Review

On collective improvisation in crisis management – A scoping study analysis

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ABSTRACT

Responding to crises requires the ability to meet the unforeseen and adapt to new conditions. The transboundary nature of crises with e.g. increased interconnectedness among critical infrastructures, involving more actors in response, will call for collective coordination. Collective improvisation can be a tool for handling challenges under these circumstances, however the research is limited and dispersed over disciplines. Therefore, the aim of this paper is to explore the capability to improvise collectively in crisis management, and how it affects performance. To achieve this, we conducted a structured scoping study of improvisation in scientific literature and found that existing research is not sufficiently explained or detailed to fulfill our purpose. Our findings show that individual improvisation seems to be aggregated to a collective level without modifications, and existing methods lack in precision and transparency. Further, there is a need for a more nuanced discussion on improvisation and performance. Implications are that studies on collective improvisation risk measuring individual rather than collective improvisation, if based on existing literature. Moreover, the concept of improvisation is connected to mostly positive outcomes and assumed to have the same meaning for everyone. As a result, one should be careful when using the concept in practice, e.g. when using it as a causal explanation for successful performance, or when suggesting measures aimed at improving the capability to improvise collectively. To move forward, we suggest adopting collective problem solving as a broader analytical frame. Finally, we highlight some theories serving as a starting point for this investigation.

1. Introduction

The challenges associated with the responses to crises[1] that affect society have been studied for almost a hundred years (Lindell, 2011; Scanlon, 1988). Researchers from various disciplines continue to remind us that response management is characterized by complexity, and that response organizations must be prepared for the unexpected and be able to adapt to new conditions (see e.g. Cutter et al., 2010; Mendonça and Wallace, 2004; Wachtendorf, 2004; Weick and Sutcliffe, 2015). In this context, it may be necessary to rely on what practitioners and academics alike describe as *improvisation*. Improvisation can be seen as a tool to deal with situations that require action without planning (see e.g. Moorman and Miner, 1998b), or where the ability to develop a plan is hindered by uncertainty (see e.g. Crossan et al., 2005). Most importantly, improvisation is a well-known response to crises (see e.g. Kendra and Wachtendorf, 2006; McEntire et al., 2013; Mendonça and Wallace, 2004), leading Tierney (2002, cited in Kendra and Wachtendorf, 2006, p. 1) to conclude that "if an event doesn't require

improvisation, it is probably not a disaster".

This paper is a critical analysis of the concept of improvisation as it is used in the scientific literature, and how it is related to capability in the context of crisis management. Although much of the crisis management research has focused on first responders, such as police and fire brigades, recent events such as hurricane Katrina in 2005, the eruption of Eyjafjallagökull in 2010, and the Great East Japan earthquake in 2011 that led to the Fukushima Daiichi nuclear disaster, have illustrated the transboundary nature of modern crises (Ansell et al., 2010). When the consequences of a crisis are spread across geographical, administrative and sectorial boundaries (e.g. from power distribution to transport, to health care) it becomes much harder to manage. This implies that in major crises, many organizations that are not traditionally seen as first responders become very important for managing its consequences. In this article, we pay specific attention to such contexts in our analysis of the meaning and role of improvisation.

One key reason why modern crises may be transboundary, for example, crossing both geographical and functional borders, is the

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[1] We are aware of the semantic heterogeneity in labeling and classifying various societal perturbations. Terms such as *emergencies*, *disasters*, *catastrophes*, and *crises* have different meanings for different scholars. In this article, we use the term *crises* as an umbrella term covering various magnitudes of societal perturbations that threaten core societal values such as life and functionality.

increased interconnectedness of critical infrastructures (CIs). A disturbance in one infrastructure can easily spread to the next, giving rise to a cascade of failures (Rinaldi et al., 2001; de Bruijne and van Eeten, 2007). The extension of the consequences beyond the system in which the disturbance originated can intensify the strain on society. Additionally, cascading effects can make it much harder to manage the initial event, and to restore vital societal functions.

Given such circumstances, the response to modern crises is expected to be a collective effort, involving many different actors, and requiring joint cooperation and coordination (Ansell et al., 2010). Moreover, as noted by de Bruijne and van Eeten (2007, p. 19) "…we face a paradoxical challenge: while CIs [critical infrastructures] have become more complex and interconnected, the management of these CIs has become increasingly institutionally fragmented". Another important challenge relates to the increasing number of actors involved in managing critical infrastructures. Yet, as Almklov and Antonsen (2010, p. 136) point out, in such a modularized, or otherwise fragmented environment, it is unclear who will, or can, take holistic responsibility for the services that are provided—unsurprisingly, making coordination difficult (Almklov and Antonsen, 2014, p. 482).

"All-hazards" (O'Brien et al., 2006) and "whole of society" (Lindberg and Sundelius, 2010) approaches have developed out of this changing context; they stress the importance of incorporating a holistic approach to crisis management. Decision-makers, in this view, must be able to consider all possible hazards when assessing risk, and manage all parts of society before, during and after a crisis. These requirements suggest that predicting and managing the real-time flow of events in a crisis is already difficult, and will become increasingly difficult. Consequently, it will be harder to plan for each situation, if only because there are more situations to plan for.

In this context, *collective improvisation* has become an increasingly important tool for better crisis management. From a practical standpoint, the idea is particularly relevant, because authorities that must assess crisis management capability often pay attention to what one, or several, organizations can achieve, rather than what a single entity is able to do. The question, however, is whether it is feasible to assess the capability for improvisation on a collective level, rather than the capabilities of individual first responders. In this paper, we adopt the notion of the micro–macro effect that characterizes complex systems (Bergström et al., 2016) and apply a holistic, rather than a reductionist approach. The interactive nature of processes means that there may be management qualities that are only traceable on a macro (collective) level in a system of human beings. This argument suggests that theories that have been developed to understand individual behavior cannot be applied to groups, without critical reconsideration. In the context of improvisation, individual actors may improvise in response to other actors' improvisation, creating a whole (collective improvisation) that is not the sum of the parts.

