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Safety management theory and the expeditionary organization: A critical theoretical reflection

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ABSTRACT

Management of safety within organizations has become a key topic within safety science. Theorizing on this subject covers a diverse pallet of concepts such as "resilience" and "safety management systems". Recent studies indicate that safety management theory has deficiencies. Our interpretation of these deficiencies is that much confusion originates from the issue that crucial meta-theoretical assumptions are mostly implicit or applied inconsistently. In particular, we argue that these meta-theoretical assumptions are of a systems theoretical nature. Therefore, we provide a framework that will be able to explicate and reflect on systems theoretical assumptions. With this framework, we analyze the ability of two frequently used safety management theories to tackle the problem of managing safety of Dutch military expeditionary organizations. This paper will show that inconsistent and implicit application of systems theoretical assumptions in these safety management theories results in problems to tackle such a practical problem adequately. We conclude with a reflection on the pros and cons of our framework. Also, we suggest particular meta-theoretical aspects that seem to be essential for applying safety management theory to organizations.

1. Introduction

Over the past decades, the application of safety management within organizations has increased steadily. Some examples are the ICAO safety management guidelines in aviation (ICAO, 2012), the SEVESO-III directives for working with hazardous materials (European Union, 2012) and the safety management system for the Dutch Ministry of Defense (VMSdef; Ministry of Defense, 2010). Also, theorizing on what safety management is, or should be, has accumulated. At the one hand, a wide array of fairly broad safety management practices and concepts are studied, ranging from safety culture (e.g., Guldenmund, 2000) to accident investigation (e.g., Roed-Larsen and Stoop, 2012), and from Normal Accidents Theory (Perrow, 1999) to high reliability theory (e.g., Roe and Schulman, 2008; Weick and Sutcliffe, 2007). Safety management systems (SMS) theory, on the other hand, seems to be a somewhat more specifically oriented toward the organization's management and control processes (e.g., Hale et al., 1997).

Recent studies, however, have criticized theorizing on safety management. In their review on occupational health and safety management systems (OHSMS), Robson et al. (2007) stated that: "*There is no consensus on what an OHSMS is and its scope is potentially wide. Some definitions are simply too vague* (...)". Also Reiman and Rollenhagen (2011) point to such conceptual confusion and argue that: "*In practice, different definitions of safety that are used explicitly or implicitly, affect safety management priorities and practices*". Moreover, Hale (2003) argued that safety management theory: "(...) *is governed by fashion and not evidence, and it has a one-sided, rationalistic view of what it is trying to do*".

In our interpretation, a contributing factor to these difficulties in safety management theory is that crucial meta-theoretical assumptions are mostly implicit or not explicated consistently. More in particular, we assert that these meta-theoretical assumptions are of a systems theoretical nature. We argue so because within systems theory, dealing with, or reducing, uncertainty is the central topic of concern (e.g., Von Bertalanffy, 1972). Dealing with uncertainty also seems to be of central concern to safety management. Grote (2007, p. 638) points out that: "*Safety is frequently defined as the smallest possible and/or acceptable risk, while risk is the product of possible damages and the probability of their occurrence. Inherent in these definitions is the concept of uncertainty*.". Managing safety within organizations consequently centers on the problem of how

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organizations can reduce uncertainty in the best possible way (Grote, 2012, p. 1985). Debate between different schools of thought within systems theory, however, has resulted in the development of fundamentally different perspectives on how a system can deal with (environmental) uncertainty in the best possible way (e.g., Blom, 1997; Kramer, 2007; Stacey, 1993). As safety management theory frequently employs systems theoretical concepts such as "control" and "emergence", it may therefore benefit from a reflection on systems theoretical assumptions. Also, such a reflection possibly resolves some of the difficulties that were described above.

The goal of this paper is therefore to show that explicating and reflecting on systems theoretical assumptions is crucial for understanding ways safety management problems are perceived, defined and the way they are tackled. We argue that this becomes particularly relevant when safety management theory is applied to safety problems within organizations. The following steps are followed to achieve the goal of this paper. Firstly, by using Grote's (2012) "minimizing" and "coping" with uncertainty distinction we identify two frequently employed, and contrasting, safety management theories: safety management systems theory and resilience engineering theory. Secondly, based on a categorization of systems theoretical perspectives constructed by Blom (1997), we build a meta-theoretical framework. Thirdly, we introduce an empirical case: managing safety of the Dutch Armed Forces' expeditionary organizations. Fourthly, we will apply the premises of both safety management theories to the case and reflect on solutions by means of our meta-theoretical framework. We conclude with an elaboration on the implications of the reflection for applying safety management theory to organizational settings. Also, we will highlight some advantages and disadvantages of our method.

