

What about IT? Crisis Exercises for Multiple Skills

E. Martina Granholm

Department of Information Systems and
Technology, Mid Sweden University
martina.granholm@miun.se

ABSTRACT

Cooperation and interaction demands digital skills. In an agile context, there is no time for learning while doing, implicating that many of the skills need to be practiced beforehand. Since exercises are one way of enhancing skills needed in crisis situations, it is important to know what skills are practiced during the exercises. This review aims to understand what skills have been practiced during exercises conducted in Sweden between 2010 and 2014. Data was obtained from 15 evaluations of exercises including multiple actors. Most exercises practiced collaboration, communication, information and shared situation awareness skills. Results showed that 4 out of 15 had a specific goal in terms of technology use. Exercises with explicit technology goals are effective as a way to change opinions about the tool in question. The participants requests additional exercises specifically targeting routines and the use of technological tools.

Keywords

crisis exercise, information and communication technology, IT-practice, skills

INTRODUCTION

During a crisis, all actors dealing with the situation need an information overview to be able to assess and act, and to find a way to handle and cope the situation with whatever is at hand. This is similar to Alberts's (2011 p. 190) definition of agility: “*the ability to successfully effect, cope with, and/or exploit changes in circumstances*”. As a means of preparation, exercises are used to train actors and thereby prepare them to use their skills in unknown situations. Since technology has become omnipresent in a way it never was before, communication and interaction using technology have become natural parts of life. Officials, being highly effected by digitalization, are in need of organizing work for continuous learning (SOU 2015:28). Digital competence has been one of the EU key competences since 2006, with a recommendation to provide adults the opportunity to develop and update key skills through lifelong learning (EU 2006). In 2010, the EU was aiming to enhance the quality of work and to provide better working conditions, in addition to providing people with the right skills (EU 2010). Sweden has set the goal to “develop into the world's most successful digital society” (Hatt 2011).

This makes acting with technology an important skill to be able to handle situations that are agile by nature, such as a crisis situation. According to Turoff (2002), the use of technology in action is dependent on daily use. He claims that if a system is not used on a regular basis it will not be used in an actual emergency. This corresponds well with what Vogel and Schwabe (2016) argue, that stress makes individuals behave according to habit to a greater extent. The problem with using certain systems or tools in crisis situations only is also highlighted in the evaluation of the Västmanland forest fire in 2014 (Asp et al. 2015). The evaluation showed a lack of knowledge of how to use the support systems for communication and information (MSB 2016a). Problems in handling both information and communication technology available to the workers were found, which lead to deciding to not use the systems at all (MSB 2015). This was also the case in the event in Rosengård, where the evaluation concluded that the users had had little practice using the information system, since it was only used in the event of a crisis (Borell and Eriksson 2008).

MSB (2015) also found that during the forest fire they had problems combining actors in the communication

system (RAKEL¹); there was confusion as to which communication group to use. Login to the web based information system (WIS²), available to authorities during crisis, was initially problematic since none of the individuals at the incident site had the user information necessary. The system for management and monitoring of rescue (LUPP³) was not used consistently from the start, which led to the decision not to use the system at all (MSB, 2015). Asp et al. (2015) claim that in the midst of crisis there is no time to learn how to use special communication and information systems. A stressful environment is not only time-strained, but also affects our ability to learn and impairs memory retrieval (Vogel and Schwabe 2016). The evaluation of the Västmanland forest fire found that it was necessary to strengthen their ability to cooperate, manage and communicate; to develop and use methods and tools as well as increase actors' competence and knowledge (MSB 2016a).

Crisis exercises are executed in order to prepare actors to be able to handle a crisis situation, that is, to be able to use different skills in a time-strained and stressful environment. The effect of stress can be alleviated if learning and retrieval context match (Schwabe and Wolf 2009), which makes the learning environment of exercises important. Lave and Wenger (2005) argue that learning is done within a specific context, a "community of practice". There is a need for a holistic approach when focusing on experiences with IT (Agarwal and Karahanna 2000). Similarly, Orlikowski and Iacono (2001) argue that IT artefacts should not be recognized as merely technical objects since they are tools for work and communication in a social context. Separating technology and people makes us lose sight of the mutual constitution (Orlikowski 2007). How we interact with technology is determined by the technological frames of each individual. Frames consisting of how the individual understands and imagines the technology, how they view the organization's technological strategy and their understanding of how to use the technology. These frames are shared by individuals with the same type of interaction with the technology (Orlikowski and Gash 1994).

Understood in this way, training and exercises that involve numerous skills is of importance to prepare society for crisis situations. Since experience from actual events shows that interacting with technology can be a problem, the question of what skills are being trained during crisis exercises arises. Do the exercises train the skills needed? The aim of this review is to understand what skills have been in focus during exercises conducted in Sweden between 2010 and 2014. If ICT has been a part of the skills practiced during the exercises, experience from the exercises will be highlighted. The result will be presented by firstly providing a picture of research done where crisis exercises and IT have been combined in different ways. The following section will explain the context of this work followed by a brief design statement. The result section provides a description of skills that are frequently trained during the exercises, which illustrate experiences concerning technological issues adjacent to these skills. Finally, the results are discussed, followed by conclusions and ideas for further research.