This paper analyzes the scientific literature focusing on collective improvisation as its own unit of analysis in the context of crisis management. Of particular interest is how the capability for collective improvisation can be assessed and, if necessary, enhanced. Our aim is to explore if the capability to collectively improvise can explain, predict and be used to assess overall performance in crisis management. Our ultimate goal is to provide guidance for practitioners (especially in contexts characterized by tight interconnections and interdependencies between and among actors) regarding how they can improve this collective ability. We therefore pay special attention to research that can be turned into practical advice, and used to assess or enhance the collective ability to improvise.

The following three questions are the point of departure in our analysis:

(a) How does the capability to improvise at the collective level affect crisis management performance?
(b) How can collective improvisation be measured?

(c) How can collective improvisation be improved?

Our review of the literature on collective improvisation identified a number of challenges in observing and measuring it. These are due to a lack of detailed explanation; the evidence suggests that it amounts to little more than an aggregation of individual improvisation at the collective level and little attention is given to interactions or emergent properties. Methods lack precision and transparency. Research focuses on successes, and little is said about any negative outcomes, indicating that improvisation is often perceived to (almost automatically) lead to a desired outcome. It appears that the concept is intuitively associated with positive outcomes, and is assumed to have the same meaning for everyone. Consequently, care should be taken when using the concept in practice, for example, when using it as a causal explanation for successful performance, or when suggesting measures aimed at improving the capability to improvise collectively. Our findings have several important implications for both academics and practitioners. Most important, our work suggests that future studies on collective improvisation run the risk of measuring individual, rather than collective improvisation, and with a positive bias.

This article is structured as follows: first we present how the terms *collective* and *performance* are used in this paper. This is followed by an outline of the method and results of our systematic scoping study on improvisation that is based on the current literature. The next section present an analysis and discussion of the findings, in order to identify contributions that can help us assess, understand, and predict collective improvisation in crisis management. Last, some limitations are discussed, and future implications for the domain as a whole are sketched out.

1.1. Collective and performance

Here, the term *collective* is considered to refer to more than one actor, where an actor can be, for instance, a person or organization, depending on the level of analysis. This simple definition makes it possible to approach the literature from a broad perspective. Here, we focus on what we see as the intersection that emerges when considering crisis management, the collective, and improvisation. More specifically, we seek to avoid any limitations related to the definition of a single term, such as 'team' or 'group'. The collective is here seen as a concept that covers, for example, groups, teams, organizations and systems, given their various meanings. At the same time, we acknowledge that distinguishing specific groups, teams, and organizations can become necessary when operationalizing improvisation in a certain context, on a case-by-case basis. It should be noted that when we present the results of our study, we retain the level of analysis given in the literature, but revert to our definition of the collective when interpreting the results.

Improvisation linked to *performance* is particularly relevant given our focus on crisis management. If improvisation cannot be related to an effective (or ineffective) crisis response, then it becomes a moot issue. Thus, we pay keen attention to if, and how, the literature discusses improvisation in relation to performance. From a broad perspective, we relate performance to how well—specifically when it comes to improvisation—the response meets the emergent needs following a crisis that Quarantelli (1997) calls "agent generated demands".

2. The scoping study

The literature that this paper draws upon comes from our systematic scoping study of improvisation. It should be noted that our aim, unlike many literature reviews, is neither to develop or evaluate a theory, nor to identify a particular problem (Baumeister and Leary, 1997). Rather, we seek to provide an overview of the available research on improvisation, and to identify material that contributes to the questions addressed in this paper.

The scoping study was chosen because we wanted to address a broad research question and apply it to many areas of research, rather than posing a single question that is addressed narrowly (Poth and Ross, 2009). Therefore, we needed to collect literature from a wide range of research areas and study designs (Arksey and O'Malley, 2005). A scoping study provides a deeper understanding of how the findings relate to each other through the identification of recurrent themes, rather than summarizing existing findings (Poth and Ross, 2009). Finally, most scoping studies are multi-disciplinary, which broadens the selection of literature. The methodology, used as a standalone activity has been applied to studies of, for example, the evaluation of disaster exercises (Beerens and Tehler, 2016), risk management in software engineering (Lobato et al., 2012), nursing (Davis et al., 2009), and medicine (van Mossel et al., 2012).

Arksey and O'Malley (2005) identify four purposes of a scoping study, here we focus on two: mapping a field of study where it is difficult to visualize the range of available material; and then identifying gaps in the literature. Typically, the method does not include an assessment of the literature, but rather assembles and disseminates the findings without evaluating their quality. However, as our aim was to go beyond describing the literature—specifically, we sought to answer the three questions described in the introduction—we took the study one step further, and analyzed the results with these questions in mind.

A scoping study starts with the identification of a broad research question, here: *What is known in the scientific literature about improvisation at various levels of analysis?*. In order to identify useful resources to help us assess, understand, and predict collective improvisation, we searched the literature using the keywords *individual, collective, team, group, organization* and *system*, in combination with *improvisation*. It is important to note, again, that 'collective' in this context refers to how the word is mentioned in the literature, which is not necessarily connected to the definition used in this paper. We acknowledge that synonyms for improvisation, such as 'ad hoc solutions', or related terms, such as 'creativity' or 'innovation' may also provide useful results. However, in this paper we are specifically interested in the literature on 'improvisation' and therefore did not include any other terms. Our key foci were definitions, methods, and studies that explain the concept of improvisation, and the connection to performance.

