Challenges in work procedures in distributed crisis management

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ABSTRACT

This is a work in progress paper on work and IT usage in distributed crisis management. The data presented in this paper has been collected at a one-day tabletop exercise with four Swedish municipalities. Four members of the four municipalities' crisis organizations were invited to the exercise, which was designed as one scenario divided into two cases. At the start of each case of the exercise, each municipality was split into two separate rooms, to simulate a distributed crisis management. During the first case they could communicate using phone, TETRA radio, and the Internet. During case two in the scenario, there was no Internet connection. The study indicates that all the municipalities managed to organize and solve the given tasks using primarily voice communication, in case one using phone or, e.g., Teams, and in case two using TETRA radio. Information sharing using IT was non-existing.

Keywords

Crisis management, distributed EOC, Tabletop exercise, Information technology use.

INTRODUCTION

During Covid-19, several organizations' crisis management was suddenly forced to prepare to manage future crises distributed, i.e., manage the crisis from several different locations. In Borglund et al. (2021), a large telephone company demonstrates distributed crisis management using standard software such as Office 365 during the pandemic. In Sweden the crisis management system is divided into three different levels. First, we have the local level, where the municipality (there is a total of 290 municipalities in Sweden) is the authority expected to organize, coordinate, and manage the crisis taking place within municipality borders. The next level is the regional level where the county board is responsible for coordinating a crisis within county borders. On the national level, the government office is responsible for coordinating a crisis (Myndigheten för samhällsskydd och beredskap, 2014). The Swedish crisis management system rests on three main principles:

> *The principle of responsibility that means that actors retain their ordinary responsibilities in situations of crisis and disaster. This principle also includes a responsibility to support other involved parties as necessary. The principle of proximity that means that crises and disasters should be managed as close as possible to those primarily concerned. The principle of similarity, which means that the methods and structures used in crisis and disaster management, should be as similar as possible to those used in normal circumstances. (https://civil-protection-humanitarian-aid.ec.europa.eu/what/civil-protection/national-disaster-management-system/sweden_en)*

The principle of proximity means that the municipality is the first frontier in coordinating and managing the crisis, and often organizes into a temporal organization (Landgren & Bergstrand, 2016; Lutz & Lindell, 2008), which in this paper is referred to as an EOC (emergency operation centre). The EOC is the center for crisis management during a crisis. During the Covid-19 pandemic, national regulations forced municipalities to start to work distributed in their EOCs. What is meant by distributed is that staff is no longer located at the same place, and Internet-based technologies are used for communication and information sharing, which gave birth to what we in our project call distributed EOCs – implicitly, the EOC is distributed to more than one location. In Borglund et al. (2021), the EOC of the telephone company was fully distributed with all personnel working from home, and no

co-location was accepted.

In this ongoing research the aim is to understand what the work at a distributed EOC looks like, how the personnel use technology for communication and information sharing, how they manage loss of power and Internet connection. This paper presents the findings from an emergency exercise divided into two cases, with four municipalities in Sweden, working in distributed EOCs.

RELATED RESEARCH

Until now research on municipality EOCs has focused on non-distributed teams even though the location where crisis management takes place affects both working routines and the technology configuration needed (Granholm, 2022). However, there is a lot to learn from related work on virtual teams in general. Bjørn and Ngwenyama (2009) argue that there is risk of exclusion when part of a team is co-located while others are connected online. It creates a risk of feeling excluded from both the team and the decisions. The need for trust and the importance of a feeling of belonging (Breuer et al., 2016, Choi & Cho, 2019) as well as leadership challenges (Peñarroja m.fl., 2017; Liao, 2017) are important aspects to consider when working with virtual teams. During crisis management many decisions are made during an event. Treurniet and Wolbers (2021) argue that to succeed with distributed decision-making during crisis management there is a need to support the translation of meaning as well as the transformation of interests. That is, decision-making requires more than information sharing since information sharing mostly consists of factual information. Information that Treurniet and Wolbers (2021) describe as a solid basis but not enough to "bridge the sematic or pragmatic boundary between the front line and the remote response network". Decision-making relies on a solid basis of information and shared knowledge of the situation. Cramton (2001) identifies the following five problems to succeed in creating mutual knowledge when working in distributed teams: failure to communicate and retain contextual information, unevenly distributed information, difficulty communicating and understanding the salience of information, differences in speed of access to information, and difficulty interpreting the meaning of silence. Ichinose et al. (2014) during a three-year study identify a very manual information sharing process and information processing even if there are information technology systems at hand.

