conceptualization further distinguishes between performance determinants and performance antecedents [34]. Regarding performance determinants, Campbell et al [32] argue that there are three significant factors at play: knowledge, skill, and motivation. This understanding thus implies that safety behavior (and thus safety compliance) is determined by individuals' motivation to perform their work in a safe manner in addition to their knowledge and skills necessary for doing so. The performance antecedents are distal causes of performance variability, and they influence task performance through the performance determinants.

Intentional and unintentional violations may have different determinants. According to Lawton and Parker [35], deliberate noncompliance with procedures and regulations is associated with attitudes of the employees. Numerous studies have, for example, demonstrated that individuals differ in their willingness to take risks (e.g., [36,37]), and Brown et al [11] found that such attitudes were negatively associated with safe behavior. Unintentional violations, by contrast, can be attributed to deficiencies in skill and information processing [29,35]. With reference to the determinants of performance, this means that knowledge and skills are more strongly associated with unintentional violations, whereas motivation is a relevant factor for intentional violations.

As knowledge and skills represent important determinants of safety behavior, exchange of knowledge among employees is relevant. Knowledge exchange includes both knowledge sharing (i.e., employees providing knowledge to others), and knowledge seeking and application (i.e., employees use knowledge of others in task accomplishment) [38]. For this to occur, knowledge possessed by individuals has to be explicated, meaning that it has to be converted into a form that can be understood, absorbed, and applied by other individuals [39]. Knowledge exchange is further understood as the contribution or receipt of task information, work methods, know-how and advice, or feedback on products and procedures [40,41], and can take place by use of different channels, both formal and informal [39]. In general, research has shown that exchange of such knowledge within and across units increases the abilities of employees to benefit from the experiences accumulated by others and thereby enhance their own knowledge and skills [42]. Knowledge exchange may thus improve safety compliance by reduction of unintentional violations. Furthermore, in addition to enhancing the knowledge and skills of employees, gaining knowledge of the

experiences of colleagues, such as challenges and complications that have occurred during operations, may increase the emphasis on safe work conduct. According to Catino and Patriotta [43], cognitive appraisal of risky situations trigger emotions that promote internalization of lessons learned when rationalized in retrospect. On this basis, it can be argued that knowledge of previous incidents and challenges may reduce the willingness to take risks, and thus increase compliance with procedures by reducing intentional violations. In sum, knowledge exchange may influence all performance determinants (knowledge, skills, and motivation), and lead to higher safety compliance by reducing both intentional and unintentional violations. The following hypotheses are therefore stated:

H1a: Knowledge exchange within units is positively related to safety compliance.

H1b: Knowledge exchange between units is positively related to safety compliance.

1.1.2. Knowledge exchange systems

Knowledge exchange systems are typically structured databases or electronic knowledge repositories that support the digital capture, storage, retrieval, and distribution of codified knowledge for later reuse [22,44–46]. In order for such systems to be successful, employees have to provide input to the systems and use available content [47–50]. System usage thus involves the engagement of employees in discussions of best practices, providing input on work procedures, governing documentation, and how to improve work processes in general. As research has shown that perception of safety priorities and engagement in organizations positively affects safety motivation and attitudes [51,52], this engagement may lead to an enhanced focus/emphasis on safety behavior. That is, in addition to the knowledge that employees gain when using knowledge exchange systems (which is hypothesized to increase safety compliance), providing input to knowledge exchange systems may have an additional effect on the motivational determinant of work performance, and thus reduce intentional violations. It is therefore hypothesized that:

H2: Use of knowledge exchange systems is positively related to safety compliance over and above the effects of knowledge exchange within (H1a) and between (H1b) units.

As the purpose of knowledge exchange systems is to support the exchange of knowledge between employees [21,22], system usage (i.e., providing input to electronic repositories/databases and application of available content) is also expected to enhance knowledge exchange both within and between units.

H3a: Use of knowledge exchange systems is positively related to knowledge exchange within units.

H3b: Use of knowledge exchange systems is positively related to knowledge exchange between units.

Thus, knowledge exchange systems usage is hypothesized to influence safety compliance both directly and through increased knowledge exchange between colleagues. The hypotheses are summarized in Fig. 1.

2. Materials and Methods

2.1. Sample and data collection

Collecting data from employees working in a distributed organizational setting, where knowledge exchange within and between units is relevant and (potentially) takes place on a regular basis,

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