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Collective improvisation in emergency response

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ABSTRACT

Emergencies are characterized by ambiguity and high stress. An emergency response typically involves a blend of public, private, and volunteer organizations. Responding to emergencies requires the capability to face unforeseen incidents and adequately adapt to them. The need for improvisation can be imperative for the success of an operation. Moreover, the interconnected nature of emergencies mandates collaboration, and collective improvisation can be a tool for handling challenges under the extreme complexity of an emergency. In this study, joint training is linked to the capability of collective improvisation in emergency response at an interorganizational level. The aim of this semi-conceptual study is to explore how joint training can improve collective improvisation capability in emergency response. To meet this aim, a literature review and pilot study are conducted. The context of this study is the management of emergency response in the Norwegian Arctic Sea region. The Arctic Sea region has a harsh climate with limited resources where involved organizations include both civil and military organizations, which makes the improvisation even more critical. This study shows that organizational memory, interorganizational trust, interorganizational communication, and information sharing are prerequisites and mediating variables that positively influence collective improvisation. Organizational structure and complex context also influence collective improvisation in emergency response.

1. Introduction

Over the past decade, emergencies have become increasingly transboundary (Pramanik, 2015). Correspondingly, today's emergency response organizations operate in an environment characterized by high risk and uncertainty. A series of incidents, such as the 9/11 attack, transport bombings in Europe, Hurricane Katrina, California wildfires, 22/7 Utøya, the Indian Ocean earthquake and tsunami in 2004, the Costa Concordia sinking, and the cruise ship Viking Sky incident in Norway, have confronted national governments around the world. These unanticipated tragedies have far-reaching and profound effects on society in general and emergency organizations in particular (Wang, 2008). Reducing the magnitude of these effects requires an effective emergency response and continuous interorganizational training. Table 1.

This study focuses on large-scale maritime incidents in the Norwegian Arctic Sea region because maritime activities are generally risky due to potential mechanical failure, natural and human-made disasters, scarce resources, and human error (Nielsen, 1999). The context of the Arctic amplifies the challenge related to the abovementioned factors due to extreme climate and weather conditions, combined with long travel distances and sparsely populated areas. Because of this, Arctic maritime emergency response actions are recognized as particularly challenging jobs that demand highly skilled emergency personnel, including those on board the ships that operate in these areas.

Managing maritime incidents in the Arctic increases the need for collaboration between actors from several preparedness institutions. Complicating variables related to the emergency response include the presence of different formal and informal institutions (Van de Ven & Walker, 1984), cultural differences, and a lack of trust between institutions involved in the international emergency response in the region (Curnin et al., 2015; McConnell & Drennan, 2006; Cohen et al., 1999; Kapucu, 2006). Increased environmental volatility may also call for flexibility in the command structure for improvisation and fast reorganization for successful collaboration (Borch & Batalden, 2014; Turoff et al., 2009). Therefore, the need for the capability to improvise can be one of several important factors besides planning, technical communication, and bilateral agreements for the success of an operation (Mendonça, 2001). Likewise, the interconnected nature of emergencies calls for joint training (Roud & Gausdal, 2019).

The importance of improvisation in emergency management has long been recognized by practitioners and researchers (Dynes, 1994;

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Table 1
Overview of exercises.

Name of exercise	Years	Description
Exercise Nord	2016 to 2019	Exercise Nord by Nord University is an annual full-scale exercise that has taken place for almost 25 years. Every year, the organizers have been able to change the exercise scenario. In 2016, 2018, and 2019, the scenario was an explorer cruise ship dealing with a fire in the engine room and requiring evacuation. In 2017, a terror scenario at the university campus was the topic of the exercise.
SARex Exercise	2016	SARex 2016 was the full-scale exercise in Svalbard connected to testing the implications of the Polar Code on national policies. In addition, practical implications were explored. The goals were to investigate the adequacy of the rescue program required by the Polar Code to study the acceptability of the standard equipment and improve winterization. In addition, the Norwegian Coast Guard personnel were able to share experiences on training for emergency procedures in icy waters with particular reference to evacuation and rescue from cruise ships.

Dynes & Quarantelli, 1976; Frykmer et al., 2018; Kendra & Wachtendorf, 2007; Mendonça, 2001, 2007; Webb & Chevreau, 2006). This debate has been initiated by criticizing the command and control structure, generalized as the appropriate normative model for all emergencies (Dynes & Quarantelli, 1976; Dynes, 1994). Regular joint training sessions between emergency organizations imply that they can learn and develop their capabilities in handling and contributing as a rescue resource in real-life incidents. One of the critical capabilities is to cope with uncertainty and pressure in situations characterized by limited access to resources and information. In areas with scarce resources, such as the Arctic, professional emergency organizations may need to develop stronger improvisation capabilities simply because there are fewer skilled resources available. Therefore, the organizations need to mobilize and rely on less-qualified rescue resources, such as random fishing, cruise, and transportation vessels that are coincidentally in the area. Woods and Hollnagel (2006) found that training and exercises increase the abilities of both professional and nonprofessional organizations to contribute to emergency operations in real situations and to improvise if necessary. Training may help organizations develop and improve their capabilities related to collective improvisation in critical situations.

Although some researchers have studied the concept of improvisation in emergency management (Rerup, 2001; Wachtendorf, 2004), few studies have been concerned with the need for joint training for collective improvisation in emergency response within a high-risk context. This study aims to bridge this gap in understanding through the following research question: *How can joint training improve the collective improvisation capabilities in emergency response?*

A semi-conceptual study is conducted to discuss this question and analyze potential answers. This assessment combines a literature review and exploratory interviews with Norwegian emergency response organizations who have been involved in recent emergency exercises in the Arctic. The conceptual perspective to address and structure the phenomenon of collective improvisation in emergency response situations is "interorganizational collaboration."

This study is organized as follows: after an introductory section (Section 1), Section 2 provides the method, and the literature and propositions are presented in Section 3. Section 4 presents the findings and discussion. Finally, Section 5 contains the concluding remarks and implications.

2. Methods

The quality of the data entry and how it has been consolidated and interpreted influence the credibility of qualitative studies (Graneheim & Lundman, 2004). This study was compiled with a sequence of procedures in order to draw valid inferences from the responses provided by the informants. The overall process is illustrated in Fig. 1.