Related research

When searching for related work, different approaches to crisis exercises in relation to information and communication technology (ICT) emerge. Studies about team exercises (Koning et al. 2012; Mendonça et al. 2006), multidisciplinary field exercises (Rudinsky and Hvannberg 2013), and support systems for crisis management groups (Drozdova et al. 2013) were found. There were also studies on exercises performed in a distributed way (Bacon et al. 2012; Coppari et al. 2008; van de Ven et al. 2014), as table-top exercises (Araz et al. 2010; Edzén 2014), and exercises conducted using a portable IT environment (Bacon et al. 2012). Reuter et al. (2009) focus on software used for planning, and Cesta et al. (2014) study software used to create timelines in scenarios. There are also some studies on the creation of scenarios (Borglund and Öberg 2014; Lundberg et al. 2012; Pottenbaum et al. 2014; Walker et al. 2011). In research on IT in relation to implementation of crisis exercises, it is clear that there is a number of software systems under construction (Ahmad et al. 2012; Greitzer et al. 2007; Oulhaci et al. 2013; Tecuci et al. 2007; van de Ven et al. 2014). Coppari et al. (2008) are developing a learning management system aimed at engineers. A large part of the literature is about computer supported simulation (see e.g. Hawe et al. 2012; LeRoy Heinrichs et al. 2008; MacKinnon and Bacon 2012; Mendonça et al. 2014; Simic 2012; Sniezek et al. 2002; Troups et al. 2011; Van den Broeck et al. 2011) and serious gaming (see e.g. De Kleermacker and Arents 2012; Di Loreto et al. 2012; Greitzer et al. 2007; Mawas and Cahier 2013; Oulhaci et al. 2013; Troups et al. 2011). Jain and McLean (2008) argue that simulation and gaming should be combined to create an arena for multiple agents to practice together. Pottenbaum (2014) emphasizes the importance of logs for learning and debriefing, as do Turoff et al. (2004), as a means to analyze chains of events.

¹ The Swedish national digital communications system used by emergency services and others in the field of public safety (www.msb.se).

² Internet-based information system for entities in the Swedish emergency management structure (www.msb.se).

³ System for operational support for emergency management (www.msb.se).

Research context

In 2002 the Swedish Parliament set up a new crisis management system, aiming for a holistic approach to planning and management of everything from everyday accidents to crisis and war (Prop.2001/02:158). The Swedish crisis management system is based on a bottom-up approach (Prop.2001/02:158). This makes the municipalities the basis of the Swedish emergency management system. Municipalities and other authorities are expected to educate and train officials and municipal staff in order to prepare them for extraordinary events (SFS 2006:544). Municipalities also have a geographical area responsibility, which means that during a crisis the municipality is responsible for liaison and coordination of the activities within the municipality (SFS 2006:544). In close cooperation with municipalities and other authorities, the Swedish Civil Contingencies Agency (MSB) is responsible for measures being taken before, during and after an emergency or crisis in issues concerning civil protection, public safety, emergency management and civil defense. MSB is liable to regulation, supervision and has its own operations as well as support, training and exercises (MSB 2016b). MSB is also responsible for national information and communication systems like WIS and RAKEL, created to facilitate information sharing. This review focuses on exercises where MSB has been involved as funder and support for the planning of the exercise.

Research design

The inclusion criteria for the review were that exercises had to: be conducted in Sweden between 2010 and 2014. Each exercise had to include multi-agencies and have elements of cooperation between these agencies. The exercise must have been evaluated and an evaluation report needs to be available on the MSB website. A total of 15 evaluations were included in the review, see Table 1. As shown in Table 1, 8 of the 15 exercises included pre-seminars. The purpose of the pre-seminars was to enhance knowledge, primarily within the area of the design of the exercise, but also to enhance knowledge of systems like WIS and/or RAKEL. In some cases, exercises included post seminars, aiming to further develop knowledge gained during the exercise.

Exercise	Year	No. agencies	No. individuals	Across national borders	Pre-seminar(s)	Exercise	Post seminar(s)	Evaluation seminar
Amalia	2010	18	403	no	2	1	no	1
Katarina	2010	17	426	no	no	1	no	1
Mårten	2010	29	110	no	no	2	no	1
Sälen	2010	30	139	yes	no	1	no	1
Jenny	2011	15	99	no	2*	1	no	2
Sievert	2011	9	24	no	no	1	no	no
Storskred	2011	19	153	no	2	1	1	1
Torne älv	2011	7	24	yes**	2	1+2+1 ^z	no	no
Henning	2012	14	246	no	no	1	1	1
Vendela	2012	12	148	no	no	4+1 ^{zz}	1	no
Astrid	2013	16	270	no	2	1	no	1
Omfall	2013	7	>100	no	3	2	no	1
Pumpa Läns	2013	18	429	no	2	3	no	1
Vildälv	2013	23	450	no	1	1	no	1
Origo	2014	13	Not reported	no	no	1	no	1

Table 1 Evaluations included in the review

* Participants were also encouraged to take an interactive online course on how to use Rakel.

** Participants from two countries participated in the pre-seminars.

^z One assignment was given one week prior to the two main exercises, followed by one assignment one week after the exercise.