Scopus, one of the largest literature databases, was searched for relevant articles, books and book chapters in English. A large number of papers were deemed irrelevant, such as where improvisation was only mentioned in the keywords, and not addressed explicitly in the text. We identified further literature from snowballing reference lists, a Google search, and from scholarly advice. The study resulted in 66 papers that were analyzed in order to obtain an overview of current research on improvisation. Fig. 1 shows the scoping study process.

A scoping study consists of collating and summarizing the material, and reporting the results, often in a narrative way, without judging its quality (Arksey and O'Malley, 2005). Appendix A presents a summary. In addition to general information, such as the author and title, the selected data should reflect the "synthesizing and interpreting [of] qualitative data by sifting, charting and sorting material according to key issues and themes" (Arksey and O'Malley, 2005, p. 26). We therefore included the level of analysis for each paper, determined by its title, any definitions given, the methods used, and descriptions of context. We also included the definition of improvisation, as given by the paper's authors, together with our interpretation of each definition's level of analysis. Last, we included information on empirical methods and performance.

3. Results and analysis

Most of the papers that were reviewed were published by authors from Europe and/or North America (54 out of 66), and all date from the beginning of the 1990s or later (Scopus includes literature dating from 1970). A quarter (17 out of 66) deal with crisis management (Bechky and Okhuysen, 2011; Brady, 2011; Gauthereau and Hollnagel, 2005; Kendra and Wachtendorf, 2006; Lundberg and Rankin, 2013; McEntire et al., 2013; Mendonça et al., 2006; Mendonça and Wallace, 2004, 2007; Rankin et al., 2013; Rimstad et al., 2014; Trotter et al., 2013, 2014; Wachtendorf, 2004; Wachtendorf and Kendra, 2006; Webb and Chevreau, 2006; Weick, 1993). Relevant papers were those in which social perturbations, such as crises, emergencies, disasters or catastrophes, were discussed. It was also important that the crisis affected societal functions and was not isolated to, for example, a single company or process.

It was crucial for the analysis to understand how the authors explained improvisation in their context, including the level of analysis. In addition, we identified how improvisation was studied and operationalized in both theoretical and empirical studies. Last but not least, it was necessary to understand how improvisation was linked to performance. As a result, we organized our findings according to: the level of analysis; the definition of improvisation; methods; and discussions of performance. It bears repeating that the levels of analysis described in this section follow those given in the reviewed papers and, consequently, the notion of the 'collective' does not necessarily coincide with our definition.

3.1. Level of analysis

The level of analysis is a central desideratum of our paper, since we argue that it is critical to distinguish between individual and collective improvisation. Table 1 illustrates the grouping of papers according to their respective level of analysis. In addition to specific levels (individual, group, team, organizational, collective, system, joint), we identified eight papers that dealt with improvisation in more general terms (i.e. where the purpose was not to discuss a particular level, but improvisation in general). We were unable to distinguish the level of analysis in 17 papers, and used the category 'unclear', however acknowledging that the authors were possibly investigating improvisation in a general sense. Seven of the papers categorized as unclear deal with crisis management (Bechky and Okhuysen, 2011; Brady, 2011; Gauthereau and Hollnagel, 2005; Mendonça and Wallace, 2004; Rimstad et al., 2014; Wachtendorf, 2004; Webb and Chevreau, 2006).

3.2. Definitions of improvisation

This chapter presents our interpretation of the definitions of improvisation given in the reviewed papers. This is not intended to be a mere list of definitions, as this has already been reported in several articles (see e.g. Cunha et al., 1999; Hadida and Tarvainen, 2015). Instead, it highlights the use of improvisation at different levels of analysis, as deployed in the reviewed literature (see Appendix A for a description of definitions and the level of analysis for each definition).

Our analysis found the following:

- Some papers do not include an explicit definition

In almost a quarter of papers (16), we were unable to distinguish any explicit definition of improvisation (including Biasutti and Frezza, 2009; McEntire et al., 2013; Mendonça et al., 2006; Mendonça and Wallace, 2007; Sayer, 2006; Wachtendorf and Kendra, 2006). Of these 16 articles, seven concerned crisis management (Gauthereau and Hollnagel, 2005; McEntire et al., 2013; Mendonça et al., 2006; Mendonça and Wallace, 2007, 2004; Rimstad et al., 2014; Wachtendorf and Kendra, 2006; Weick, 1993).