The first part of this study is a literature review to provide an account of the state of knowledge within the research area of joint training and collective improvisation and connect the study to the broader theoretical picture (Gill & Johnson, 2002). The second part of this study is explorative interviews with civil and military organizations in Norway because the phenomenon of improvisation capability in emergency response is understood within the Arctic sea region. The interviews are primarily used for qualitative data collection for the empirical pilot study. The interviews are complemented with secondary data obtained from Nord University and University of Stavanger in Norway. These secondary sources include evaluation reports of Exercise Nord by the Nord University and SARex Exercise by the University of Stavanger. However, the use of evaluation reports is limited in the study and mainly used as background information.

Although this is not a classical hypothesis-testing study, parts of the literature review have been organized as proposition-developing activities that have been applied abductively to the analysis of the interviews. The purposes of the pilot study and supplementary secondary data are to collectively measure the propositions drawn from the literature review, validate the findings, and evaluate the extent to which the propositions are supported. The combination of multiple sources of data provides a more holistic understanding of the phenomenon, strengthen findings through data triangulation, and enhancing credibility and trustworthiness.

2.1. Empirical data collection

The empirical data were collected during 2016 and 2019 through semi-structured interviews and textual analysis of evaluation reports. The interview data were collected from two main Norwegian organizations that respond to maritime emergencies: the Coast Guard from the tactical level and the civil Joint Rescue Coordination Centre (JRCC) from the operational level. In Norway, these two organizations work together closely during maritime search and rescue operations. Six semi-structured, in-depth interviews were conducted with three Norwegian on-scene coordinators (OSCs) from the Coast Guard and three Norwegian search and rescue mission coordinators (SMCs) from the JRCC. The interview guide for the semi-structured interviews was tested via a pilot study on two informants within the emergency field and then was adjusted. The key informants were selected based on their participation in large-scale Arctic maritime exercises. The source of the secondary data is the evaluation reports on two full-scale exercises that occurred in Norway: Exercise Nord (we followed this annual exercise for four years) from 2016 to 2019, and the Search and Rescue Exercise (SARex) in 2016. The JRCC and Coast Guard took part in these exercises, and the informants are those who participated in the two exercises. The reason for this purposive selection of informants and using evaluation reports only from these two exercises was to ensure that they have some common experience from joint training activities in the Arctic.

Reflection on these two exercises served as a point of departure for the interviews. However, during the interviews, informants were asked to reflect on full-scale, tabletop, and simulation exercises that they have participated in within the Arctic Sea region because the aim of this study was not to analyze particular exercises, such as the Nord or SARex. All interviews were face to face and carried out in English, which is the second language for both parties. Each interview lasted approximately 45 min.

2.2. Data analysis

The literature review was performed via a structured search using the Scopus database. Based on the research question, several keywords

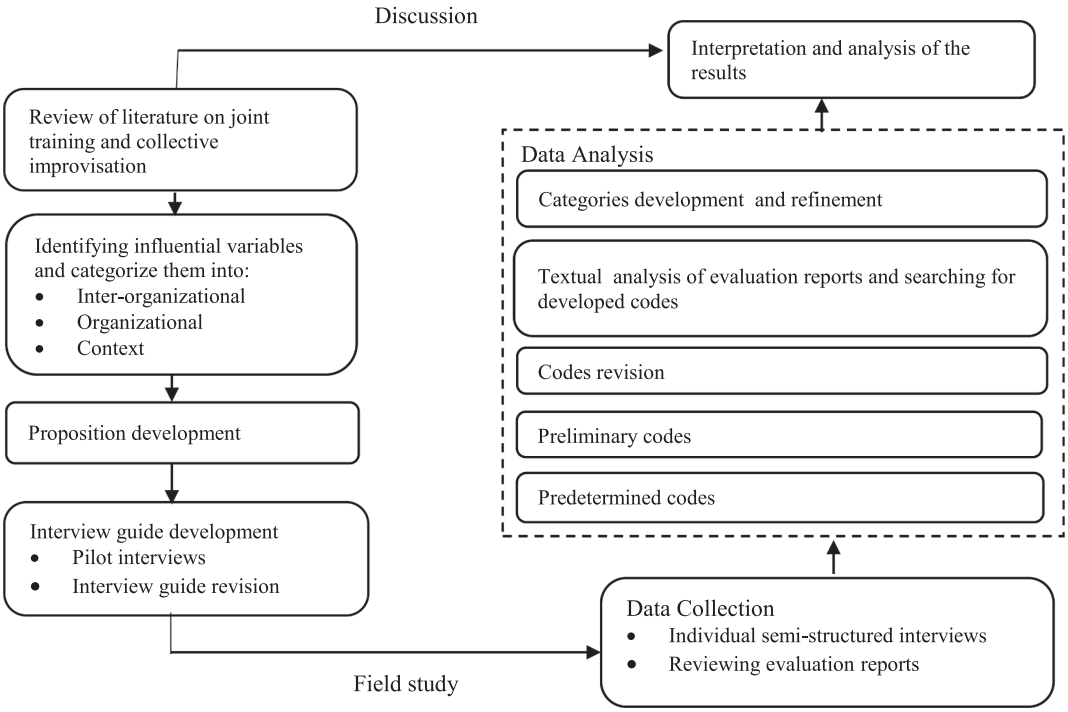

Fig. 1. Methodological approach.

were chosen for search queries. The relevance was based on whether the study covered improvisation as a concept during crises or emergencies and whether it investigated any factors influential on improvisation. Twenty-three studies were identified. Specific influential variables on improvisation were identified from the literature within both organizational and interorganizational studies. The variables were analyzed and categorized deductively under two categories: organizational variables and interorganizational variables. Then, the literature contributions were coded inductively into another category labeled context.

The semi-structured interviews were recorded and transcribed. In order to ensure anonymity and confidentiality of participants, the informants were given codes such as OSC1 or SMC1. The transcribed interviews were first analyzed and coded deductively (Miles et al., 2014) per the interview guide and identified themes from literature review and then were distributed according to the categories. All the findings from the interviews were listed in a table to compare the informants' inputs and the literature (Table 2). Interviews may include "subjective theories," spontaneously mentioned by the interviewees while answering open questions (Flick, 2018). The intention was not to influence the interviewees by asking questions about specific variables that had been identified in the literature but instead to let them discuss their experiences and voice their opinions concerning improvisation in an emergency context. Their responses were then analyzed to determine whether the specific, identified variables were similar to those found in the literature.

