



## Review

# Interorganizational complexity and organizational accident risk: A literature review



Vibeke Milch\*, Karin Laumann

Department of Psychology, Norwegian University of Science and Technology, NO-7491 Trondheim, Norway

## ARTICLE INFO

### Article history:

Received 20 January 2015

Received in revised form 18 August 2015

Accepted 21 August 2015

### Keywords:

Interorganizational complexity  
Safety  
Organizational accident risk  
Literature review

## ABSTRACT

Due to increased outsourcing in many industries, organizations are becoming larger and more interorganizationally complex and numerous operations now require cooperation among employees from different organizations. This paper presents a review of empirical literature addressing safety issues in complex interorganizational systems wherein the potential for major organizational accidents is present. Thematic analysis of the literature resulted in four main themes: economic pressures, disorganization, dilution of competence and organizational differences. The themes were viewed in light of different theoretical perspectives on organizational accident risk. The findings suggest that issues due to interorganizational complexity can hinder efficient safety management and thereby elevate the risk of organizational accidents. It is emphasized that further research is needed to better understand the implications of interorganizational complexity on safety management.

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\* Corresponding author. Tel.: +47 73 59 19 79, mobile: +47 47 66 01 08.

E-mail addresses: [Vibeke.milch@svt.ntnu.no](mailto:Vibeke.milch@svt.ntnu.no) (V. Milch), [Karin.Laumann@svt.ntnu.no](mailto:Karin.Laumann@svt.ntnu.no) (K. Laumann).

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## 1. Introduction

The present dynamic society is characterized by rapid change, globalization, fierce competition and the rapid advancement of technology (Rasmussen, 1997), features that require organizations to obtain flexible personnel with specialized expertise and skills in order to stay competitive. In many industries there has been a tendency toward increased outsourcing of activities and functions to subcontractor companies (Johnstone et al., 2005). This development has given rise to complex socio-technical systems in which multiple companies are involved and work processes require the collaboration of employees from different organizations and coordination across organizational boundaries. This phenomenon can be referred to as *interorganizational complexity* and is arguably a consequence of increased outsourcing. Interorganizational complexity represents an emergent characteristic of modern organizations that use complex, hazardous technology. As industrial installations become larger and more interorganizationally complex, an important question is what implication such complexity has for safety.

It is largely acknowledged that increased complexity in technology, work tasks and organizational structures renders organizations more vulnerable to organizational accident risk due to increased degrees of freedom and ways in which components of complex systems may interact and produce unforeseen situations (e.g. Perrow, 1984; Rasmussen, 1997; Reason, 1997; Dekker, 2011). While outsourcing indeed may involve benefits in terms of increased flexibility, competitiveness, specialized expertise and cost effectiveness, the involvement of multiple organizations adds to the complexity in a system (Perrow, 1984) by introducing an increased number of organizational interfaces to be coordinated, employees with different backgrounds and practices, different sets of rules and operational procedures, and the need for greater communication and information sharing across organizational boundaries.

Investigations into several large scale organizational accidents have shown that issues with roles and responsibilities, communication and coordination between organizations were contributing factors leading up to accident scenarios. Examples include NASA accidents *Challenger* and *Columbia* (Garner, 2006; Vaughan, 1990) as well as the more recent *Deepwater Horizon* accident (Tinmannsvik et al., 2011). Such findings suggest that interorganizational complexity may have implications for managing the risk of organizational accidents. Yet, in safety research, few studies have addressed the connection between safety and complexities that result from interactions among multiple organizations.

We argue that understanding the issues arising at the interfaces between organizations may provide valuable insight into better understanding organizational accident risk and how to manage it. The objective of this paper is to examine this connection by reviewing empirical literature that addresses safety in complex interorganizational systems wherein the risk of organizational accidents is present. The aim is to identify issues addressed in the literature and consider how such issues pose challenges for both safety and risk of major accidents. As such, two research questions are posed: *What interorganizational safety challenges can be identified in the literature? Moreover, how are the interorganizational issues identified in the literature related to organizational accident risk?*

The rest of the paper is organized as follows: the second section will describe the theoretical framework on organizational accidents in complex systems used to analyse the findings from

the literature analysis. The next section describes the approach for the literature review. Findings are presented in Section 4, and in Section 5 discussed in light of theoretical perspectives. Finally, some main points are drawn in summary and conclusion.

## 2. Theoretical perspectives

Since there are many approaches to safety, there are many approaches to assessing safety in a system. Accident rates, analyses of risks and hazards, investigations of past accidents and near misses, and analyses of organizational characteristics such as safety culture or safety climate all provide sources of information about different aspects of safety. In the safety literature, a distinction is commonly drawn between individual accidents and organizational accidents (Reason, 1997). While the former relate to relatively isolated failures, often due to unsafe acts committed by individuals in which there is a clear relation between cause and effect, the latter involves complex and often catastrophic events with multiple causes and system-wide implications. The causal roots of organizational accidents are thought to be far more comprehensive than those of individual accidents and involve complex interrelations among multiple contributing factors. Accordingly, it has been acknowledged that a systems perspective is essential to understanding organizational accident risk in complex systems (Dekker, 2011; Rasmussen, 1997; Reason, 2000).

There are several theoretical perspectives taking a systemic approach to organizational accidents in complex systems. In this paper, findings are discussed from three different perspectives. Reason's (1997) ideas on latent conditions, Dekker's (2011) concept of drift into failure, and Weick and Sutcliffe's (2007) perspective on high reliability organizations. These were chosen because they represent different viewpoints on organizational accidents in complex systems and include both longstanding ideas and recent theoretical developments. Arguably, the combination of these perspectives provides the width necessary to illuminate and explore the findings in a nuanced manner. A brief description of each framework is provided in the following.

In the well-known Swiss cheese model, Reason (1997) describes how latent conditions dormant in a system may combine with active failures to ultimately breach the defences in depth. Active failures are errors with immediate, visible consequences made by people at the sharp end, while latent conditions represent invisible faults that may linger in the system for years, originating from decisions made by people higher up in the system. An organizational accident occurs if successive holes in the layers of defence align, representing a breach of existing safety barriers. In this respect, organizational accidents imply a systemic malfunction. In recent years, however, some researchers have argued that organizational accidents in complex systems can occur from unanticipated interaction among subcomponents in the system. Dekker's (2011) concept of drift into failure synthesises research on organizational accident causation in complex systems the last decades describing how seemingly well-functioning and successful organizations can drift into failure. In such thinking, the central premise is that interactions and interrelationships between subcomponents in complex systems may result in outcomes that are difficult to predict. As such, failure does not necessarily mean the existence of a broken component; on the contrary, failure can result from normal organizational behavior influenced by pressures in the

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