- The link between the definition and level of analysis is poorly defined

A comparison of the level of analysis and its focus found that there was often a mismatch. In a large majority (42) of papers, the definition
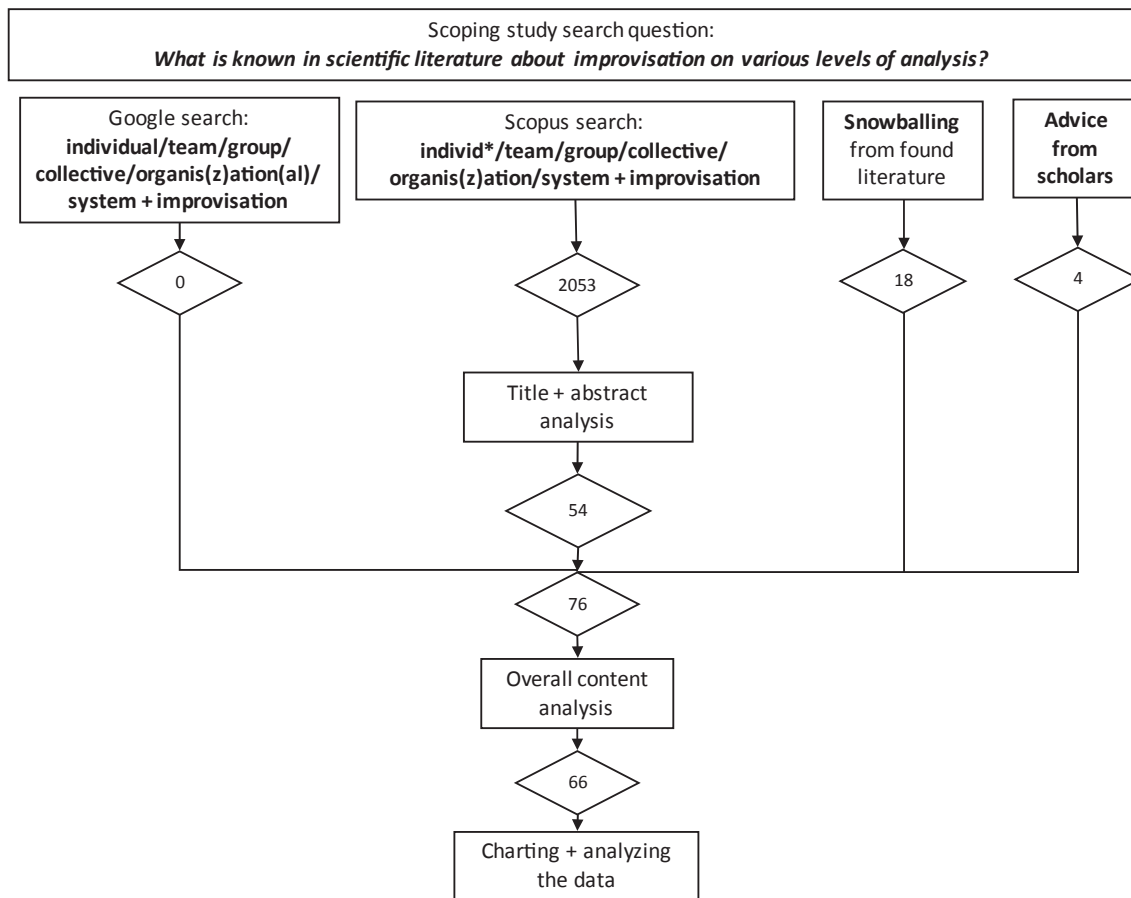
Fig. 1. Our scoping study process.

Table 1
Level of analysis found in the reviewed papers.

Level of analysis studied	Number of papers
General	8
Unclear	17
Individual	8
Group	1
Team	7
Organizational	15
Collective	6
System	1
Joint	1
Mix of levels of analysis	2
Total number of papers	66

of improvisation given in the text represented a level of analysis that was inconsistent with the paper's stated or implied level of analysis. By way of example, the following papers focus on organizational improvisation, but only a general definition of improvisation is given: Crossan et al. (2005), Kamoche et al. (2003), Miner et al. (2001) and Weick (1998). Similarly, Akgün et al. (2007) and Akgün and Lynn (2002) study team improvisation but only offer a general definition. Flach (2014), Lundberg and Rankin (2013) and Magni et al. (2009) study individual improvisation but only give general or organizational definitions. Last, Camilleri (2008), Pavlou and El Sawy (2010), Pavlovich (2003) and Zheng, Venters and Cornford (2011) study

collective improvisation, but only provide a general definition.

● Common definitions

It was possible to distinguish some commonly-used definitions of improvisation. By way of example, Moorman and Miner's definition of organizational improvisation as "the degree to which composition and execution converge in time" (1998b, p. 698) is used in 14 papers; Crossan and Sorrenti's definition, "intuition guiding action in a spontaneous way" (1997, p. 156) is used in nine papers; and Cunha et al.'s definition, "the conception of action as it unfolds, drawing on available cognitive, material, affective and social resources" (1999, p. 302) is used in six papers, and four other papers when including the organizational aspect.

These definitions are used at various levels of analysis. For example, Moorman and Miner's (1998b) definition of organizational improvisation is referred to in papers where team (Akgün et al., 2007; Akgün and Lynn, 2002; Vera and Crossan, 2005), collective (Pavlou and El Sawy, 2010), and individual (Lundberg and Rankin, 2013) improvisation was studied. In a similar vein, Cunha et al.'s (1999, p. 302) definition, "the conception of action as it unfolds, drawing on available cognitive, material, affective and social resources", either with or without adding "by an organization and/or its members", is used as a general or organizational definition. However, it is referred to in papers where collective (Zheng et al., 2011), organizational (Crossan et al., 2005; Kamoche et al., 2003) or team (Vera and Crossan, 2005) improvisations were studied.

3.3. Empirical methods

Almost a third (11) of the 35 empirical papers use either the method developed by Moorman and Miner (1998a), or that of Vera and Crossan (2005) (the work of the latter builds on the former).[2] Both methods originate from the area of product development and these eleven studies are also most explicit in how they measure improvisation, for example, by listing the questions posed.

Moorman and Miner (1998a) observed organizational improvisation; they attended, recorded and transcribed meetings, and distributed questionnaires. Organizational improvisation is defined as, "improvisation by groups, departments, or whole organizations" (p. 4), and the authors define improvisation in general as, "the composition and execution of an action converge in time so that, in the limit, they occur simultaneously" (p. 1), i.e. the narrower the gap, the more improvisation takes place.