^{zz} Four assignments were given, one per week prior to the exercise.

In the review of the evaluations a qualitative approach was combined with a thematic text analysis method. The first step of the analysis was reading each of the evaluations a repeated number of times to get an overview. When reading the evaluations it became clear that four areas were common to all exercises, i.e. the skills specified both explicitly and implicitly as the aims of the exercises. In addition, they were frequently used as a way to structure the evaluations. The skills that emerged as common in the evaluations were: cooperation, communication, information, and creating shared situation awareness (SSA). Bearing these skills in mind, the evaluations were again read through a repeated number of times, in search for references to the skills and use of technology.

The review is limited by the use of secondary data. Each evaluation used is has a goal that is different from that of this review. Even so, the evaluations describe the purpose and goals aimed for in each of the exercises. They outline what has been trained, in what way, and the opinions of the participants. The reliability of the evaluations should be considered high since they have been guided and produced by or with the support of the MSB.

RESULT

This section is structured according to the skills that were found during the analysis of the material: cooperation, communication, information, and creating shared situation awareness (SSA). To be able to reach SSA there is a need for both information and communication. Nonetheless, this section uses the areas to structure the result since they are distinctions used in the evaluations.

The exercises included all demand cooperation between multiple agencies. The design of the exercises differs from full-scale and table top exercises with dam failure/flooding or nuclear accident scenarios, see Table 2.

Exercise design	Exercise (year)	Scenario	
Table top	Sievert (2011)	Nuclear accident	
Full scale	Amalia (2010)	Plane accident	
	Omfall (2013)	Nuclear accident	
Seminary	Without counter play	Jenny (2011)	Power failure
		Vendela (2012)	Power failure
	With counter play	Mårten (2010)	Nuclear accident
		Torne älv (2011) **	Flooding
Simulation	Without counter play	Sälen (2010)	Traffic accident
		Storskred (2011)	Dam failure
	With counter play	Katrina (2010)	Flooding
		Henning (2012)	Nuclear accident
		Astrid (2013)**	CBRNE* accident
		Pumpa Läns (2013)**	Flooding
Vildälv (2013) **	Dam failure		
Origo (2014)	Building construction accident		

Table 2 Exercise design and scenarios

* CBRNE, chemical, biological, radiological, nuclear and explosion

** Exercises with a specific goal connected to technical issues

An additional aim in one of the exercises was to make sure that flaws found in previous exercises were rectified (Brobakken et al. 2010). Four of the fifteen exercises had a specific aim regarding technical issues (Bengtsson 2011a, 2013a; b; Nordin 2013). The aims connected to technical issues were similar. To understand and be able to use layers in GIS was the goal of one of the four exercises. Three of the exercises aimed to use WIS for

communication and the fourth exercise aimed to use RAKEL for communication. There are examples of exercises taking steps to improve technological skills prior to the exercise (Bengtsson 2011a, 2012a); there are also examples of evaluations where technology is never mentioned (Länsstyrelsen Västernorrland 2011). These are, however, exceptions; technology is mostly mentioned, at least in passing. The overall aim and goals of the exercises tend to be cooperation (Bengtsson 2010, 2011b; c; a, 2012a, 2013a; b; Myndigheten för samhällsskydd och beredskap 2013; Nordin 2013), how to handle information (Bengtsson 2010, 2011c; a, 2012b; a; Nordin 2013), communication (Bengtsson 2010, 2011a, 2012c, b; a, 2013a; b; Myndigheten för samhällsskydd och beredskap 2013; Nordin 2013), SSA (Bengtsson 2010, 2011c, 2012c; b, 2013a; b; Göransson 2014; Nordin 2013), trying out alarm plans (Bengtsson 2010, 2011b, 2012c, 2013a; b; Nordin 2013), evaluate and develop the organization's ability to handle a crisis situation (Bengtsson 2010, 2011a, 2012b; Göransson 2014), and to increase overall knowledge about a specific area and surrounding agencies (Myndigheten för samhällsskydd och beredskap 2013).

Cooperation

The process of planning seemed to be productive in a number of ways; to the design of the exercise as well as a basis for further collaboration following the exercise (Bengtsson 2010), and has also increased knowledge of surrounding actors (Bengtsson 2010).

There have been discussions about what issues require cooperation (Bengtsson 2010), routines for cooperation (Bengtsson 2010, 2011c), and who is responsible for the initiation of cooperation (Bengtsson 2010). During the exercise Sälen (Brobakken et al. 2010), it was established that knowledge of other actors as well as established ways of contact are crucial for efficient cooperation. Structure and who is responsible for leading the cooperation meetings were also topics discussed (Bengtsson 2010). Needs for clarification and cooperation routines were identified (Bengtsson 2010, 2011c; Nordin 2013), as some of the meetings were perceived as unstructured (Bengtsson 2013a). It was suggested that agendas were prepared to be used in these situations, since structure is important when time is short. Leadership during collaboration meetings was also identified as important, and it was suggested that it should be decided in advance who is going to lead the meeting (Bengtsson 2010).