3. Literature review

3.1. Collective improvisation

The notion of improvisation arises in varied contexts, and the term "improvisation" has been defined differently within various domains, such as management, music, theater, therapy, and education. Several definitions of improvisation have similar features, such as "just-in-time strategy" (Weick, 1987, p. 229), "real-time composition" (Pressing, 1988, p. 142), "practice without planning" (Embrey et al., 1996, p. 22), creative and spontaneous behavior of managing an unexpected event (Magni et al., 2009), and simultaneous conception and execution (Zheng et al., 2011). In ordinary discourse, the composition of an activity occurs first and is followed by implementation; however, in improvisation, the time gap between these events is narrow so that, in the limited time, composition converges with performance (Moorman & Miner, 1998). Therefore, improvisation is defined as a response to an unexpected or unanticipated situation that is outside the boundaries of organizational preparation (Magni et al., 2009). While other concepts for responding to unexpected situations exist, such as innovation and adaptation, a temporal factor makes improvisation exclusive (Trotter et al., 2013).

Improvisation occurs at multiple levels, and with variable dynamics. This study uses the term "collective" to refer to improvisation at the interorganizational level, which is also the level of analysis. The term "collective" indicates improvisation when more than one actor is involved, and an actor can be either a person from another organization or a group of people from different organizations (Frykmer et al., 2018).

3.2. Importance of collective improvisation in emergency response

One challenging feature of emergencies is their dynamic nature. Although many, if not most, of the emergency cases are similar, emergency responses are nonroutine activities that often require situation-driven behavior in which the involved organizations need to adapt and improvise within the contexts of scarce resources and difficult conditions (Comfort & Kapucu, 2006; Drabek & McEntire, 2003). This adaptation demands creativity, flexibility, and competence to receive, process, and act on orders from external organizations, often referred to as collective improvisation in the literature (Mendonça & Wallace, 2007; Webb, 2004). Although all emergency organizations have their own established procedures and responsibilities, large-scale incidents call for collaboration and joint responses to cope with a demanding situation. Responders may act alone or within *ad hoc* or established organizations, and they might adhere to or depart from their expected roles (Bosworth & Kreps, 1986; Kreps & Bosworth, 1993). The study of improvisation is particularly appropriate in emergency response at different organizational levels in which numerous agencies may need to coordinate their activities to respond effectively (Mendonça & Wallace,

Table 2
Summary of findings.

Variables and propositions	References	Key findings of the pilot study	Supported by pilot study
Role of context Because collective improvisation is more crucial in a complex environment, and joint training positively influences this capability, joint training is more crucial in a complex context.	Mendonça & Wallace (2004), Woltjer et al. (2006), Mendonça & Fiedrich (2006), Van de Walle et al. (2014), Borch & Andreassen (2015), Roud et al. (2016), Roud & Gausdal (2019), Roud and Gausdal (2019)	Complex context requires improvisation. In extreme environments, it is impossible to plan everything. Due to the nature of the emergency response and the vulnerability in an Arctic environment, improvisation is critical. Time constraints in the Arctic are extreme, so improvisation can be a solution for management. It is necessary to constantly train and improvise in harsh environments where survival time is short. The emergency context in the Arctic is life-threatening, so organizations must be prepared and trained regularly. Being capable of improvising must be the focus in complex contexts. Complex contexts require collaboration and collective sense-making because improvisation occurs socially or jointly. Lack of cooperation may hinder collective improvisation. Collaborative training is needed to achieve this. Tailormade training for improvisation is critical to handle challenges.	Supported
Organizational structure Hybrid organizational structures may improve the collective improvisation capabilities in emergency response.	Weick & Roberts (1993), Mendonça & Wallace (2004), Egeberg & Trondal (2009), Ansell et al. (2010), Egeberg (2012), Borch & Batalden (2014), Christensen et al. (2016a)	Different organizations have different hierarchies. Civilian organizations may have a more flexible structure than the military. Improvisation requires a hybrid system to have some structure and flexibility. The structural mechanism that allows responders to decide based on the local situation may tolerate improvisation. Organizations in joint operations need to ensure that they can reconfigure rapidly and generate a new plan to execute. Familiarity with other organizations' structures and decision-making commands helps improvisation emerge. Joint training is necessary, so organizations develop competence on how to act when the structure system changes.	Supported
Organizational memory Organizational memory may mediate the relationship between joint training and collective improvisation capabilities in emergency response.	Moorman & Miner (1997, 1998), Crossan et al. (2005), Vera & Crossan (2005), Mendonça (2007), Størseth et al. (2009)	Logs of exercises and previous incidents should be reviewed to improve improvisation capabilities. Exercises should have clear learning outcomes and be evaluated to determine whether the objectives are met. The trainer should manipulate the factors and evaluate improvised actions or decisions. Improvised actions can be the result of learning. Experience from exercises or real incidents influences future improvisation. Evaluation should be a principal component of exercises. This directly adds to organizational knowledge. If joint training leads to developing new knowledge and competence, then it influences organizational memory. Having a shared database for past exercises and incidents is a proper way to store information in organizations. In seminars and conferences, we share our experience, but there may be a need to store such information properly in the organization.	Partly Supported
Interorganizational trust Interorganizational trust may mediate the relationship between joint training and collective improvisation in emergency response.	Mishra (1996), Lee et al. (2006), Gausdal et al. (2016), Roud et al. (2016), Roud & Gausdal (2019) Christensen et al. (2016b)	Joint exercises can contribute to building trust. Trust is directly linked to reliability, affecting collective improvisation. Trust plays a significant role in emergency management and processing sensitive	Partly Supported

(*continued on next page*)

Table 2 (*continued*)

Variables and propositions	References	Key findings of the pilot study	Supported by pilot study
		information that has a substantial effect on collective improvisation. Too much blind trust may have negative consequences. Some level of control should exist in emergency response. The trust between the individual and their organization and between organizations is a prerequisite for developing collective improvisation capabilities. Experience and face-to-face communication in exercises may help develop interorganizational trust. Having a supportive culture in organizations enables improvisation. Training provides a safe environment for trust development and improvisation. In a trust-based country, such as Norway, improvisation is not sanctioned or interpreted as an error. The trust-based approach potentially increases the accomplishment of improvisation. The physical distance between emergency organizations hinders frequent interaction and trust-building, whereas exercises can contribute to developing a close relationship to overcome the physical distance.	
Interorganizational communication and information sharing Information and communication may mediate the relationship between joint training and collective improvisation in emergency response.	Cooper & Kleinschmidt (1986), Pigeau & McCann (2000), Comfort & Kapucu (2006), Johansson & Hollnagel (2007), Bharosa et al. (2009), Rankin et al. (2013)	Information is critical because incorrect information can have a catastrophic result. Effective communication is the core of successful improvisation. Collective improvisation fails in situations with poor interorganizational communication. Real-time communication is crucial for collective improvisation. Real-time information is vital in complex decision-making. Immediate feedback from the upper level and on-scene is critical for improvisation. The Arctic has limited coverage, so communication in various scenarios in exercises is challenging. Coordinating resources requires stable communication, and in the Arctic, this is a massive obstacle. Familiarity with the communication structure of other organizations facilitates the improvisation process. Exercises and training help overcome communication challenges associated with improvisation. Disseminating and exchanging information in face-to-face meetings during exercises is helpful. Informal contact may lead to smoother and faster improvisation in complex contexts. Informal connections can be established in joint training and programs. Having pre-communication and knowing other organizations facilitates improvisation and prevents compromising response quality.	Supported

2004).