Vera and Crossan (2005) studied work teams in a municipal setting and asked individual team members to complete a survey that included items on team improvisation. The authors aimed to, "unpack the nature of collective improvisation" (p. 203), and defined collective improvisation as "improvisation by work teams" (p. 204); more specifically, they argue that, "although collective improvisation builds on individual improvisation, team improvisation is more than the sum of individual improvisations because the joint activities of individuals create a collective system of improvisational action" (p. 204). When the focus switched to individual improvisation, the 'team' in the original questions was replaced with 'I'. In addition, the authors interviewed informants, who were asked to describe events in which their team had to "come up with something really fast" or "think on their feet" (p. 210).

Moorman and Miner's method was used in Akgün and Lynn (2002) and Akgün et al. (2007) to study team improvisation, albeit with modified questions. Moorman and Miner's method is also used to study organizational improvisation (Gross, 2014; Mendonça et al., 2006) and collective improvisation (Pavlou and El Sawy, 2010). Vera and Crossan's method is used to study team (Magni et al., 2013; Magni and Maruping, 2013) and individual improvisation (Magni et al., 2009; Nisula, 2015), again with modified questions.

The remaining 24 empirical studies use interviews, questionnaires, observations, document analysis or analysis of secondary data or recordings to study improvisation at various levels of analysis. Of these, ten deal with crisis management (Bechky and Okhuysen, 2011; Brady, 2011; Gauthereau and Hollnagel, 2005; Kendra and Wachtendorf, 2006; Lundberg and Rankin, 2013; McEntire et al., 2013; Mendonça and Wallace, 2004; Rankin et al., 2013; Trotter et al., 2014; Wachtendorf, 2004). However, only three (Lundberg and Rankin, 2013; McEntire et al., 2013; Noy et al., 2011) explicitly specify their method.

3.4. Improvisation and performance

To understand how the capability to improvise affects performance in crisis management, we need to establish whether the literature relates improvisational behavior to performance. This requires investigation of if, and how, authors relate improvisation to outcomes, i.e. if improvisation does or does not result in valued outcomes.

Just under half of the papers (31) highlight that improvisation is linked to desired outcomes (see e.g. Akgün et al., 2007; Klein et al., 2015; Lemons, 2015). In 21 of the 31 papers the authors acknowledge that it can lead to negative outcomes (see e.g. Crossan et al., 2005; Cunha et al., 1999; Gross, 2014; Magni and Maruping, 2013; Wachtendorf, 2004). In around half (12) of these 21 papers, the discussion of negative consequences is fairly extensive. The 35 papers that present neither positive nor negative outcomes focus on improvisation

as a tool that is available in certain situations. Examples include: where adaptation is sought after; where no procedures exist (Trotter et al., 2013); when individuals are faced with a surprise (Miner et al., 2001); or where, for example, time constraints and/or uncertainty prevails (see e.g. Cunha et al., 2014; Magni and Maruping, 2013; McEntire et al., 2013; Rankin et al., 2013; Webb and Chevreau, 2006).

4. Discussion and implications

In this chapter, we discuss our findings and implications for the field at large. Unless otherwise stated, we use 'collective' as defined by us, and as its own unit of analysis.

4.1. A failure to specify the object of study or level of analysis

Hadida and Tarvainen (2015) highlight that the meaning of improvisation is often taken for granted. This is confirmed by the fact that many of the papers we reviewed were unclear regarding the level of analysis, or failed to provide an explicit definition of the term, or the link between the definition and the level of analysis was incoherent. While not a majority, the comparatively high number of papers that did not define, or otherwise distinguish the level of analysis must be of concern to any reader of this literature. It appears that the authors expect the reader to know what improvisation is, and recognize cases where it is beneficial. However, if a general definition of improvisation is used when studying the individual level, how can we be certain that the results reflect individual improvisation and not improvisation in general? In short, there is a risk that the results do not reflect improvisation at the appropriate level of analysis—either the one intended by the authors, or the one tacitly assumed by the reader. While we acknowledge that authors may have a clear idea of their object of study, it is important to highlight the fact that it is difficult for readers to use theories, methods or results from papers that do not explicitly define the object of study or level of analysis.

4.2. A single definition of improvisation is used for different levels of analysis

Our analysis highlighted that the same definition of improvisation is used for different levels of analysis—no attempt is made to modify it to the specific level in question. This phenomenon is probably linked to the finding noted above: the meaning of improvisation often seems to be taken for granted (Hadida and Tarvainen, 2015). This oversight can both undermine the results, and muddy the definition itself. It is unclear to us how the same definition can be applied to individual and collective improvisation, when the circumstances ought to be quite different. We argue that it should be possible to distinguish collective and individual improvisation, and consequently study collective improvisation as its own unit of analysis. An example is the definition "the degree to which the composition and execution converge in time" (Moorman and Miner, 1998b, p. 698). How can individual and collective improvisation be differentiated, using this definition, in the absence of an explanation regarding how to actually study the collective dimension? Here again, although the authors may have a clear picture of their object of study, this will not help readers to find theories of collective improvisation in crisis management.

4.3. Definitions lack relevance

Our study distinguished various definitions of improvisation, based on different levels of analysis. Here, we discuss whether these definitions can be used to observe collective improvisation in crisis management.