There is also need for technology to back this up. Videoconference is highlighted as a good solution, but regardless of technological solution the participants have to be prepared for the meeting. The solutions also need to be tested beforehand and allow simple things like muting the microphone (Bengtsson 2010). When cross-border cooperation is needed, problems occurred where contact channels affected information sharing between countries (Brobakken et al. 2010). Conference call is also used, but the evaluation does not mention how the participants perceived this (Bengtsson 2012b). A need to increase and improve the use of RAKEL communication was detected, primarily because it is not used in everyday work (Bengtsson 2012b). For example, when consciously using RAKEL during the exercise, the participants had a noticeable change of opinion about the system in a positive direction (Bengtsson 2012a).

Communication

Communication in locations where there are shadow zones can be a problem (Bengtsson 2010). Another problem that occurred during the exercise in terms of communication was participants using other means of contact than those agreed on. Private cellphones and calls from spare vehicles resulted in a chaotic situation at SOS⁴ and at the command center of some of the participants (Bengtsson 2010).

It is important to understand what issues are important to communicate. A description of these issues could be useful, since an actual accident involves added pressure for the operator (Bengtsson 2010). Some participants perceived the communication of information as irregular and far apart (Bengtsson 2010).

For some, using RAKEL for communication was an entirely new experience, which explains their being unaccustomed to using the system. Some argued that instead of using cellphones RAKEL should be used, to be

⁴ The Swedish national organization for emergency calls

able to spread the information as far as possible (Bengtsson 2010). But since some still do not have access to the system it leads to a need for routines for how to reach those without access to RAKEL (Bengtsson 2013a).

Information

Sometimes meetings during the planning stage were conducted in an informal setting, which resulted in information loss as decisions from short conference calls were never communicated outside the small group present, or interested parties outside the organization (Bengtsson 2010, 2011b). Much of the documentation during the planning was sent by e-mail between participants (Bengtsson 2011b). Despite this, more documentation from planning meetings was requested (Bengtsson 2012a), as was documentation from decisions during the exercise (Bengtsson 2010, 2011c, 2012b, 2013a, a; a; Nordin 2013). Various systems are used for documentation, but there is no discussion about in what way or if this results in any problems (Bengtsson 2012b). Routines for documentation were asked for during the exercises (Bengtsson 2012b, 2013a). For example, there was no routine for whiteboard and scratch paper documentation, or how to document e-mails (Bengtsson 2012b). One of the evaluators interfered mid-exercise and suggested that WIS could be used as documentation channel (Bengtsson 2013b; a). One participant conducted all communication through a third party to avoid documentation. This requires the ability to listen-in on calls in order to not lose valuable time for analysis (Bengtsson 2010).

Clear documentation is perceived as important. Preferably a template is used to make it as clear as possible (Bengtsson 2010). A structure for documentation in WIS is requested (Bengtsson 2011c). Participants that had assigned documentation and information to one member of staff argued that this was a good way to organize the work. The organization felt that their information work was successful (Bengtsson 2010). A conclusion drawn by the participants, was that the communication between different documentation systems should be done automatically (Bengtsson 2010).

WIS is both mentioned as a way to facilitate and support the collection and sharing of information (Bengtsson 2013c) as well as a part of the exercise goals (Bengtsson 2013a). Participants found that it is hard to use a system that was only used during crisis or exercises. Systems need to be used in other situations than during an exercise (Bengtsson 2012a) both for users to know how to use the software and to learn how to use it better (Bengtsson 2011c), it is clear instructions and routines are required (Bengtsson 2013a). Participants mention that they would like to have both training and education on how to use WIS (Bengtsson 2011b, 2012c, 2013b; a; Nordin 2013) and RAKEL (Bengtsson 2012c, 2013a). The absence of technology use is observed even though there are digital devices in the room that could facilitate the work (Bengtsson 2013b). Some participants also lacked access to update information on the platform used (Bengtsson 2010). According to the evaluation, there was a lack of guidelines for which presentation tools to use, and decisions on where to present the information were made at random (Bengtsson 2010).

The participants requested procedures and routines for how to create and distribute coordinated information (Nordin 2013). The importance of choosing which channel to use for information sharing and gathering is noted (Bengtsson 2010, 2011c). There were discussions about what information should be delivered, and if there is a risk of information overload (Bengtsson 2010). A frequently used channel for gathering information was the radio (Bengtsson 2010). When it came to sharing information, a lack of coordination and collaboration was observed. Some of the participants did not have access to WIS (Bengtsson 2012a), and some chose not to use it (Bengtsson 2010, 2012c), which made it unclear how many were reached by the information in the system. In cases when participants had access to WIS, not all of the participants chose to share their journals and to make their information available to other participants in the exercise. However, not all participants followed the journals shared by other participants. (Bengtsson 2011c). There was limited use of the intranet to distribute internal information, which was identified as a point of improvement (Bengtsson 2010). Ideas for what channels to use for internal information was also a result of the exercise. Another point of improvement was guidelines for what to communicate, how to structure it, and the amount of information delivered through social media and websites (Bengtsson 2010). There are discussions about what channels to use to distribute information to the

public, and how to adapt the information to different target groups but no discussion about the effect of different channels (Bengtsson 2012a).