Improvisation can be a matter of survival because, in a dynamic environment, individual and organizational expertise is futile unless it is put to use in creative ways that match situational demands (Rerup, 2001). Even in highly structured organizations, such as the military, improvisation is a well-grounded process that can be leveraged to manage situations where plans, procedures, and methods fail (Ciborra, 1999). Previous literature has highlighted the importance of improvisation and concluded that an emergency with no need for improvisation is probably not a genuine emergency (Kendra & Wachtendorf, 2007). Therefore, improvisation and emergency response are closely related. Without adequate collective improvising, emergency management may lose its flexibility and ability to adapt to the changing environment and, thus, lose its effectiveness (Mendonça, 2007). The outcome of improvisation in this context is survival. Learning by doing is understood as creating or upgrading knowledge, capabilities, and competencies. Improvisation is a capability that fades if it is not exercised regularly (Rerup, 2001).

It is challenging to explore an organization's improvisational capabilities during a real response operation (Rodríguez et al., 2006). Furthermore, it is difficult to document all the experience, human interaction, and human behavior under emergency response circumstances (Killian, 1956). Joint training between organizations is one way to develop improvisational competence and capabilities. Training may be defined as a method for developing knowledge, capabilities, and attitude (Salas & Cannon-Bowers, 2001). Full-scale exercises are one of the methods proposed to study and train for improvisation (Mendonça, 2007; Mendonça & Wallace, 2004; Rodríguez et al., 2006; Trnka et al., 2016; Woltjer et al., 2006). In this study, the term *joint training* refers to tabletop, full-scale, and simulation exercises in which multiple organizations gather and train together to better prepare for emergency response. These are the types of exercises that informants generally reflect on; however, some studies have highlighted the difference between the terms *training* and *exercise* (Green, 2000; Skinner & Hodges, 2006; Bullock et al., 2017; Salas & Cannon-Bowers, 2001; McEntire & Myers, 2004). According to Salas and Cannon-Bowers (2001), *training* has a performance-related purpose with defined needs that may require the individuals and organizations to exercise, whereas *exercise* refers to activities where individuals and organizations develop specialized knowledge, skills, and attitudes to meet training needs (McEntire & Myers, 2004). Nevertheless, in this study, the terms are used interchangeably. Therefore, the proposition (P1) is that *joint training positively influences collective improvisation capabilities in emergency response.*

3.3. Role of context complexity

Organizational theory has treated complexity as a structural variable that characterizes both organizations and their environments. Simon (1996) defined a complex organization as one made up of many parts that have multiple interactions. Likewise, Thompson (2017) described a complex organization as a set of interdependent parts, which together make up a whole that is interdependent with a broader environment. Concerning organizations, Daft (1992) equated complexity with the number of activities or subsystems within the organization.

With respect to the environment, complexity is equated with the number of different items or elements that must be dealt with simultaneously by the organization (Daft, 1992). Njå (1998) asserted that rapid and often unpredictable changes characterize complex environments, whereas Pearson and Clair (1998) claimed that an emergency is a low-probability and high-impact event that threatens the viability and goal of the organization. Although emergency events are unpredictable, they are not unexpected (Massey, 2001).

Large-scale emergency response in the Arctic is considered a complex context. Large-scale incidents, such as a cruise ship sinking, require collaboration between private companies, governmental and local agencies, and volunteers. Therefore, the emphasis of the study is on emergency organizations in the Arctic where multiple organizations operate in a complex environment (Andreassen et al., 2018). The Arctic Sea region has changed in the last century, and the environment has become more complex due to changing ice conditions and an increase in the number of vessels operating there (Borch et al., 2016a; Dalsand & Nese 2016; Kim et al., 2014; Marchenko et al., 2015). This turbulent environment creates high interaction and dependency between actors and activities in the area.

The distinctive characteristics of an emergency in the Arctic makes it unique, and this demands improvisation in emergency response for the following reasons. First, in comparison with other seaways, the Arctic has fewer floating objects (Borch et al., 2016b), and the rarity of maritime incidents in the Arctic limits the chances for learning. Moreover, the time pressure forces the convergence of planning and execution because the survival time in this harsh climate is extremely short. Furthermore, large-scale events have high and broad consequences that are hard to predict; hence, the complexity of events rises. Therefore, interdependencies must be managed among a wide range of physical and social systems. Finally, multiple decision-makers and responding organizations may need to negotiate in the process of responding to the event, which is especially difficult because communication is challenging in remote areas of the Arctic. When more than one Arctic nation is involved, decision-making becomes even more complicated and time-consuming. In emergency response, decision-making challenges are not caused by a lack of planning, but rather develop because, in fact, the major problem in emergency management is that the team often does not exist formally until the emergency occurs (Van De Walle et al., 2014). Consequently, emergencies in the Arctic introduce an acute demand for quick response and resources, and collective action and collaboration are the solutions to access scarce resources (Svedin, 2016). Thus, proficiency in collaboration and collective improvisation can be an effective and efficient way to be more resilient in case of the threat of a large-scale incident in a complex environment. Therefore, the second proposition (P2) is that, *because collective improvisation is more crucial in a complex environment and because joint training can positively influence this capability, joint training is more crucial in the complex context.*

3.4. Organizational structure

Improvising collectively requires an environment that supports creative and spontaneous behavior. Johnstone (2012, p. 118), a theatrical teacher, said, "If I want people to free-associate, then I have to create an environment in which they aren't going to be punished, or in any way held responsible for the things their imagination gives them." Improvisers take signals from their environment and take action with whatever they have at hand (Weick & Roberts, 1993).

