Assessment of complex sociotechnical systems – Theoretical issues concerning the use of organizational culture and organizational core task concepts

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Abstract

This article studies organizational assessment in complex sociotechnical systems. There is a practical need to monitor, anticipate and manage the safety and effectiveness of these systems. A failure to do so has resulted in various organizational accidents. Many theories of accidents and safety in industrial organizations are either based on a static and rational model of an organization or they are non-contextual. They are thus reactive in their search for errors and analysis of previous accidents and incidents, or they are disconnected from the actual work in the organization by their focus on general safety attitudes and values. A more proactive and predictive approach is needed, that is based on an accurate view on an organization and the demands of the work in question. This article presents and elaborates four statements: (1) the current models of safety management are largely based on either a rational or a non-contextual image of an organization, (2) complex sociotechnical systems are socially constructed and dynamic cultures, (3) in order to be able to assess complex sociotechnical systems an understanding of the organizational core task is required, and (4) effectiveness and safety depend on the cultural conceptions of the organizational core task. Finally, we will discuss the implications of the proposed concepts for safety research and development work in complex sociotechnical systems.
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1. Introduction

Assuring the safety and effectiveness of a complex industrial organization is demanding. Most safety management systems and theories of safety critical organizations emphasize the regular self-assessment and auditing of the activities. Rasmussen (1997, p. 183) notes that in spite of all the efforts to design safer systems, severe, large scale accidents still happen. He questions whether safety research has adequate models of accident causation (see also Pidgeon and O'Leary, 2000; Dekker, 2005). We argue that many theories of accidents and safety in industrial organizations are based on a static and rational model of an organization or they are non-contextual. They are thus reactive in their search for individual human errors and analysis of previous accidents and incidents, or they are disconnected from the actual work in the organization by their focus on general safety attitudes and values. At the same time, organization research has begun to increasingly emphasize the dynamic and interpretative aspects of organizations. Safety management approaches based on this interpretative view of the organization are still rare. We can thus raise the question of whether safety research has adequate models of complex industrial organizations. This article illustrates two concepts that can be used in understanding and assessing complex industrial organizations, namely the concepts of organizational core task and organizational culture. The aim of this article is to study organizational assessment and more specifically, the significance of organizational culture in assessing the safety and effectiveness of modern industrial organizations.

Industrial organizations of modern society are complex and dynamic sociotechnical systems (Rasmussen, 1997; Leveson, 2004; cf. Perrow, 1984). This is due to the following reasons. In addition to multiple goals (efficiency, safety, credibility, and employee wellbeing), multiple interacting parties (different technical disciplines, various tasks, outside contractors) and complex social structures, they encompass uncertainties in the tightly-coupled and complex technology and the environment (market pressures, political decisions, [de]regulation). The work itself is usually highly specialized, mediated via various tools and information systems, and potentially hazardous (to personnel and/or the environment) (Vicente, 1999, pp. 14–17; see also Perrow, 1984; Rasmussen, 1997; Kirwan, 2001; Orton and Weick, 1990).

Complex sociotechnical systems are uniquely dynamic and constantly changing and adapting. The premises of daily activity and strategic control and steering of these organizations are based on partly implicit norms, values and conceptions. The hierarchy as a control mechanism is undermined by an increasingly horizontal distribution of expertise (Barley, 1996, p. 437). Work in these organizations is becoming increasingly difficult to label as blue collar or white collar, or to dichotomise into mental versus manual labour (cf. Barley, 1996; Oedewald and Reiman, 2003). The complexities of the technology and the physical phenomena on which the work focuses (nuclear reaction, chemistry, etc.) require more and more abstract understanding. Furthermore, the tools themselves have become more complex and abstract (e.g. more computer systems and less hands-on-work, cf. Zuboff, 1988). The work requires specialization into some content areas, but at the same