Some exercises confirm that actors use both WIS and personal technological systems to share and present information (Bengtsson 2010, 2012b), but there is no mention of their skills in handling the systems (Bengtsson 2012b). One evaluator notes that a problem is that the different systems cannot communicate with each other (Bengtsson 2012b). Some information sent between participants was not read because of compatibility issues (Bengtsson 2012b). The need to regularly update the information presented was also highlighted (Bengtsson 2012b). Some participants in the exercises in 2011 emphasize the importance of being able to visualize information which provides a clear picture of the situation (Bengtsson 2012b; a). There were participants with technology well-suited for the visualization of the event, which could, in theory, be shared with other participants, but because of security solutions and software issues it was impossible in practice (Bengtsson 2012b). Some participants lacked the physical localization suitable to visualize the event, which results in problems viewing past, present and future information of the event. Others struggled with the structure and procedure of what information to display, leading to a lot of static information (Bengtsson 2010). When reporting about the situation at the scene, information was at times insufficient and unstructured, and not always delivered on time, and sometimes not at all. This affects the support given to participants at the site of the incident (Bengtsson 2010). There is a need for guidelines for these reports (Bengtsson 2011c).

Shared situation awareness (SSA)

Some participants used monitors to visualize the SSA. They also included pictures sent from the location to get the clearest picture possible (Bengtsson 2010). However, not all participants considered this as something positive, since the monitors could be a distraction once the briefing was done (Bengtsson 2010). There were also cases where the SSA was shared orally (Bengtsson 2013b).

Some evaluations are clear about what technology is involved in the display of the SSA and reflect on the effect of having an oral presentation of the picture only (Bengtsson 2013a). Routines and procedures for how to create the SSA (Nordin 2013) are requested, as are routines for the creation and visualization of an SSA in a transparent way, in addition to a clarification of the difference between situational awareness and documentation (Göransson 2014).

Participants requested better procedures and structure for the SSA, how to display the SSA and what it should consist of. The SSA is sometimes perceived as more of a duty rather than something useful when handling the situation, which leads to working with the SSA only when it is to be presented at meetings with other actors (Nordin 2013). The participants do not see the importance of sharing, creating and having awareness of the bigger picture. Instead they feel it is enough to have knowledge of the parts they need to solve the situation within the area of their responsibility. There are indications that participants do not seek and verify information, which leads to situation awareness relying on external information and no attempts made to verify the SSA (Bengtsson 2012b).

Discussion

To be able to handle an agile situation like a crisis, most probably in a stressful environment, demands a vast set of skills. Stress impairs memory retrieval and make people behave according to habit to a greater extent (Vogel and Schwabe 2016), but the effect of stress can be alleviated if learning and retrieval context match (Schwabe and Wolf 2009). This argues for the importance of exercises and training as a preparation for the unexpected. As digital tools are frequently used in day-to-day work and various events showed that some choose to not use these tools, finding out what skills are being trained during exercises could be useful. The aim of this review was to understand what skills were practiced during the exercises, and if ICT was a part of the skills practiced, as well as to illustrate experiences drawn.

The review finds that the most frequently practiced skills are cooperation, communication, information sharing, and creating shared situation awareness. During the exercises, technology was not always a natural part of what

was practiced. Instead technology was not used at all, or was taken for granted while other objectives were in focus. The skills identified are all areas that involve technology in one way or another. Participants express a need and wish to learn how to use technology more efficiently (Bengtsson 2011b, 2012b; Göransson 2014; Nordin 2013), since technology is considered to be useful, but demands that the staff knows how to use it (Bengtsson 2011c). Experiences from the exercises highlight the need to improve technological skills, regardless of whether the goal of the exercise was explicitly technological or not. When pre-seminars were used to prepare participants on how to use for example WIS, the outcome of the exercise tended to be positive. Both because it seems to increase the participants' level of satisfaction with the exercise, and because having the time to prepare was considered necessary. In addition it was also an effective way of changing how the tool in question was perceived. There is no plan as to what tool to use to display different types of information. This leads to users having to make these decisions then and there. According to Vogel and Schwabe (2016) stress makes individuals act according to habit to a greater extent. That is, when under pressure, people tend to choose a tool s/he is familiar with without taking into consideration if there is another tool that could be more suitable.

In these exercises, participants have mentioned wanting a clearer structure for how to use WIS for documentation, guides, routines and guidelines. Agarwal and Karahanna (2000) argue that a holistic approach focusing on IT experiences is needed. In the exercises, participants from exercises, regardless of whether the exercises have goals that are explicitly technological or not, have mentioned problems using the tools and described the effect of using certain tools. This is similar to what Orlikowski argues, that separating technology and people make us lose sight of the mutual constitution (Orlikowski 2007). Participants in the 4 exercises with explicitly technological goals mentioned wanting clearer routines and procedures for how to use and present information using the tools. During the exercises, practical issues of how to refine routines and develop skills using the technical device were identified. Participants in all types of exercises requested more training and practice using the technology involved in the handling of the crisis, indicating that there is a need for training to facilitate the use of the technology in their job.