First, we agree with Vera and Crossan (2005) that, although individual improvisation can be considered as a function of the individuals making up the collective, this alone is insufficient to create

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[2] Six use Moorman and Miner's method and five utilize Vera and Crossan's.

collective improvisation. The same idea is made more explicit by Moorman and Miner (1998a, p. 5), who state, "there must be an element of collective design and execution" to distinguish collective improvisation. However, it is unclear to us what this "collective design and execution" might look like, or how we can use it to observe collective improvisation in crisis management. Similarly, other definitions of collective improvisation shed no light on how it might be operationalized as its own unit of analysis. For instance, the definition of organizational improvisation as "the combined effort of several individuals, groups and/or organizations" (Cunha et al., 1999, p. 311), or team improvisation as "improvisation by work teams" (Vera and Crossan, 2005, p. 204) seems to us to be an unmodified aggregation of individual improvisation. In the same vein, definitions of organizational improvisation, such as "improvisation by groups, departments, or whole organizations" (Moorman and Miner, 1998a, p. 4) or team improvisation as "collective action of team members during which the convergence of creativity and spontaneity occurs" (Magni et al., 2013, p. 1012, adopted by Vera and Crossan, 2005) are equally unhelpful.

Organizational improvisation is, we argue, often deployed as an umbrella term for improvisation in general, reflected in the recurring use of the definitions provided by Cunha et al. (1999) and Moorman and Miner (1998b) at various levels of analysis. We suspect that organizational improvisation, as it is described in the current literature, often reflects a generalized view of improvisation that is thought to be appropriate at any level of analysis, and is not necessarily limited to the context of a specific organization. This makes it difficult to distinguish organizational improvisation from general improvisation and we, like other readers, struggle to understand how theories of organizational improvisation can be used to observe collective improvisation in crisis management.

4.4. Time is difficult to operationalize

The definition provided by Cunha et al. (1999, p. 302) appears to be useful, "the conception of action as it unfolds, by an organization and/ or its members, drawing on available material, cognitive, affective and social resources". The first part (*the conception of action as it unfolds*) refers to the time interval between planning and acting; all other things being equal, the shorter the time interval, the more likely one is to improvise. This interval can be used to distinguish improvisation from related terms such as 'creativity', 'innovation' or 'adaptation' (Frykmer and Uhr, 2015), and it appears to be a tempting basis to study collective improvisation. However, the challenge is more difficult. If we try to turn time into something we can study, we end up with questions that we do not know the answer to, such as how narrow should the time gap be for it to be called improvisation? How much convergence is necessary? These questions are especially relevant when the context is performance in crisis management. Furthermore, if we examine improvisation at the tactical, operational or strategic level (i.e. at different timescales), what are the timescales between acting and planning on each level? In short, it appears that time cannot without further investigation be operationalized as a means to observe improvisation, and we would like to see more research in this area.

4.5. Empirical methods lack precision and transparency

Two empirical methods were widely used to study improvisation (11 papers): Moorman and Miner (1998a) and Vera and Crossan (2005). The eleven papers describe their methods in quite detail, and include survey questions, while the others provide little explanation. Only three other papers gave a detailed method. This lack of transparency is, perhaps, a reflection of space limitations in articles, or assumptions about what the reader needs to know, or not. However, we argue that the lack of detail makes it impossible for these publications to increase understanding of collective performance. Without knowing what questions the authors asked, or how and what they observed, we

cannot understand and use their methodology—and, consequently, we cannot examine the impact of collective improvisation on crisis management in practice.

Even regarding the methods of Moorman and Miner, and Vera and Crossan, we must repeat the concerns given in chapter 4.1. First, it is not clear what, if any, level of analysis was used by Moorman and Miner in their interviews. Although the pronouns 'we' and 'our' are used, the interviewees' answers are ambiguous: for example, "I figured out action as we went along", and suggest that he/she is reporting their own actions, rather than what the team did. In other words, we cannot be completely sure that the improvisation measured with these questions is organizational and not individual.

Second, in Vera and Crossan's original study, as in other studies where the method is used, *individuals* are asked whether the *team* improvised, i.e. individuals are asked about collective behavior. However, we do not wish to rely on individuals' views of what others are thinking and doing when empirically investigating improvisation. Instead, we want to step outside the mind of the individual, to study collective improvisation, and focus on cognitive processes "in the wild" (Hutchins, 1995a). We adopt the view that cognition should not be analyzed through the 'black box' of the human mind, but rather in its context and through activities. Finally, in their own work, as in other studies of individual improvisation "the team" in Vera and Crossan's initial questions was replaced by "I", in order to reflect an individual level of improvisation rather than the original team level. Although Vera and Crossan state that "team improvisation is more than the sum of individual improvisations" (2005, p. 204), they use the same questions for both. We have concerns regarding the fact that the pronouns were merely exchanged without modifying the questions or underlying theories. As chapter 4.1 highlights, how can we be certain that individual and not team improvisation is measured, if the questions are not modified to represent this new level of analysis, or another element is added to the study?

These observations suggest a lack of precision and transparency in existing methods used to study improvisation. A particular concern is how to transition from the individual to a collective focus, be it in terms of observations, questionnaires or interviews. We acknowledge that this issue may not be a unique to disaster management, and is also relevant in other research fields. Consequently, there may be useful literature in other areas that can help us understand collective improvisation in general, and to find methods to measure it. The domain of team research appears promising in this respect (see e.g. Cooke et al., 2004; Salas et al., 2005; Stålsett et al., 2016).

4.6. The discussion of outcomes needs to be nuanced

Our study shows that only a fifth (12) of papers discuss unwanted outcomes in detail, while 31 link improvisation to positive results. This is consistent with Vendelø's (2009) and Vera and Crossan's (2005) view that most studies give a positive value to improvisation, and indicate that it is perceived to (almost automatically) lead to a desired outcome. The latter authors call for more empirical research to capture not only improvisational successes but also failures. We acknowledge that the negative outcomes of improvisation may be described in other terms (e.g. as procedural violations or rule-breaking). Nevertheless, we are of the opinion that a more nuanced discussion is needed, and that more empirical research may open the way to a more thorough investigation of when improvisation is beneficial, and when it is not.

