



The Safety Culture Enactment Questionnaire (SCEQ): Theoretical model and empirical validation[☆]



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ABSTRACT

This paper presents the Safety Culture Enactment Questionnaire (SCEQ), designed to assess the degree to which safety is an enacted value in the day-to-day running of nuclear power plants (NPPs). The SCEQ is based on a theoretical safety culture model that is manifested in three fundamental components of the functioning and operation of any organization: strategic decisions, human resources practices, and daily activities and behaviors. The extent to which the importance of safety is enacted in each of these three components provides information about the pervasiveness of the safety culture in the NPP. To validate the SCEQ and the model on which it is based, two separate studies were carried out with data collection in 2008 and 2014, respectively. In Study 1, the SCEQ was administered to the employees of two Spanish NPPs ($N = 533$) belonging to the same company. Participants in Study 2 included 598 employees from the same NPPs, who completed the SCEQ and other questionnaires measuring different safety outcomes (safety climate, safety satisfaction, job satisfaction and risky behaviors). Study 1 comprised item formulation and examination of the factorial structure and reliability of the SCEQ. Study 2 tested internal consistency and provided evidence of factorial validity, validity based on relationships with other variables, and discriminant validity between the SCEQ and safety climate. Exploratory Factor Analysis (EFA) carried out in Study 1 revealed a three-factor solution corresponding to the three components of the theoretical model. Reliability analyses showed strong internal consistency for the three scales of the SCEQ, and each of the 21 items on the questionnaire contributed to the homogeneity of its theoretically developed scale. Confirmatory Factor Analysis (CFA) carried out in Study 2 supported the internal structure of the SCEQ; internal consistency of the scales was also supported. Furthermore, the three scales of the SCEQ showed the expected correlation patterns with the measured safety outcomes. Finally, results provided evidence of discriminant validity between the SCEQ and safety climate. We conclude that the SCEQ is a valid, reliable instrument supported by a theoretical framework, and it is useful to measure the enactment of safety culture in NPPs.

1. Introduction

For the past 30 years, scientists and practitioners have continuously worked toward the creation of specific models, methodologies, and tools for the assessment of safety cultures. However, most culture studies have relied too heavily on the organization's espoused values (i.e. what should be done), instead of capturing what is actually enacted. Thus, many tools may be skewed toward the “declared” culture, rather than identifying “culture in action” (Siehl and Martin, 1990). In particular, questionnaires to assess safety culture have not yet been successful in grasping information about safety values

(Guldenmund, 2000) and capturing the enactment of safety. In addition, most safety culture questionnaires created for High Reliability Organizations (HROs) are not supported by solid theoretical frameworks. Due to these shortcomings, even though questionnaires have been the main strategy for safety culture assessment (Antonsen, 2009; Gadd and Collins, 2002; Guldenmund, 2000), none of them has been widely used and accepted to capture and assess the enactment safety culture in the nuclear industry. Thus, there is rather limited guidance about how to assess safety culture (benefiting from the inherent advantages of questionnaires) in order to ensure safety in nuclear power plants.

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This paper presents the SCEQ, a safety culture questionnaire developed to overcome these weaknesses. On the one hand, the SCEQ was designed to assess the degree to which the safety value is enacted in the operations of nuclear facilities and other HRO. On the other hand, the SCEQ is based on a safety culture model that measures its manifestation in three fundamental components of the functioning and operation of any NPP or HRO.

The paper aims to empirically validate the SCEQ and the dimensionality of the model on which it is based. The authors expect that the SCEQ will serve the nuclear industry and other High Reliability Industries in the difficult but unavoidable quest to assess safety culture enactment.

1.1. What is safety culture?

The culture of an organization is composed of a specific set of elements that guide the ultimate behavior of its members toward the attainment of specific organizational goals. These cultural elements are hierarchically ordered from deeper and more intangible layers to more superficial and visible ones (Deal and Kennedy, 1982; Detert et al., 2000; Furnham and Gunter, 1993; Hofstede, 1991; Lundberg, 1990; Rousseau, 1990; Schein, 1985). Schein's (1985) three-layer model provides a widely-accepted framework to understand these cultural elements. At the organizational surface, the layer of artifacts is found. Artifacts are the most tangible and overt manifestations of culture, and they include everything that can be seen, heard and felt in an organization. Typical artifacts include physical environment, language, myths, stories, observable rituals, emotional displays, observable behaviors, and, in general, any kind of visible product of organizational members. At the second layer, one can find the espoused values, norms, philosophies and organizational rules that reflect what this organization would ideally like to be. This level can be expressed in public declarations during meetings or ceremonies, written documents describing the organization's mission and strategy, leaders' messages, etc. The third and deepest layer is composed of basic beliefs and assumptions shared by the members of the organization. These assumptions, often implicit, are deeply rooted in the history of the organization, as they have demonstrated to be useful for organizational survival and development. Therefore, to a greater extent than artifacts and espoused values, these underlying assumptions tell the members of an organization how to act, perceive, think, and feel about events and things if they are to be successful.