Creating a shared situation awareness (SSA) both within an organization and across multiple organizations requires routines, procedures and structure, which was something all actors involved requested. When creating SSA using technology, technological frames are set (Orlikowski and Gash 1994). A carefully designed crisis exercise will enhance multiple skills including the digital skills needed to solve an assignment. Using technology but not following up on the results of using said technology is in itself a risk. In the exercises, participants were told to use a specific information system, however, not all of them did, and there were some who did not know how to use it. The evaluations do not discuss the impact of this on the construction of the SSA and solving the issue at hand. This shows the importance of considering the practice, including IT, not only during the construction and implementation of exercises but also the during the evaluation phase of exercises, in order to find issues in the use of IT. Evaluation of exercises where the use of certain technology is a goal captures technical issues more clearly and illustrates areas of improvement, but also the effect of using, or not using, technology.

Conclusion

Even though technology is a natural part of everyday life for many people, those participating in these crisis exercises have been struggling with both demands based on the crisis scenario and a lack of routines as well as lack of technological strategy and insufficient digital skills. Finding the time to develop the skills needed in a crisis situation is difficult, which makes it important to make the most out of any exercise taking place. A crisis exercise is a context that can be used as an opportunity to learn more than isolated abilities like communication in a crisis context; it can be used to further develop digital skills which will benefit the organization. Experiences from the exercises as well as previous research (see e.g. Asp et al. 2015; Borell and Eriksson 2008; Turoff 2002) shows that how technology is used in a crisis depends on its use on a daily basis. One way to use technology intended for the use in a crisis situation and enhance knowledge could be to use these technologies in the planning phase and thereby creating an opportunity to use a tool rarely used.

The results of this paper should be of interest for scenario makers. When creating scenarios, including digital skills in the exercise should be considered. It could be things such as making sure that people have access to the

necessary systems and restricted rooms, or including, for example, finding the right position on a map using GPS and/or coordinates in the exercise. Experience from these evaluations shows that pre-seminars preparing participants by giving them training and practice using the technological systems used in the exercise have been successful. Participants have also mentioned that there is an uncertainty about how to handle technological tools.

In the evaluation, participants requested routines, structure and training in technological skills. A problem that seems to emerge when looking at the evaluations, is that requests and flaws found early on, and many years ago, are still requests and flaws in exercises carried out in 2014. This leads to questions of how to transfer knowledge from one exercise to another. There is a need for research aiming to understand how experience from both actual crisis as well as earlier exercises can be used to develop future exercises, and how these experiences can serve as a source of knowledge in the event of a crisis. The way exercises are evaluated is also an area for research in order to find new and complementary ways to evaluate exercises. There seems to be a lack of research that aims to understand the entanglements of technology and actors during a crisis situation. This is of essence if exercises that aim to reflect the actual practice. Participants expressed uncertainty concerning how to handle technological tools. It would be of interest to study to what extent involving technology experts in the exercises, for instance participants from the IT department, would affect the degree of use and perceived confidence of handling technology. There is also a need for research studying different approaches to exercises in order to understand how preparation training and layout of the exercise affects the outcome and how exercises are perceived.

This work was supported by the Interreg Sweden-Norway program [20200037]

REFERENCES

- Agarwal, R., and Karahanna, E. (2000). "Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage." *MIS Quarterly*, 24(4), 665–694.
- Ahmad, A., Boin, A., Brivio, P., Gobetti, E., and de la Rivière, J.-B. (2012). "Interactive Simulation Technology for Crisis Management and Training: The INDIGO Project." Vancouver, Canada.
- Alberts, D. S. (2011). *The agility advantage: a survival guide for complex enterprises and endeavors*. DoD Command and Control Research Program, Washington, DC.
- Araz, O. M., Jehn, M., Lant, T., and Fowler, J. W. (2010). "A New Method of Exercising Pandemic Preparedness Through an Interactive Simulation and Visualization." *Journal of Medical Systems*, 36(3), 1475–1483.
- Asp, V., Bynander, F., Daléus, P., Deschamps-Berger, J., Sandberg, D., Schyberg, E., and CRISMART. (2015). *Bara skog som brinner?: utvärdering av krishantering under skogsbranden i Västmanland 2014*. CRISMART, Försvarshögskolan, Stockholm.
- Bacon, L., Windall, G., and MacKinnon, L. (2012). "The development of a rich multimedia training environment for crisis management: using emotional affect to enhance learning." *Research in Learning Technology*, 19(0).
- Bengtsson, T. (2010). *Amalia - Regional samverkansövning 2010. Utvärdering*, Länsstyrelsen Jämtlands län, Östersund.
- Bengtsson, T. (2011a). *Seminarium och beredskapsövning Torne älv: Utvärderingsrapport*. Utvärdering.
- Bengtsson, T. (2011b). *Mårten 2010. Utvärdering*, Länsstyrelsen i Gävleborg, Gävle.
- Bengtsson, T. (2011c). *Övning Katrina 2010. Utvärdering*, Länsstyrelsen Västernorrland, Härnösand.
- Bengtsson, T. (2012a). *Utvärdering av Regional samverkansövning Jenny 2011. Utvärdering*, Länsstyrelsen Västmanlands län, Västerås.
- Bengtsson, T. (2012b). *Storskred 2011. Utvärdering*, Länsstyrelsen i Västra Götaland.
- Bengtsson, T. (2012c). *Henning 2012. Utvärdering*, Länsstyrelsen Kalmar län, Kalmar.
- Bengtsson, T. (2013a). *Övning Vildälv 2013. Utvärdering*, Länsstyrelsen i Västerbotten, Umeå.
- Bengtsson, T. (2013b). *Pumpa Läns 2013. Utvärdering*, Länsstyrelsen i Östergötland, Linköping.
- Bengtsson, T. (2013c). *Vendela.2012. Utvärdering*, Länsstyrelsen Västernorrland, Härnösand.
- Borell, J., and Eriksson, K. (2008). "Utvärdering av Malmö stads hanteirng av Rosengårdshändelserna april