CONCEPTUAL FRAMEWORK

In the paper at hand, we use activity theory as a conceptual framework to understand work in hybrid EOCs. Activity theory consists of basic principles suitable for a conceptual framework (Engeström, 2014). As a framework, it presents principles making it possible to see relationships between the tools, the worker, and the object of activity. The unit of analysis in activity theory is always an activity. Work is considered an object-oriented practice mediated by tools and models. The theory describes how social rules, division of labour and the community also have a mediating relationship to the object of the activity (Engeström, 2014). In addition, the theory provides a way to understand the relationship between activity, action, and operation. That is that the object of an activity is fulfilled through one or several actions and each action is performed through one or several operations. Activity theory was therefore selected as useful to increase the understanding of the ongoing research on the transformation from co-located EOCs to distributed EOCs.

METHOD

This research is an ongoing project where the focus is to understand what is required for efficient crisis management when the EOCs are distributed and not located at one place. A qualitative research method (Myers & Avison, 2002; Taylor & Bogdan, 1998) is used to understand the actions taking place during the work in hybrid EOCs. The data collection has consisted of observations and shorter interviews, together with after-action reviews following the two emergency exercises.

Research design

The exercise used as basis for this study, was designed as a table top exercise (See e.g. in van Laere & Lindblom, 2019), where four municipalities were involved. Each municipality was asked to bring four members of staff that in case of a real crisis would be working in the municipality EOC. They were asked to bring the computers they would normally use, while the radio units that they would normally have access to within the municipality were provided for them. Sweden's emergency radio network is called RAKEL, which is based on the TETRA (Terrestrial Trunked Radio) standard, which is a common standard for radio communication in Europe.

The exercise was carried out at the training facility Sandö which is part of the Swedish Civil Contingencies Agency (MSB). At the Sandö training facility we used eight separate training rooms for our exercise. Each room

was equipped like a modern conference room with monitors and whiteboards. Each case of the exercise started with each municipality being divided into two separate rooms, to simulate a distributed crisis management.

The exercise was divided into two cases that followed each other. The first case was done in the morning and the second in the afternoon. Both cases started with a 15-minute preparation information, followed by a 90-minute exercise, and ended with a 15–30-minute after-action review. The context of the scenario was presented in the 15-minute preparation. For the 90-minute exercise, the four municipalities were divided into two teams and in two separate rooms – this to simulate the crisis organization in the municipality working distributed from two locations. The case narrative is presented below.

Case narrative and exercise information

The preparation information for the municipalities described the actual situation in Sweden in late autumn 2022.

Energy prices in Sweden are high, the central bank has increased the repo rate, inflation has never been higher, and Sweden is entering a recession. This affects many citizens. Adding to this, the NATO application from Sweden and Finland has increased the military threat from Russia and during the Swedish election in September, an increased level of misinformation campaigns had been identified. The weather forecast promises some light snow showers and a temperature just below zero in this region.

Information case 1:

27 November 23.30 Home care staff in several Swedish municipalities in Västernorrland (Sollefteå, Kramfors, Örnsköldsvik, and Härnösand) report difficulties logging into their computers and accessing information in the municipality's IT system.

28 November 03.00 The IT departements cannot explain computer login difficulties. At the same time, municipal staff are reporting difficulties using mobile phones and several telecom operators are reporting operational disruptions. It is possible these issues originate from the telecom operators who also provide Internet access for several of the services.

28 November 07.00 The IT departments in Sollefteå, Kramfors, Örnsköldsvik, and Härnösand have had informal meetings together, called in their own staff before the problem search started and started discussions with companies that supply cloud services, servers, and certain IT systems.

28 November 08.30 A common picture for the four municipalities is that they have been subjected to an extensive Ransomware attack, where several business-critical systems have ceased to work.

28 November 08.50 All employees who try to log in to their computers when arriving at work report that they are unable to log in. They seem to be able to work locally on computers, but no central systems or shared file storage can be accessed.

28 November 09:20 The county administrative board informs the municipalities of Sollefteå, Kramfors, Örnsköldsvik, and Härnösand that they have strengthened their duty officer function (TIB) to provide the municipalities with support.