An organizational structure is a normative structure composed of rules and roles that specify, more or less clearly, who is expected to do what and how they are expected to do it (Scott & Davis, 2015). Thus, the structure broadly defines the interest and goals to be examined and the considerations and alternatives that should be treated as relevant. Moreover, structure emphasizes how departments are designed and which regulations, policies, and procedures control the activities (Egeberg & Trondal, 2009). Improvisation requires a structure that allows for bottom-up solutions that are sensitive to local conditions rather than imposing top-down rules (Mendonça & Wallace, 2004). Therefore, the organizational structure can influence the environment in a way that provides the opportunity to improvise.

In emergencies, the degree of autonomy of the involved organizations and the quality of the information provided for making major decisions may be crucial. A meaningful vertical relationship exists between central and local authorities that are more frequently faced with practical challenges or the operational side of an emergency (Christensen et al., 2016a). As several organizations are involved in emergency response, an integrated structure is required for all of them. They all have important roles to play in building a resilient society (Parlak & Gunduz, 2015). An emergency underlines the necessity for strong leadership and central control at the strategic level, but an emergency emphasizes the need for local autonomy and flexibility at the operational level. In emergency response in the Arctic, local improvisation may be difficult if central constraints are extreme and allow the local actors only restricted freedom (Christensen et al., 2016a). Thus, local competence, knowledge, and training become crucial factors in the Arctic.

A significant finding in the literature is that emergency management systems should be decentralized at least to some degree, implying that political and administrative executives should facilitate a self-organized response system rather than try to control that system (Ansell et al., 2010; Boin, 2008). Emergency management has many dimensions and layers. The size and abundance of the emergency management layers make it diverse, and many necessary components must be brought together. The multiplicity of components and layers reveals the importance of the mixed structure, called a *hybrid structure* (Parlak & Gunduz, 2015). The common characteristics of a hybrid structure are

independent and generally separate ownership by organizations and individuals, but they execute joint management activities and common services (Moynihan, 2005).

During a large-scale maritime incident, which is characterized by complexity, uncertainty, and ambiguity (Head, 2008), the organizational structure often does not fit the problem structure. Specialization based solely on purpose or specific tasks is not the best solution to transboundary emergencies in general. The high environmental volatility in the Arctic may make the situation even more challenging and calls for dynamic capabilities in the structure for collective improvisation and fast reorganization for further interorganizational collaboration (Borch & Batalden, 2014; Turoff et al., 2009). Accordingly, emergency response may benefit from a loosely coupled organizational structure. Therefore, the third proposition (P3) is that *a hybrid organizational structure may improve collective improvisation capabilities in emergency response.*

3.5. Organizational memory

Organizational memory involves organizational knowledge, capabilities, procedures, and shared assumptions and beliefs (Moorman & Miner, 1997). The literature has emphasized organizational memory —the knowledge stored within an organization, such as routines and prior experience. Organizational memory has been studied within the improvisation concept but, at present, has fallen outside the safety context (Crossan et al., 2005; Moorman & Miner, 1997; Vera & Crossan, 2005). However, both Klein (1993) and Mendonça (2007) related organizational memory to the combined expertise and experience of those in an organization and found a positive relationship with improvisation. Greater expertise provides members of the organization with a larger source of knowledge to draw upon when engaging in pattern recognition and mental simulation. Having a greater pool of events to draw upon increases the likelihood that members of an organization can identify leverage points on which to build improvised solutions. This idea is supported by the recommendation of Størseth et al. (2009) that an organization can prepare for successful improvisation by ensuring members have a wide variety of response options and knowledge on which to base their responses.

According to Moorman and Miner (1997), scholars disagree on whether organizations, similar to humans, store information in memory. However, this may depend on the definition of memory. Thus, it seems that a growing number of scholars (Casey & Olivera, 2011; Moorman & Miner, 1997; Walsh, 1995; Walsh & Ungson, 1991) have realized that organizations reflect the presence of stored knowledge through their processes and physical artifacts. Thus, the nature of the improvisation that can occur is influenced by organizational memory (the past experiences of the groups of actors in the system), and in turn, improvisation modifies that memory. The term "memory" refers to both knowledge stored in nonhuman and human repositories (Crossan et al., 2005). Thus, organizational memory involves expertise and skills that depend on innate cognitive ability and formal and informal training and education (Crossan et al., 2005). Broad and diverse expertise and competence developed via joint training will better prepare the organization to effectively improvise in emergencies (Crossan et al., 2005). The proposition, therefore, aims to incorporate organizational experience and the influence of organizational memory into the relationship between joint training and collective improvisation. Hence, the fourth proposition (P4) is that the *organizational memory level may mediate the relationship between joint training and collective improvisation capabilities in emergency response.*

3.6. Interorganizational trust

Trust is considered a multi-dimensional and dynamic concept (Butler, 1991) and has been defined differently by different scholars. A robust definition of trust with a focus on vulnerability is "the willingness of a party to be vulnerable to the action of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor and control that other party" (Mayer et al., 1995, p. 712). Although this definition was developed at the interpersonal level, it may also work at the interorganizational level because the decision regarding whether to accept vulnerability is made by individuals, even if they do so on behalf of organizations. Mayer et al. (1995) identified three dimensions of trust: ability, benevolence, and integrity. McAllister (1995) distinguished between affective and cognitive-based trust. Similarly, Abrams et al. (2003) distinguished between competence-based and benevolence-based trust. Moreover, Roud and Gausdal (2019) identified that interorganizational cognition-based trust is crucial in emergency response operations. However, their findings did not identify affect-based trust as essential for the response operation (Roud & Gausdal, 2019).

Interorganizational trust is a key factor of collaboration in the context of networks (Gausdal, 2012) and might have the same effect in collective improvisation in emergency response. Trust across sectors and organizations may help the actors to focus on joint problem solving, which allows for improvisation and implementation of new strategies that enhance better performance (Christensen et al., 2016b). Having the capabilities to improvise and devise alternative solutions also helps emergency organizations to manage and respond to incidents better that occur unexpectedly with a low degree of probability and predictability (Torgersen et al., 2013).