- 2007.” Lunds universitet.
- Borglund, E., and Öberg, L.-M. (2014). “Creation of an Exercise Scenario: A collaborative Design Effort.” University Park, Pennsylvania, USA.
- Brobakken, M. T., Carlsson, B., Nyberg, J., and Schenning, C. (2010). Sälen 2010. Utvärdering, Länsstyrelsen i Dalarna, Falun.
- Cesta, A., Cortellessa, G., and De Benedictis, R. (2014). “Training for crisis decision making – An approach based on plan adaptation.” *Knowledge-Based Systems*, 58, 98–112.
- Coppari, S., Di Pasquale, G., Goretti, A., Papa, F., Papa, S., Paoli, G., Pizza, A. G., Severino, M., Santini, A., and Moraci, N. (2008). “The TRIPOD e-learning Platform for the Training of Earthquake Safety Assessment.” *AIP*, 1916–1925.
- De Kleermacker, S., and Arents, L. (2012). “Serious gaming in training for crisis response.” Vancouver, Canada.
- Di Loreto, I., Mora, S., and Divitini, M. (2012). “Collaborative Serious Games for Crisis Management: An Overview.” *IEEE*, 352–357.
- Drozdova, M., Rapant, P., and Malerova, L. (2013). “Support system for the training of crisis management group members.” 247–256.
- Edzén, S. (2014). “Table-Top Exercises for Emergency Management: Tame Solutions for Wicked Problems.” 2014 47th Hawaii International Conference on System Sciences (HICSS), 1978–1985.
- EU. (2006). Europaparlamentets och rådets rekommendation om nyckelkompetenser för livslångt lärande. Bryssel.
- EU. (2010). En agenda för ny kompetens och arbetstillfällen EU:s bidrag till full sysselsättning. Meddelande från kommissionen, Bryssel.
- Göransson, G. (2014). Utvärderingsrapport Origo. Utvärdering, Kronobergs län, Kalmar.
- Greitzer, F. L., Kuchar, O. A., and Huston, K. (2007). “Cognitive Science Implications for Enhancing Training Effectiveness in a Serious Gaming Context.” *J. Educ. Resour. Comput.*, 7(3).
- Hatt, A.-K. (2011). IT i människans tjänst-en digital agenda för Sverige. Stockholm.
- Hawe, G. I., Coates, G., Wilson, D. T., and Crouch, R. S. (2012). “Agent-based Simulation for Large-scale Emergency Response: A Survey of Usage and Implementation.” *ACM Comput. Surv.*, 45(1), 8:1–8:51.
- Jain, S., and McLean, C. R. (2008). “Components of an Incident Management Simulation and Gaming Framework and Related Developments.” *SIMULATION*, 84(1), 3–25.
- Koning, L. de, Buul-Besseling, K. van, Hemert, D. A. van, Huis in 't Veld, M. M. A., Dongen, C. J. G. van, and Paulissen, R. T. (2012). “MIRROR : Improving coordination in multidisciplinary crisis management teams.” *Proceedings of the 9th International ISCRAM Conference – Vancouver, Canada, April 2012*, 1-5.
- Länsstyrelsen Västernorrland. (2011). Sievert 2011. Utvärdering, Länsstyrelsen Västernorrland, Härnösand.
- Lave, J., and Wenger, E. (2005). *Situated learning: legitimate peripheral participation. Learning in doing*, Cambridge University Press, Cambridge England ; New York.
- LeRoy Heinrichs, W., Youngblood, P., Harter, P. M., and Dev, P. (2008). “Simulation for Team Training and Assessment: Case Studies of Online Training with Virtual Worlds.” *World Journal of Surgery*, 32(2), 161–170.
- Lundberg, J., Granlund, R., and Fredäng, A. (2012). “Scenario play workshops: Co-design of emergency response scenarios for information technology design in collaboration with emergency response personnel.” *Proceedings Of The 9th International Iscrum Conference*.
- MacKinnon, L., and Bacon, L. (2012). “Developing Realistic Crisis Management Training.” Vancouver, Canada.
- Mawas, N. E., and Cahier, J.-P. (2013). “Designing Collaboratively Crisis Scenarios for Serious Games:” *SCITEPRESS - Science and Technology Publications*, 381–388.
- Mendonça, D., Beroggi, G. E. G., van Gent, D., and Wallace, W. A. (2006). “Designing gaming simulations for the assessment of group decision support systems in emergency response.” *Safety Science*, 44(6), 523–535.
- Mendonça, D., Cutler, B., Wallace, W. A., and Brooks, J. D. (2014). “Collaborative Training Tools for Emergency Restoration of Critical Infrastructure Systems.” *New Perspectives in Information Systems and Technologies*, Volume 1, Á. Rocha, A. M. Correia, F. . B. Tan, and K. . A. Stroetmann, eds., Springer International Publishing, Cham, 571–581.
- MSB. (2015). MSB:S stöd vid skogsbranden i Västmanland 2014. Karlstad.

