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Empowering team leadership and safety performance in nuclear power plants: A multilevel approach

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ABSTRACT

Despite the large body of work on team leadership, hardly any literature has dealt with team leadership in safety performance settings. The goal of the present study is to analyze how team leader behaviors influence team members' safety performance in nuclear power plants. For this purpose, an empowering leadership approach was assessed. We consider a multilevel model in which safety performance is divided into three types of behaviors. The sample was composed of 479 workers in 54 groups from two Spanish nuclear power plants. The results suggested that leaders' empowering behaviors generated higher safety compliance behaviors and higher safety participation behaviors by team members, whereas risky behaviors were reduced. Empirical support was found for hierarchical linear modeling linking leadership and safety performance behaviors. Practical implications, study limitations and directions for future research are discussed.

1. Introduction

The role of leadership is of prime importance for the safety of nuclear power plants (NPPs). In general, leadership is viewed as a shift lever for safety culture, and as an important antecedent of achieving high levels of safety (e.g., Fahlbruch, 2005; IAEA, 2002, 2007, 2008). Although safety leadership is promoted through seminars, simulator trainings or safety culture reviews in the nuclear industry, only a few studies have empirically analyzed and specified the impact of leadership on safety performance (e.g., Martínez-Córcoles et al., 2011; Yule et al., 2007). The question of which leadership style might best fit within the highly regulated work context of nuclear power plants still remains unanswered. Whereas leadership theories are primarily concerned with enhancing the effectiveness and efficiency of employees' work performance, it is questionable whether these promoted leadership styles will obtain the same positive results within a work context where the trade-off between efficient and safe performance is sometimes crucial. The present study aims to examine the differential impact of safety leadership on safety performance in that context. Using a multi-level approach, we tested the effects of an empowering team leadership style (ELQ, Arnold et al., 2000) on safety performance. As a result, we introduce three dimensions for the safety performance construct, namely, safety compliance, safety participation and risky behavior. In the next two sections, we introduce research on safety leadership and the leadership model utilized in our study.

1.1. Safety leadership

Empirical findings in safety research have shown that leadership constitutes the strongest factor affecting organizational safety performance. Many of these studies focus on well-known leadership approaches, namely leader-member exchange (LMX) (Dansereau et al., 1975; Graen and Cashman, 1975) and transformational leadership (Bass, 1985, 1990), and they have been applied to several industrial sectors, such as manufacturing, metal processing, construction or food service (e.g., Barling et al., 2002; Clarke and Ward, 2006; Hofmann and Morgeson, 1999; Michael et al., 2006; Mullen and Kelloway, 2009; Simard and Marchand, 1994; Zohar, 2000, 2002). For instance, Hofmann et al. (2003), using a multilevel approach, demonstrated with transportation members of the US Army that high-quality leader–member exchange relationships expanded safety citizenship role definitions when there was a positive safety climate, and that there was no such expansion in a less positive safety climate. Both leader–member exchange and safety citizenship role definitions were positively related to safety citizenship behavior. Research on transformational full-range leadership

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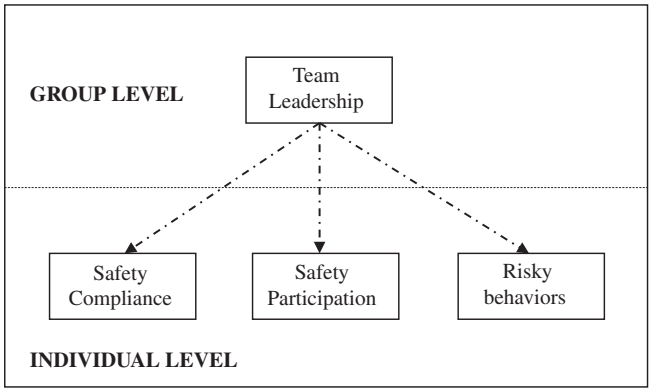

Fig. 1. Hypothesized multilevel model.

models (Bass, 1990; Bass and Avolio, 1997) reveals that group-level leadership [transformational and constructive (contingent-reward) leadership] predicted injury rates in manufacturing jobs through the mediation of group-level safety climate (Zohar, 2000).

In nuclear power plants, research about leadership and its relationship with safety performance is very scarce. For example, Kivimaki et al. (1995) found that participative management (providing communication and feedback to subordinates) was positively associated with safety performance. According to Flin and Yule (2004), stimulating, individually considerate, and rewarding styles were found to be influential in leaders' impact on workers safety behaviors. Katsva and Condrey (2005) suggested that the most effective leadership style in nuclear power plants (at all leadership levels) would be characterized by flexibility, the development and implementation of new ideas, and the encouragement of new initiatives. Martínez-Córcoles et al. (2011) conducted a study in a nuclear power plant that assessed the impact of an empowering leadership style[1] (EL) on the perceived safety behaviors of employees. Focusing on individual leadership, they found that EL enhances perceived safety behaviors by means of safety climate. Moreover, the authors show that empowering leaders influence employees' perceived safety behaviors positively in both strong and weak safety cultures. Thus, one can tentatively conclude that leadership styles that encourage and empower workers should have a positive effect on safety in NPPs.