28 November 09.30 The municipalities' crisis management organization has been activated.

The task for the municipality was to a) establish a basis for decision, b) create a shared common operational picture with the other municipalities, and c) agree on what the four municipalities needed from the county administration.

Information case 2:

28 November 12.30 The Swedish Post and Telecom Authority, the Swedish Police, the Swedish Civil Contingencies Agency, and the armed forces jointly confirm that around 10 Swedish municipalities have been affected by IT breaches in the form of ransomware. It concerns municipalities located in the same region where new regiments have been established. The national overall picture is that a foreign state is behind the attacks, like the attack that was made against the European Parliament. Autonomous hacker groups or state-sponsored hacker groups could be behind the attack. The Swedish Post and Telecom Authority also announces that there are considerable telephone traffic disruptions.

28 November 13.22 An excavation outside Hudiksvall has accidentally damaged a fiber cable, resulting in no fiber-based Internet in the region until 14.45.

The task for the municipality was to a) establish a basis for decision about what action to take in the next 48 hours, b) identify areas where the four municipalities could cooperate.

RESULTS

The results are thematically structured for readability. The results presented here are the findings from this study but should be considered in a larger research effort where this exercise was the start.

Establishing an internal and shared common operational picture

The communication between the two municipality nodes was rather efficient. They used both mobile telephones and/or Teams/Skype for verbal communication. However, the creation of the operational picture was very communication-based and task-oriented. Initially all four municipalities divided tasks between each "node" and then worked independently of each other. There was no sharing and co-creation of the common operational picture. When it came to the shared operational picture, i.e., shared between the four municipalities, it was only done by voice. The shared common operational picture was established during a call involving all municipalities and actors. Instead of establishing a shared common operational picture between the four municipalities, there was a shared common operational picture between eight nodes.

Many of the municipalities relied on the document templates they had for crisis management and documented their internal operational picture and suggestions for decisions in a document, but each node only documented their task.

Organization of work process

None of the four municipalities had a preplanned way as how to organize the crisis management in hybrid way. They managed to communicate because they used their work computers and work phones, where their colleague's contact information could be found. Some of the municipalities only communicated with each other over phone and did not use Teams, Skype, or Zoom. As all municipalities divided their internal tasks between themselves, there was no obvious need to share documents or co-create documents using technology. The four municipalities were aware that they needed to organize a meeting where they all participated. One of the municipalities took lead in the meeting and suggested to the others to organize the meeting over the Internet using MS Teams. One challenge was how to share the link of the meeting. It was solved after 10 minutes of emailing, calling on private telephones etc. The "leading" municipality did not have contact information to the other municipalities in the county. Having a leading role was not something that had been pre-planned. When the collaborative meeting started the leading municipality asked if there were any objections to them leading the meeting. The leading municipality had a written agenda and structured the meeting well. Each of the "nodes" was allowed to speak, and together they established a shared common operational picture as well as a shared and agreed on the help needed from the county board.

Structure of the large meeting

As mentioned, one municipality took the lead, one municipality took the overall lead, and at each of the nodes, there was one person taking the lead at that node. It was an experienced person with a clear idea of what the four municipalities needed to achieve during the meeting. This person let each node speak and after the "round table talk" the person summarized how the operational picture could be interpreted and then there was some negotiation until everyone was satisfied with the outcome. They only used voice during the meeting. During the second exercise when both the Internet and mobile communication was not usable, they used the TETRA system to organize the meeting. This proved to be more problematic; some actors did not fully know how to communicate via radio, so some sentences were cut off and needed to be repeated.

Use of technology

The technology used during this exercise was computer for Teams, Skype or Zoom meeting, mobile telephone, and TETRA radio units. As mentioned, the collaborative opportunities available in Teams, Skype and Zoom were not used at all, only voice communication was used. For the municipalities it was easier and/or more convenient to use the phone with the speaker to interact and share information with the other node within the municipality. Using the speaker on the phone made it possible for the staff to use their computer more easily when using Teams, Skype or Zoom. During the second case of the exercise the scenario was designed to force the actors to use TETRA radio for communication, at least between all four municipalities. The skills in using TETRA radio indicated that most actors rarely or never trained using a radio for communication. Both establishing a connection with others,

i.e., to change the callgroup, and the lack of skills in how to use a radio for communication proved challenging. During the collaborative meeting with all four municipalities during case two of the exercise involved using TETRA radio, but when communicating between the two municipality nodes they used the telephone (not over IP). One municipality moved into one location because of the issues with communication over TETRA.