The organizations operating in joint emergency response depend on an elaborate body of collective knowledge and diverse skills and have minimal time or no time at all to determine who knows precisely what (Meyerson et al., 1996). The involved organizations function as one temporary collaborative organization under joint command. In such temporary organizations with extreme time pressure, swift trust (Curnin et al., 2015; Meyerson et al., 1996) may emerge. Regarding this, Roud and Gausdal (2019) investigated the concept of swift trust in emergency management exercises and identified that collaborative exercises and training develop trust among involved organizations in the emergency preparedness phase. Thus, joint training can be identified to enhance trust among the involved individuals and organizations (Lee et al., 2006). Because it strengthens interorganizational performance and collaboration (Foulquier & Caron, 2010; Gausdal et al., 2016; Mishra, 1996; Virrantaus et al., 2009; Zucker, 1986), trust is one of the keys to strengthening interorganizational collaboration (Mathieu et al., 2001). On the grounds of substantial uncertainty, a high risk of cognitive and organizational errors (Webb, 1996), and high dependency on other organizations, interorganizational trust is crucially important to improvise collectively to respond to emergencies. Hence, the fifth proposition (P5) is that the *interorganizational trust level may mediate the relationship between joint training and collective improvisation capabilities in emergency response.*

3.7. Interorganizational communication and information exchange

One of the key elements for collective improvisation in emergencies is effective methods of communication (Rankin et al., 2013). Access to information and an appropriate informational infrastructure among emergency organizations in a complex environment is crucial for fast decision-making (Bharosa et al., 2009; Comfort & Kapucu, 2006). The capabilities to coordinate actions and collectively improvise requires well-functioning communication. Organizations experience challenges in a large-scale emergency due to poor communication and unfamiliarity with the communication structure of collaborating organizations (Bharosa et al., 2009). Large-scale emergencies require sharing and coordinating information between numerous autonomous organizations, causing friction in the relief activities (Adrot & Robey, 2008). These findings underline the need for high information quality for the emergency organization. This becomes more critical when response organizations need to take a role for which they lack previous training,

experience, and professional competence (Rankin et al., 2013). During an emergency response, information flows from fixed channels following the chain of command (Boersma et al., 2019). Therefore, the defined roles and functions influence information sharing, and the challenges of information sharing, in turn, influence communication for collective improvisation. Different communication patterns and information systems may hinder collective understanding and may consequently affect collective improvisation in emergency responses (Johansson & Hollnagel, 2007).

Joint training may facilitate communication and resilience, which are essential for collective improvisation in emergencies (Johansson & Hollnagel, 2007). Joint training and exercises may provide a platform for developing communication skills by establishing a common language and professional terminology. Therefore, organizations that need to communicate in future emergencies may obtain a baseline level of literacy in that language and become familiar with each other's communication media and structures (Pigeau & McCann, 2000). Well-practiced organizations that emphasize communication and information may avoid time-consuming mistakes in rapid decision-making in a changing environment (Cooper & Kleinschmidt, 1986). Hence, the sixth proposition (6) is that *the proper communication and information exchange may mediate the relationship between joint training and collective improvisation capabilities in emergency response.*

4. Findings and discussion

The findings from the literature review, interviews, and exercise evaluation reports indicate that, in facing an unexpected event with novel problems, those involved must act quickly. Therefore, improvisational capabilities play a significant role in handling emergencies. Incidents in the Arctic demand decision-making under extreme time constraints. The interviews showed that, after a general discussion on improvisation, almost all referred to the importance and links between training and improvisation capabilities. According to informant SMC1 and SMC3 in Norway: "Even if we have extensive planning, still we have to improvise and train how to improvise in parallel." "In a SAR [search and rescue] operation in the Arctic, it is difficult to have a complete situational report all at once, so improvisation is part of our daily task." A couple of informants mentioned the training aspect of improvisation. Informant OSC3 highlighted, "Even though the improvisation is essential in emergencies, we need proper practice and experience to improvise correctly and not make the situation worse." "In emergency operations, none of the operations is exactly the same as previous ones; that is why we constantly train for more efficient decision making with limited information available."

Nearly all informants agreed that they are not interested in improvisation itself but in the capability to improvise based on a limited analysis, which is crucial. Informant OSC2 asserted, "Before we improvise, we have to able to assess the situation and make sure that our current plan is not applicable; then we can think of improvisation. This is exactly what we need to train for." Following the discussion on the capability to improvise, informant SMC2 said, "In a SAR operation, many actors are involved. Thus, if an organization improvises, the other actors need to be capable of responding and maybe improvise too. This can increase the complexity of the situation." He continued, "That is why we participate in joint exercises to learn how to respond collectively." The interviews revealed that OSCs and SMCs are fully aware of the definition of improvisation and its importance. The findings support Propositions 1 and 2 and show that the informants reflected on joint training and collective improvisation capabilities in the Arctic.

4.1. Organizational structure

The organizational structure and the word "hierarchy" were frequently used by informants, discussing how hierarchy is essential in situations where they must improvise. Informant SMC1 argued, "The nature of our job requires flexibility because each situation is unique, but it all depends on the leader of the operation and the organization in charge, which in Arctic SAR is the Joint Rescue Centre." She continued, "The interdependencies in emergency response where different organizations with their own organizational structure [are] working together, make collective improvisation a real challenge." Informant OSC1 who is usually fully responsible for coordination and decision-making at incident scenes said the following:

I normally execute a predefined task, but in complex situations, the critical decision is taken over by a higher-level organization in a strategic meeting at JRCC. Because a large-scale event is rare and can develop in multiple directions, the organization should develop more flexible plans to be capable of reconfiguring and executing almost simultaneously.

Informants also stated that collective improvisation is dependent on the prior exercises and training that help organizations become familiar with all the hierarchy and decision-making structures of other involved organizations. Informant SMC2 said that, because the emergency response in the Arctic is complex and demanding, organizations could face unpredictable challenges. Therefore, involved actors need to train on how to act if the structure and system change. He said, "We require a system that is not strongly structured because if one component is not at a place, then, the whole organization will collapse. To deal with this, we need a hybrid system, continuous practices, and informal contact." Nevertheless, the need for informal contact as an interplay between formal structure and informal networks might be highly relevant for trust development and interorganizational communication (Lane & Bachmann, 1998; Temby et al., 2017).