A prevailing view seems to be that improvisation is the only option in certain situations (Miner et al., 2001; Trotter et al., 2013), for example under time constraints and/or when uncertainty is high (see e.g. Cunha et al., 2014; Magni and Maruping, 2013; McEntire et al., 2013; Rankin et al., 2013; Webb and Chevreau, 2006). Although we recognize this, there may also be situations in which individuals choose to improvise (or not), in the absence of any of the factors that normally trigger it. At the same time, Kamoche and Cunha (2001) note that not

everyone is willing or able to improvise. We see a need for more research into these situations, in order to add to our understanding of when improvisation occurs, and under what circumstances.

4.7. Summary and implications

To summarize whether the capability to improvise can help us understand, assess, and predict collective performance in crisis management, we refer back to the three questions that guide our paper:

(a) How does the capability to improvise at the collective level affect crisis management performance?
(b) How can collective improvisation be measured?
(c) How can collective improvisation be improved?

We identified the following challenges to observing and measuring collective improvisation:

(1) research on collective (including group, team, organizational and system) improvisation lacks clear explanations, or appears to merely aggregate individual improvisation to a collective level;
(2) research on individual improvisation cannot be applied to the collective level;
(3) time (when used to measure improvisation) is difficult to operationalize; and
(4) empirical methods do not provide us with tools for observing and measuring collective improvisation.

If we cannot observe and measure collective improvisation, we cannot study the effect of interventions aimed at improving the collective capability to improvise. Furthermore, research focuses on successes and neglects negative outcomes, indicating that improvisation may be perceived as automatically leading to a desired results. We are of the opinion that there is a need for a more nuanced discussion of the outcome of improvisation, and more research into when, and under what circumstances it occurs, before we can fully establish a connection between improvisational acts and performance.

We conclude that even if the literature on improvisation is extensive, it does not provide a clear demonstration of the link between the capability to improvise and performance on a collective level. As there a failure to establish the connection in general, it cannot be established in the context of crisis management.

Our findings have implications for the field in general and, especially, for empirical studies of collective improvisation. Using existing definitions and methods without modifications may lead researchers to solve *Type Three Errors*, i.e. correctly solving the 'wrong' problem (Mitroff and Linstone, 1992). In the context of collective improvisation, this refers to how improvisation is defined or formulated in the first place. Existing research appears to merely aggregate individual improvisation to a collective level. Therefore, we argue, there is a risk that researchers measure individual improvisation and not the intended, collective level.

Our findings may have practical implications for societal safety. Safeguarding vital functions is important—not only from the perspective of reducing the immediate negative effects of future disasters, but also in order to facilitate an effective response operation. However, as our results illustrate, the role of improvisation in achieving this is unclear. There is a risk that (collective) improvisation becomes a concept that professionals intuitively associate with something positive, tacitly assuming that it has the same meaning for everyone. Thus, the concept has the potential to become a "folk model" (Dekker and Hollnagel, 2004).

There are several types of situations in which the concept might be used erroneously. First, care should be taken when, after a crisis, "successful improvisation" is used as a causal explanation for positive performance. As our results show, the concept lacks rigorous

measurement methods, and there is a risk of mixing levels of analysis (individual and collective). Therefore, in our opinion, is it unclear how it can be concluded that "successful improvisation" actually happened during a crisis (and at which level), or that it is possible to attribute a positive outcome to it.

Second, the need to 'improve the capability to improvise' is a normative conclusion that might follow, for example, real crises or exercises. However, given the significant challenges in measuring and establishing causal relationships with respect to the concept, such conclusions are not very helpful in improving crisis management. The introduction to this article highlights that improvisation is considered, by both practitioners and scholars, to be a key element in crisis response management and capability. Therefore, the problem of measuring it creates challenges for response organizations, supervisory/monitoring agencies, and funding organizations alike. These challenges are practical thresholds, and not only inspiration for academic debate. How can anyone detect whether an organization's capability to improvise has been improved or impaired if it cannot be measured?

We remind the reader that this argument takes as its starting point the vague notions found in the literature on how to operationalize improvisation. There are other related concepts, such as agility (NATO, 2013), where the discussion on measurement and causal relationships may be clearer. However, they have far less impact on the practical and academic discussion. Moreover, if improvisation does become a folk model, it could become a legitimate 'conclusion', or 'lesson learned' from real crises and exercises—simply because it is hard to disagree with. Society will be open to increasing the capability to improvise, but the literature reviewed here will not provide any practical guidance on how to achieve it.

Finally, there is the risk that certain forms of management are associated with a better ability to improvise in crises. For example, in the United States, commercial companies such as Wal Mart and Home Depot were successful in responding to Hurricane Katrina (Wang et al., 2016) while the Federal Emergency Management Agency was severely criticized for its failure to deliver critical supplies (The Whilt House, 2006). Although it is difficult to know if improvisation (or a lack thereof) played a significant role in the response to the hurricane, it is easy to imagine that commercial companies could be better at crisis improvisation than, for example, governmental agencies. This example, and others (e.g. Dell's quick recovery after the Taiwan earthquake in 1999), may reduce the impact of criticism of the privatization and liberalization of critical infrastructures (e.g. Roe, 2016).