DISCUSSION

In this section we discuss the findings from a thematic perspective related to the theoretical framework.

Fragmentation

None of the municipalities worked collaboratively, and technology was not used as a mediator to establish a collaborative and common operational picture. It was more divided where the municipalities internally gave different members of staff different tasks. When EOCs are working together in one physical space, Granholm (2018) emphasizes that a lot of sensemaking is created through interaction among individuals and with interaction with artefacts in the room. That is, actions are carried out in collaboration when the EOC is gathered in a single physical place. In the hybrid exercises observed in this study, actions performed to create a common operational picture were no longer collaborative as much as individual actions. Each node switched focus from being object-oriented towards the activity, to being short-lived goal-oriented towards the action they had to perform. Maybe the time of the exercise forced them to rush towards a presentable result. But instead of acting as one crisis organization each municipality acted as two separate units. It is of course positive that there is autonomous capacity as well as trust in each other's capacity, but the traditional collaboration actions usually found in an EOC were missing. The operational picture was never common for one of the municipalities. Each of the four municipalities had two operational pictures that were never discussed and made common. During the meeting between all municipalities, the shared common operational picture was developed based on a single node's perspective and then aggregated with the remaining seven nodes' perspective.

During case one when this meeting was organized using Teams or mobile phones, there was more active collaboration and discussion during the establishment of the shared common operational picture. During case two when the municipalities were forced to use TETRA radio, the communication was as limited as possible and the actors that were used to use TETRA radio talked much more than the others.

Hybrid technology not used to its full potential

The exercise aimed to better understand hybrid crisis management. Even if all actors had working technologies during case one that could support collaborative work mediated by computers, the collaboration was only taking place over voice call. In each of the eight nodes you could find collaboration between the two municipality staff members that were sitting in the same room. They worked as is common in physical staff rooms or EOCs. However, the work between the nodes involved a low level of collaboration.

The municipalities did not use the affordance of the technology. After over two years of pandemic a better competence in using Teams, Skype or Zoom for collaboration was expected. Instead of viewing the technology as mediating artefacts that affords both sense giving and sensemaking they viewed the technology as a voice communication tool. Not using the technology as an active part in a collective sensemaking action derives the EOC of the combination of externalized information that is a vital part of creating a mutual understanding (Granholm, 2018). Checklists, regulations, and plans are also mediating artefacts in an object-oriented activity (Engeström, 2014). However, none of the four municipalities acted in a way that suggested that they had been planning for a hybrid crisis management structure.

An obvious challenge with the meetings in both case one and case two of this exercise is that both the online meeting and meetings where TETRA radio is used only allows one speaker at a time. In a physical EOC you often find simultaneously ongoing discussions taking place between the people in the EOC. The only time when there is only one speaker at a time is during certain meetings when there is an agreed meeting structure. This means that the Hybrid EOC does not offer the same type of interaction. Looking at the presented shared common operational picture we saw that it was rather low in richness during the exercise. This could be a consequence of the absence of mediating tools and not using the affordance offered by the tools, which creates a situation where the focus is switched from the object of the activity to the goal of the action.

During case two of the exercise when TETRA radio was the only way to communicate with more than one person, another challenged emerged: very few had ever trained talking via TETRA radio. Whiteboards, visualization, or maps were not used during the exercise.

CONCLUDING REMARKS

While the participants solved the challenge they were facing, the expected level of technology use to collaborate over the Internet was surprisingly low. There was no difference between case one and case two since no one fully used the affordance of the technology in case one. Nonetheless the municipalities managed to reach their objectives by only using verbal communication, and a loss of Internet connection did not change their way of working. As this is the start of a longer research effort this exercise will be repeated in the early autumn, to see whether some of these findings could be exercise dependent. We also aim to organize an exercise where work is carried out from home when the emergency situations occur, and information etc. will have to be shared in a hybrid way. We also want to investigate if the use of TETRA radio could be improved if the municipalities used their own TETRA stations, and not borrowed ones.

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