The present study aims to expand the findings of Martínez-Córcoles et al. (2011) in three distinct ways. Firstly, a multi-level approach is used to assess the impact of EL at the group-level; i.e. the group influence of team leadership is assessed. This approach agrees with recent team and leadership literature calling for the use of multilevel methodology in team and organizational settings (Burke et al., 2006). Secondly, safety performance is differentiated into three different types of safety performance behaviors (see Fig. 1) that are relevant for work performance in NPPs. Thirdly, we test the direct effects of leadership on safety performance. In addition to their climate mediated effects (see Martínez-Córcoles et al., 2011), supportive leadership styles are also likely to have direct (i.e., unmediated) effects on safety records, due to their characteristics (i.e., open and egalitarian communication within and across group boundaries) (Zohar, 2003). Next, we will first introduce the empowering leadership model, and then state our predictions about the impact of EL on safety compliance, safety participation and risky behavior.

[1] According to previous definitions offered by Carson et al. (2007, p. 1218), Srivastava et al. (2006, p. 1240) and Vecchio et al. (2010, p. 531), we define an empowering leadership style as leaders' behaviors that share power with subordinates with the aim of creating self-directedness in them. Following this definition, we refer to empowering team leadership style as team leaders' behaviors that share power with the team, with the aim of creating a self-managed team.

1.2. Empowering leadership

The empowering leadership model by Arnold et al. (2000) claims that the main function of a leader is to increase a team's potential for self-management. The empowering leadership model distinguishes five dimensions corresponding to different behaviors that empowering leaders must show. The first one is "leading by example", which refers to a set of behaviors that demonstrate the leader's commitment to his or her own work as well as to the work of his/her members. With regard to safety, one can assume that leaders who practice what they preach will obtain good safety results, since a sense of coherence between what is said and what is done is created. The second dimension is "participative decision making", which refers to the leader's use of members' inputs in decision-making, displaying behaviors such as encouraging members to express their ideas and opinions. Leaders who encourage their employees to participate in decision-making about safety (e.g., with regard to potential safety improvements) should instill a sense of group belonging as well as a greater commitment to safety. Tjosvold (1990) found that members of a flight crew performed more effectively in dangerous situations because team members were motivated by their leader to contribute to team functioning with their ideas. The third dimension is "coaching", the ability of leaders to encourage their team members to solve problems in a self-managed way, thereby providing members with opportunities to share and increase their knowledge. Yule et al. (2007) found that as team knowledge increases, the propensity to engage in risk-taking behaviors decreases. The fourth dimension is "informing", which refers to the dissemination of information by leaders, such as the organization's mission, philosophy or other important information. One can assume that good safety results will be achieved when information is transmitted by leaders on a regular basis, e.g., by means of regular group meetings where information between team members and leaders is shared. Moreover, organizations with better safety records were characterized by a high frequency of safety discussions between managers and employees (Cohen, 1977; Smith et al., 1978). The last dimension is "showing concern/interacting with employees", which includes behaviors such as taking time to discuss members' concerns or showing concern for their welfare. Leaders who provide their employees with emotional support acknowledge and reward team performance. Consequently, their behavior will achieve high levels of safety commitment among their group members. Katsva and Condrey (2005) highlight individual treatment and feedback as crucial to obtaining good safety outcomes in nuclear power plants.

The EL is a team leadership model that is suitable for application using a multilevel approach, in order to capture the specific influence of team leaders on team performance. In the present paper, a team[2] is considered as a group of people who work in a setting characterized by a team task, with clear boundaries, a specified authority to manage work processes, and some degree of membership stability (Hackman, 2002). To date, there have been relatively few multilevel theories and little empirical research on team leadership (see Avolio and Bass, 1995; Pearce and Conger, 2003; Pearce and Sims, 2002). Although some authors have taken multilevel approaches into consideration in assessing the impact of group constructs like safety climate (group-level safety climate) or leadership (team leadership) on safety results, these studies have predominantly been conducted in domains where personal safety is at stakes (e.g., Hofmann et al., 2003; Neal and Griffin, 2006; Zohar, 2002, 2008). However, there has been too little multilevel research about leadership in NPPs, even though scholars and practitioners recognize that team leaders play a

[2] Note that although other previous research differentiates between a group, a team, and a unit, in the present paper these terms are treated as similar.