The evaluation reports of Exercise Nord revealed that all the organizations had to follow the descriptive scenario based on each organization's plan and procedures without having the opportunity to improvise if needed (Nord, 2016, 2017). Most of the informants agreed that they had to follow the Nord exercise scenario, which was consistent with their organizational structure. Informant SMC3 said, "We understand that we should meet the exercise's objective, but at [the] same time, there is a need for some autonomy both at individual and organizational level[s]. This is more critical in incidents where NGOs [nongovernmental organizations] or private organizations are involved." Further questions were asked about why this is important in collaboration with NGOs, and he continued:

During our collaboration with other governmental organizations like [the] Coast Guard or police, there is a kind of pre-established confidence according to their competence and their familiarity with the strategic structure of communication; however, when it comes to other organizations, we need to be more flexible, especially in the Arctic area, because some local organizations may have more precise knowledge about the area, like fishing vessels. In some cases, they are on scene before [the] Coast Guard, and we need to coordinate and engage them in the operation. That is when we need to have flexibility and, at the same time, follow the major structure."

The evaluation report of SARex showed that the emergency response in the Arctic sea region is very demanding and complicated. A short time of survival and poor communication coverage put extra pressure on emergency organizations. Informant OSC2 addressed these issues as follows:

In [the] case of [a] large-scale incident in the Arctic region, it is not easy to fully follow the command and control structure. We need to exercise more in a realistic environment to practice coordination and improvisation in [a] joint response. Therefore, it is very important for us to have flexibility that enables us to improvise. But this doesn't mean we don't need structure; otherwise, collaboration will turn out to be chaos. The balance of having structure and flexibility can improve our response efficiency as well.

The findings from this section support the critical influence of organizational structure in improvisation in general and collective improvisation in particular. The findings are in line to a large degree

with the literature presented before. Therefore, the pilot study supports Proposition 3.

4.2. Organizational memory

Almost all the informants suggested that improvisation is somehow grounded in organizational memory. Informant OSC3 said, "I can see the link between learning and memory clearly, yet this learning from training or real incidents needs to be encoded into organizational memory. Otherwise, there is no point in training for improvisation." Similarly, informant OSC1 highlighted, "Having a systematic way of storing the logs and evaluations of exercises where all the involved organizations have access can be a solution to collectively improvise in the future and prepare for [a] joint response." Therefore, it can be argued that knowledge stored in organizational memory from the past can be recombined by actors in present or future improvisation. Exercise evaluations were the focus of some of the interviews, and the informants constantly discussed the role of evaluations after exercises. Informant SMC1 said, "Developing improvisation capability needs proper training, but training without detailed evaluation is useless. Not everyone can participate in large exercises that happen once a year, so all the evaluation should be stored in an organization."

Informant SMC3 emphasized that training is not necessarily useful for collective improvisation. He said:

Joint exercises without clear learning outcomes and objectives, this is a waste of money and time. We need tailormade exercises with improvisation in the center, and all the participants should be fully aware of it. Apart from the individual benefit, organizations should learn the most out of exercises to develop organizational and interorganizational improvisation capability.

Informant OSC1 argued that, under stressful conditions, mutual understanding is the core of improvisation. He said:

In a high workload situation where several organizations are working together, only the response team who can anticipate the other's needs and can adapt to changing situations will be successful. If organizations have this awareness coupled with the knowledge of actors' competence area stored in memory, then they have a decent system for collective improvisation. This is one of the reasons that the Coast Guard exercises a lot with JRCC to have [a] better understanding.

The findings of this study are similar to the outcome of two studies that investigated the link and relationship between training, memory, and improvisation (Miner et al., 2001; Vera & Crossan, 2005). The informants discussed learning as more than a memory. The findings also revealed the significant role of rational leadership in an emergency, which means that actors permit different people to take the lead depending on the needs of the situation (Liang et al., 1995). Joint training will lead to developing the competence to work together smoothly and to improvise collectively. People who have been trained together face less need for planning and have greater cooperation, fewer misunderstandings, and less confusion in a situation where they need to improvise collectively (Liang et al., 1995). The findings of this section partly support Proposition 4.

4.3. Interorganizational trust

Informants addressed the need for and development of trust between organizations. Some informants agreed that trust is directly connected to reliability. Informant OSC2 argued, "Trust plays a significant role in emergency management and processing the sensitive information that has a high impact on complex situations." Similarly, informant OSC3 said, "Who to trust in an unfamiliar setting, let's say in [a] large-scale emergency response, is not easy [to determine], but trust is a prerequisite for ad hoc decision-making." Likewise, informant SMC3 said, "The safest data is the one I see with my own eyes or from a trusted party." Pre-existing relationships and good collaboration seem to go hand in hand. This tenet is illustrated by informant OSC1 who said, "The better we know each other, the easier the collaboration will be." "In emergencies, multiple professional organizations are working closely, and in Norway, we trust each other, so collectively improvising is all right and well accepted, while this might not be the case in an international operation." Informant OSC2 said:

Improvisation has a lot to do with how much your organization trusts you and how much you trust the organization. This is the same when we work with JRCC. We have a good connection and working relationship. I am not sure how it should be with a stranger organization if we don't have prior experience with them. I have a direct number to call in JRCC when I am in need. We already had much training together and established a trustworthy relation.

All informants agreed that improvisation requires organizations to support improvisers, and that is how collective improvisation can be successful. Informant SMC3 mentioned, "Our organization is backing us for improvisation, but we have to keep in mind that our improvised decision should not cause harm to anyone." He continued, "Continuous training can be a good solution by providing a safe environment to practice improvisation and develop mutual understanding between the collaborating organizations." Informant SMC3 said, "Participations in recurrent exercises can facilitate the process of trust-building; this is what I experienced after taking a part in Nord exercises for three years." Reviewing the evaluation report of Exercise Nord showed that less time was used, at least in the planning phase, in 2018, which might be due to the establishment of mutual understanding between the actors after several years.

Several informants emphasized the value of joint training and claimed that it is very practical and useful for trust development and future emergencies. Informant SMC1 said, "In the Arctic, the number of huge incidents is limited, meaning the organizations don't have enough experience. Training and exercises between organizations is a good platform to gain experience and meet each other. This gives us a better perspective on other organizations' competence." Some asserted that tabletop exercises might be more useful for trust development because participants sit in a small group and discuss issues without time stress. Informant OSC3 said, "Frequent interaction and exercises influence our level of trust, both personal and organizational. That helps us to share the report and documents more freely." Overall, the informants agreed that trusting relationships and not feeling like strangers were very beneficial in collaboration and particularly in joint decision-making and improvisation. The findings in this section explain the role of trust in collective improvisation and trust development during exercises. The informants did not explicitly focus on collective improvisation but more on individual improvisation. Nonetheless, the finding partly supports Proposition 5.