- MSB. (2016a). Ansvar, samverkan, handling : åtgärder för stärkt krisberedskap utifrån erfarenheterna från skogsbranden i Västmanland 2014. MSB, Stockholm.
- MSB. (2016b). "Msb.se - Myndigheten för samhällsskydd och beredskap." <<https://www.msb.se/>> (Sep. 20, 2016).
- Myndigheten för samhällsskydd och beredskap. (2013). Omfall 2013. Utvärdering, Länsstyrelsen Västmanlands län, Västerås.
- Nordin, D. (2013). Astrid 2013. Utvärdering, Länsstyrelsen Kalmar län, Kalmar.
- Orlikowski, W. J. (2007). "Sociomaterial Practices: Exploring Technology at Work." *Organization Studies*, 28(9), 1435–1448.
- Orlikowski, W. J., and Gash, D. C. (1994). "Technological Frames: Making Sense of Information Technology in Organizations." *ACM Trans. Inf. Syst.*, 12(2), 174–207.
- Orlikowski, W. J., and Iacono, C. S. (2001). "Desperately seeking the 'IT' in IT research - a call to theorizing the IT artifact." *Information Systems Research*, Vol 12 (2)(121–134).
- Oulhaci, M. A., Tranvouez, E., Espinasse, B., and Fournier, S. (2013). "Intelligent Tutoring Systems and Serious Game for Crisis Management: A Multi-agents Integration Architecture." 2013 IEEE 22nd International Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE), 253–258.
- Pottenbaum, J., Marterer, R., and Schneider, S. (2014). "Taxonomy of IT support for training emergency response & management." Pennsylvania, USA.
- Prop.2001/02:158. (2002). Samhällets säkerhet och beredskap.
- Reuter, C., Pipek, V., and Müller, C. (2009). "Avoiding crisis in communication: a computer-supported training approach for emergency management." *International Journal of Emergency Management*, (Vol. 6, Nos. 3/4).
- Rudinsky, J., and Hvannberg, E. T. (2013). "Communication Interface for Virtual Training of Crisis Management." Baden-Baden, Germany.
- Schwabe, L., and Wolf, O. T. (2009). "The context counts: Congruent learning and testing environments prevent memory retrieval impairment following stress." *Cognitive, Affective, & Behavioral Neuroscience*, 9(3), 229–236.
- SFS 2006:544. (n.d.). Kommuners och landstings åtgärder inför och vid extraordinära händelser i fredstid och höjd beredskap. Svensk författningssamling.
- Simic, G. (2012). "Constructive simulation as a collaborative learning tool in education and training of crisis staff." *Interdisciplinary Journal of Information, Knowledge and Management*, 7, 221.
- Sniezek, J. A., Wilkins, D. C., Wadlington, P. L., and Baumann, M. R. (2002). "Training for Crisis Decision-Making: Psychological Issues and Computer-Based Solutions." *Journal of Management Information Systems*, 18(4), 147–168.
- SOU 2015:28. (2015). Gör Sverige i framtiden: digital kompetens.
- Tecuci, G., Boicu, M., Hajduk, T., Marcu, D., Barbulescu, M., Boicu, C., and Le, V. (2007). "A Tool for Training and Assistance in Emergency Response Planning." 40th Annual Hawaii International Conference on System Sciences, 2007. HICSS 2007, 23–23.
- Toups, Z. O., Kerne, A., and Hamilton, W. A. (2011). "The Team Coordination Game: Zero-fidelity Simulation Abstracted from Fire Emergency Response Practice." *ACM Trans. Comput.-Hum. Interact.*, 18(4), 23:1–23:37.
- Turoff, M. (2002). "Past and future emergency response information systems." *Communications of the ACM*, 45(4), 29–32.
- Turoff, M., Chumer, M., Walle, B. de, and Yao, X. (2004). "The Design of a Dynamic Emergency Response Management Information System (DERMIS)." *Journal of Information Technology Theory and Application (JITTA)*, 5(4).
- Van den Broeck, W., Gioannini, C., Gonçalves, B., Quaggiotto, M., Colizza, V., and Vespignani, A. (2011). "The GLEaMviz computational tool, a publicly available software to explore realistic epidemic spreading scenarios at the global scale." *BMC Infectious Diseases*, 11(1), 37–50.
- van de Ven, J. G. M., Stubbé, H., and Hrehovcsik, M. (2014). "Gaming for Policy Makers: It's Serious!" *Games and Learning Alliance*, A. De Gloria, ed., Springer International Publishing, Cham, 376–382.
- Vogel, S., and Schwabe, L. (2016). "Learning and memory under stress: implications for the classroom." *npj*

Science of Learning, 1, 16011.

Walker, W. E., Giddings, J., and Armstrong, S. (2011). "Training and learning for crisis management using a virtual simulation/gaming environment." *Cognition, Technology & Work*, 13(3), 163–173.