In general terms, most scholars refer to safety culture as a focused aspect (Richter and Koch, 2004), sub-element (Kennedy and Kirwan, 1998), sub-facet (Cooper, 2000; Mohamed, 2003) or subset (Clarke, 1999; IAEA, 1998a; Reiman and Rollenhagen, 2014; Sorensen, 2002) of organizational culture that alludes to organizational and/or worker features related to health and safety. In this line, and using Schein's model as a reference framework, an NPP has a high and strong safety culture (see González-Romá and Peiró, 2014) when its cultural elements (i.e. basic assumptions and values held by its workers and visible artifacts) result in safety management and performance behaviors designed to guarantee the safety of workers, the public, and the environment. Therefore, safety culture is present to the extent to which safety is the most important value in an NPP and, this is demonstrated through the enactment of this value in the behaviors its members do. As the International Atomic Energy Agency (IAEA) and the Institute of Nuclear Power Operations (INPO) conclude, in a safety culture, safety is the enduring overriding priority, always emphasized over any competing organizational goal (e.g. production, innovation, etc.) (IAEA, 1991; INPO, 2004), and a clearly recognized value (IAEA, 2006a).

1.2. Espoused vs. enacted values

Values refer to what is desirable (Kohn and Schooler, 1983; Rokeach, 1973; Schwartz, 1994; Williams, 1979). They are enduring

convictions (Rokeach, 1973) and tendencies to prefer certain states of affairs to others (Hofstede, 1980) in trying to achieve our goals (e.g. cooperation vs. competition or flexibility vs. rigidity). In the nuclear industry, safety (vs. risk) can be considered an instrumental value (see Rokeach, 1973 for an explanation of terminal and instrumental values) to achieve organizational goals (i.e. the necessary level of production without putting workers and the society at risk).

However, in some circumstances (e.g. financial rewards for producing more energy in an NPP), the enduring convictions or preferred tendencies of a specific group (e.g. safety) may be questioned. Members do not always behave according to the values that “in theory” are preferred and shared by their organizations. This distinction has been addressed in the literature as espoused theories vs. theories in use (Argyris and Schon, 1974); espoused rules vs. real rules (Shapiro, 1995); or espoused values vs. enacted values (Simons, 2002). Espoused values reflect what the organization articulates as essential, the managerial philosophy, and its aspirations, whereas the real, in use, or enacted values are the decision rules that guide employees' ultimate behavior in real situations and settings.

In the organizational context, the study of espoused vs. enacted values has mainly been addressed from two perspectives: 1) From an employee-leader approach, the concept of “behavioral integrity” is used (Simons, 2002). Behavioral integrity is defined as “the perceived pattern of alignment between an actor's words and deeds” (Simons, 2002, p. 19). It refers therefore to the congruence between the leader's espoused and enacted values, the famous “walk the talk”. 2) From an organizational approach, the concept of “organizational authenticity” is adopted (Cording et al., 2014; Freeman and Auster, 2011; Liedtka, 2008). Organizational authenticity is defined as the consistency between an organization's espoused values and the practices it carries out (Cording et al., 2014). It refers therefore to the alignment between the actions taken by an organization and the values it openly espouses.

From both the employee-leader and organizational approaches, the main interest in studying espoused and enacted values lies on how they determine individual and collective behaviors and organizational outcomes (e.g. organizational productivity) (Cording et al., 2014), corporate growth (Neumann, 2005), confusion and dissatisfaction (Patankar et al., 2012), employee performance (Schuh and Miller, 2006), commitment (Branch and Olson, 2011), and the underreporting of near misses and first aid injuries (Lauver et al., 2011). Thus, if values determine and guide behaviors, measuring the varying degrees to which organizational values are enacted can provide information about the likelihood of future safety performance and employee behaviors in NPPs (e.g. if safety is a central value of an NPP, it can be expected that their workers will do everything possible to avoid risky behaviors).

However, is not clear to what extent espoused values determine employees' behaviors (Wilpert and Schöbel, 2007). It could be argued that measuring espoused values would be useful when espoused and enacted values are aligned. Unfortunately, the values espoused by managers and leaders are not always coherent with the values that guide their priorities and behaviors (Argyris and Schon, 1978; Simons, 2002; Zohar and Hofmann, 2012). Specifically, there is “sufficient evidence from inquiry reports into major hazard incidents and disasters that idealized enactment rarely occurs” (Waring, 2015, p. 261). As Schein (1992) points out, the enacted values, the ones that are supported, prioritized and rewarded in the day-to-day organizational functioning, inform members about the actions expected from them. In summary, it seems that to understand an organization and predict its future performance, it is not enough to merely capture the culture reflected in its espoused values.

1.3. Capturing the enactment of safety culture

The need to take the level of enacted values into account when studying organizations has been widely highlighted (Branch and Olson, 2011; Schein, 1992; Siehl and Martin, 1990; Waring, 2015; Zohar and

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