However, it is important to note that there are also many examples of unsuccessful crisis management by commercial companies, such as Ericsson's response to a fire at a supplier's plant in 2000, and Dole Food Company's response to Hurricane Mitch (Ponis and Ntalla, 2016). Second, as the present study has shown, it is hard to establish a causal link between improvisation and performance, and therefore outcomes might be due to other factors. Third, commercial companies that operate in a free market are, in general, considered better at adapting to the needs of their customers. Nevertheless, this is not necessarily true in a crisis situation. Improvisation in crises can be very different from adaptation to changing market conditions, and automatically assuming that being good at one implies being good at the other is dangerous.

We are aware that, in the words of Crossan and Sorrenti (1997, p. 175), "getting locked into definitional debates is a[nother] potential pitfall", and acknowledge that our paper may be overly focused on definitions and details. Is it really that important to address collective improvisation at such a level of detail? We would welcome a discussion of the question, and believe that it will contribute to the development of research on improvisation. In the meantime, however, we argue that the findings presented in this paper highlight the need for further research into how improvisation affects collective performance in crisis management, before we can assess whether we should develop a capability for it or not.

In our study, we strived for transparency, especially since the lack of

transparency is one of our concerns with the existing literature. Therefore, all steps are thoroughly documented, which, we argue, means that it can be repeated easily. We are aware of that certain steps are subjective and prone to bias, which may weaken validity. Issues include the selection of the literature to incorporate, which was affected by our background and values, as was the process of judging the quality and relevance of theories and methods. Furthermore, only the first author selected the relevant papers and carried out the in-depth analysis. Although we acknowledge that this may weaken the study's validity, the process was frequently critically examined and discussed with colleagues.

4.8. Moving forward – collective problem solving?

Our findings raise the question of whether collective improvisation provides a suitable framework to look at collective performance in crisis management? We acknowledge that in a crisis, improvisation may seem like the only reasonable way to solve problems under time constraints and uncertainty, but there is also a risk that it becomes just another loaded buzzword associated with positive values that can be used to describe and justify any process that deviates from the original plan. Vague concepts might have a negative impact on future empirical research, especially research with a normative underpinning.

We argue that a more pragmatic approach is to frame the problem as "collective problem solving"—at least until we have a better understanding of collective improvisation as a concept, together with any contextual benefits and drawbacks, and the connection between it and performance. This broader analytical framing would provide scope for the development of more applicable theory. The results of this study, and a larger scoping study of the cognitive aspects of crisis management (by the first author), suggest that problem solving is an over-arching issue when looking at crisis situations. Although improvisation may be one instrument that can be used when solving problems under time constraints and uncertainty, which often prevail in crises, taking a step back to look at broader problem-solving theories may help us to understand collective performance in crisis management.

We acknowledge that the problem solving domain is vast, and that concepts vary between disciplines and contexts. Nevertheless, some theories may be useful as a starting point. Traditional problem-solving models described in, for example, Smith (1989) or Mintzberg et al. (1976) have been criticized as overly sequential, simplistic and time consuming to apply to the dynamic context of crises (see e.g. Klein, 1998). Therefore, dynamic models such as Klein's (1998) non-linear problem solving, Brehmer's (2000) dynamic decision making, or the intuitive system 1 vs. analytical system 2 idea popularized by Kahneman (2011) may be more useful. To the best of our knowledge, most of these theories have been applied in an individual context, while studies at the collective level are rare.

Useful material may also be drawn from the domain of Cognitive Systems Engineering, (for an overview see Hollnagel and Woods, 2005). Crisis management systems can be seen as cognitive socio-technical systems consisting of humans and artefacts (e.g. computers or communication tools). Analysing such a system's cognitive processes means that, rather than trying to analyze the processes of each individual's mind and mapping this onto the system, we should conceptualize the system as a whole (Hutchins, 1995b). This approach means that we can observe representations of the system directly, without determining processes that are internal to individuals. More specifically, our work seeks to use the interactions between actors in a system, and the system's output (here, an improvised activity) is used as a means to observe collective improvisation; rather than measure individual improvisation to create a collective product.

Similarly, several research approaches are relevant in the context of collective crisis management. Examples include Macrocognition (Klein et al., 2006a,b), Resilience Engineering (Hollnagel et al., 2006), and Reliability Seeking Virtual Organizations (Grabowski and Roberts,

2016). However, to the best of our knowledge, the tools and concepts needed to investigate how collective improvisation (or problem solving) might be improved are lacking, or need to be developed. A fruitful way forward is likely to be based on combining insights from these areas with some of the contributions identified in the present scoping study.

5. Conclusions

Our scoping study found that existing literature has several limitations regarding the investigation of collective improvisation in the context of crisis management. Our findings demonstrate that research on collective improvisation lacks detail, and appears to merely aggregate individual improvisation to a collective level. Furthermore, empirical methods do not provide the tools that are required to observe and measure it. In addition, the connection between improvisation and performance needs to be further explored, in order to understand how the capability to improvise affects collective performance in crisis management. Finally, we found that research focuses on positive outcomes, while negative outcomes are neglected, suggesting that we need a more balanced discussion.

There are several implications of our findings. We argue that research on collective improvisation that is based on existing definitions and methods risks solving the 'wrong' problem. Specifically, general or individual improvisation, rather than collective improvisation is measured. Moreover, there is a risk that (collective) improvisation may become a folk model. In this case, it is intuitively associated with positive outcomes and assumed to have the same meaning for everyone, despite the lack of precise definitions. In a similar vein, given the lack of evidence regarding the connection between improvisation and performance, using 'successful improvisation' as a causal explanation for positive performance may be misleading. Finally, we should not overlook the risk that commercial companies may become associated with a greater ability to improvise in crises, as several recent examples suggest, as this may downplay criticism of the privatization and liberalization of critical infrastructures.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.ssci.2018.02.028.

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