4.4. Interorganizational communications and information exchange

All informants have addressed the importance of communication and information exchange. Informant OSC2 said, "Most of our decisions are made based on the information we get, so in [the] case of wrong input, we will have catastrophic results in response. Regardless of the need for improvisation, communication and time are the core in emergency operations." Informant SMC2 said, "Improvisation may fail or suffer due to poor communication between organizations and involved personnel." Most of the informants agreed that time is crucial, and real-time information plays a critical role. They expressed that having real-time information can facilitate their decisions in a complex situation and lead to adequate improvisation. Informant SMC3 emphasized, "Immediate updates from the scene can guide me when I should deviate from our standard routine and improvise; also, I need quick feedback based on our improvised action from a higher level of command." Following his statement, others also refer to the real-time factor of receiving information. Informant OSC2 said the following:

In the Arctic, communication is not as smooth as in the Mediterranean. In some areas around Svalbard, communication is extremely poor,

and we need to improvise a lot, but we need to remember that JRCC and other actors need to know what we are doing. So, this poor communication can sometimes create serious problems for those coordinating the resources and other vessels operating in the incident area. It's not easy to decide whether you should improvise or not without [a] proper communication channel.

Several informants agreed that training and exercises could facilitate handling communication and information challenges. The majority claimed that feedback helps to develop competence and act on time accordingly. Informant SMC2 said, "Informal contact is very useful for further information exchange and dissemination. One effective way to establish such contact is participating in collaborative exercises where you actually meet people face to face." A couple of informants (OSC1 and OSC3) discussed the role of informal communication: "Norway is not a big country, and I know the key people in the field; however, improvisation is not always happening in formal form; most of the time, it is a combination of formal and informal ways of communication." "The informal communication and relationship can be developed in joint activities such as exercises, seminars, and conferences." Informant SMC1 partly described the role of training and communication in developing improvisation capability: "Because improvisation in emergency response is happening in a collective setting, improvisers must learn and practice how to communicate and share information within the group to the upper level in a way that they don't compromise the response quality." Reviewing the evaluation reports of Nord exercise from 2016 to 2019 revealed that participating organizations used less time on establishing communication channel and making decisions in 2019 comparing to 2016. This might be due to their annual participation in Nord exercise, which facilitated fast decision-making and may possibly lead to adequate improvisation. This is in line with the findings from interviews.

The findings from interviews confirmed the significance of communication and information exchange in collective improvisation during emergency response. Moreover, these findings highlighted the role of informal communication, which is not covered in the theory presented in this study. However, this can be intricately linked to the influence of trust in collective improvisation. The findings identified that the familiarity with the communication technology of other organizations and the structure of information flow are particularly important for collective improvisation. Therefore, Proposition 6 is supported by the pilot study. An outline of the main findings from the literature and the pilot study about how collective improvisation capability is influenced by joint training is provided in Table 2.

5. Conclusion

This study addressed the challenges and highlighted the importance of collective improvisation capabilities in emergency response. The aim of this study was to explore how joint training can influence collective improvisation capabilities, which was accomplished by drawing upon the literature on emergency management, improvisation, organizational factors, and the role of context. Some aspects of the relationship between joint training and collective improvisation, such as interorganizational trust, interorganizational communication, information exchange, and organizational structure, are identified and considered to be matters that may influence collective improvisation. The findings of the pilot study suggested that organizational memory, interorganizational trust, interorganizational communication, and information exchange are mediator variables. Complex contexts and the organizational structure are independent variables that may influence collective improvisation capabilities. Based on the preliminary findings and the literature, a conceptual model is proposed to illustrate the relationships in Fig. 2.

This study highlighted that the maritime emergency response in the Arctic is more challenging than the emergency response on the mainland. This is due to harsh weather conditions, long travel distances, the lack of communication infrastructure, and limited resources that may subsequently increase the risk of emergency operations in the Arctic sea region compared to the mainland. These contextual challenges, among others, may lead to slow information flow between the involved organization, requiring the involved actors to make decisions and take action based on the limited available information. Collective improvisation in large-scale Arctic Sea emergencies is critical, particularly given their unique contextual challenges. The study has theoretical and practical implications. The theoretical implications include the novel framework indicating how collective improvisation is influenced by joint training, context, and organizational structure. Moreover, the six developed propositions contribute to emergency management and training theories. Practical implications include the acknowledgment of the joint training influencing improvisation capabilities in emergency response and the emphasis on training to improve response team collaboration and performance. While training and exercises are vital tools in all high-risk contexts, the infrequency of maritime incidents makes such practice particularly important in the Arctic.

The study has some limitations. The existing literature on collective improvisation is scarce, and the empirical sample is quite small and did not include some key personnel in the response operation. The interviews were in English, which is the second language of both the interviewer and informants. Moreover, the semi-structured interviews show a lack of standardization for the data-collection process. Norway is considered a high-trust country (Newton, 2001); thus, the data from the pilot study may not be applicable in a low-trust country. There are considerable possibilities for future research. The results from this study are limited in scope and must be corroborated in further studies. The relationships proposed in the basic model must be tested. Each factor that affects collective improvisation requires further qualitative exploration. In this study, the effects and differences between collaboration patterns among professional emergency responders and nonprofessional responders in exercises were not considered. Ideally, a multiple case study from public, private, and volunteer organizations would be preferable to confirm and test the framework. Future research can consider these factors in study design.

This study focused on specific relationships between the chosen

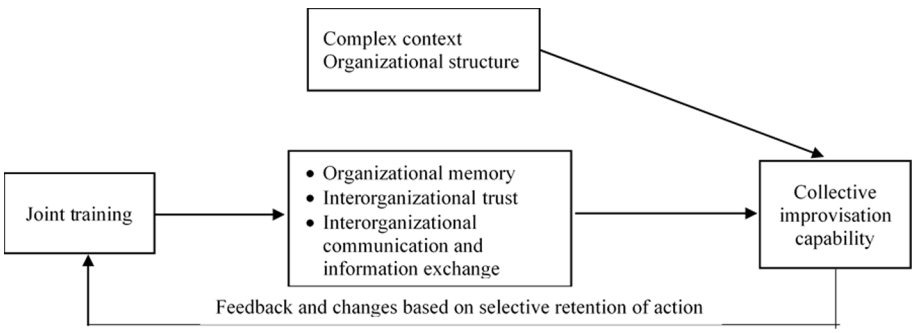

Fig. 2. Conceptual model.

variable, but there might be more relationships between variables. For example, organizational structure and context may influence joint training. Another example is that organizational structure may influence interorganizational trust. These assumptions could offer new approaches for further research.

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