2. Two frequently used safety management theories

This section will discuss two safety management theories that are frequently applied to improve organizational safety: safety management systems theory and resilience engineering theory. In selecting these theories we employed Grote's distinction between "minimizing uncertainty" and "coping with uncertainty" paradigms in safety management (e.g., Grote, 2012). Although Grote does not define what she conceptualizes as a "paradigm" we will employ her distinction because it is regarded as a practically useful tool to categorize contrasting avenues of theorizing in safety management. To Grote, the minimizing uncertainty approach aims to achieve a high level of predictability, standardization and specialization and is founded on Taylor's scientific management and bureaucratic organizational theory (2012, p. 1985). In contrast to the minimizing approach, the coping with uncertainty approach stresses: "*the need for flexible adaptation* (...) *by providing them with options for action rather than fixed plans and standards*" (Grote, 2012, p. 1985).

In our interpretation, the safety management systems theory of Hale et al. (Hale et al., 1997; Hale, 2003) can be defined as a "minimizing uncertainty" approach because to Hale et al., safety issues are regarded as resulting from deviations that have to be removed in order to ensure predictable, stable and safe organizational behavior. In their 1997 publication, Hale et al. argue that the concept of deviation from a desired standard or ideal situation is well known in safety and that: "*Deviations can be seen as undesired outputs arising from problems with inputs, controls and/or resources.*" (1997, p. 128). In his 2003 article, Hale sums up what components should constitute a "good" SMS (Hale, 2003, pp. 187–189):

1. A clear understanding of the company's primary production processes and all their ancillaries, with all the scenarios leading to significant harm. [...] Task and job safety analysis must be rooted in a functional analysis of the processes so that the deviations in the flow of those processes, which can lead to accidents, can be traced to their origins and linked to barriers.
2. A life cycle approach to safety management, considering how all the system elements are designed, purchased, constructed, installed, used, maintained, modified, and disposed of.
3. A problem-solving cycle identifying, controlling, and monitoring these scenarios at three levels: people in direct control of the risk, procedures and plans and a structure and policy level that at intervals reviews the current operation of the SMS and makes structural improvements to it.
4. Feedback and monitoring loops ensuring assessment against performance indicators at each of the three levels.
5. Systems at the middle level, linked to the staff and line functions of the company, delivering the crucial resources and controls to safety–critical tasks at the lower level.

To model an organizational safety management system (SMS), Hale et al. (1997) employ In't Veld's Structured Analysis and Design Technique (SADT, 2002). The SADT technique is used to visualize every process step in the production cycle of a particular product and study a particular activity with regard to its inputs, outputs, resources and controls. This method enables one to determine where deviations in inputs and resources threaten the safe and stable output of a particular activity so that these deviations can be reduced in order to ensure safety. In the words of Hale et al.: "*The logic of the modeling is that the inputs must be necessary and sufficient to produce the outputs, given the resources and the control criteria*" (1997, p. 126). Summing up, the SMS developed by Hale et al. aims to control for safety by reducing deviations. It aims to do so by generating safety criteria and scenarios for inputs, outputs and resources. Based on these criteria, the SMS is able to steer the behavior of particular activities back to stable and, presumably, safe behavior by means of the implementation of barriers.

In contrast to the "minimizing uncertainty" approach, we interpret that resilience-engineering theory can be defined as a "coping with uncertainty" safety management theory. Resilience engineering theory aims to account for the problem that quite often work situations seem to be dynamic and that aiming for a stable "steady state" may not be the best way to ensure safety in such dynamic situations. Although Rasmussen (e.g., 1994, 1997) did not label his own work as "resilience engineering theory", it can be stated that he was one of the first theorists who addressed the influence of operational dynamics on safety as a reaction to the, then, dominant "human error" approach. Moreover, resilience-engineering theory seems to be building on Rasmussen's theoretical premises, such as in the work of one of the main contributors to resilience engineering theory, Erik Hollnagel (e.g., Hollnagel, 2004, 2012).

In his 1997 article, Rasmussen pointed to the effects of "dynamic" operational conditions on managing safety. He stated that: "*Control of activities and their safety by the classic prescriptive command-and-control approach deriving rules of conduct top-down may be effective in a stable society where instruction and work tools at all levels can be based on task analysis. In the present dynamic situation, this approach is inadequate and a fundamentally different view on system modeling is required*" (1997, p. 185). In the same paper Rasmussen proposes that: "*safety in the direct interaction with the work environment must be based on an identification of the boundary of safe performance by analysis of the work system, and the criteria that drive the continuous adaptive modification of behavior.*" (1997, p. 206). In line with Rasmussen, Woods (in: Hollnagel et al., 2006, p. 22) states: "*Resilience then concerns the ability to recognize and adapt to handle unanticipated perturbations that call into question the model of competence, and demand a shift*