

Emerging communities of collaboration: co-location in emergency response systems in the ‘Safety house’ in Sweden

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ABSTRACT

Co-location as a form of network governance is a way of organizing response teams when responding to an emergency situation. At the ‘Safety house’ in the province of Jämtland in Sweden main emergency response actors and supporting actors work together in a shared physical place in order to facilitate the process of cooperation and joint decision making. In order to identify the strengths, weaknesses, obstacles, needs and information system role, we explored this case by looking at how the involved actors experience this new working context. We applied an analytical framework developed specifically for new forms of emergency response. It was found that co-location of actors increases the efficiency in using professional response resources and shortens the emergency response time. Information systems can have a significant role in improving the collaboration between actors at the ‘Safety house’. However secrecy issues, the problem of control and politics and the evaluation of the performance of actors are major challenges which face further development of the co-location concept.

Keywords

Emergency management, new forms of collaborations, co-location, network governance

INTRODUCTION

The need to feel safe and have quick access to help in case of an emergency is an on-going social issue that concerns the citizens who need the help, as well as the emergency response system (ERS) which provides it. Response time is one of the most important factors (Mattsson and Juås, 1997) which depends on criteria such as the form of collaboration between actors (Berlin and Carlström, 2011) and on proper decision-making processes (van de Walle and Turoff, 2008). Meanwhile, the resources in ERSs are limited and therefore localized to a few places in society. Thus, the time for the ERS to respond to alarms and arrive at the emergency site can sometimes be too long. Several factors such as long distances, financial cutbacks, decreasing personnel resources, and citizen expectations for improved services have forced society to develop new ways of organizing the ERS in order to make the response more efficient and effective. This includes bringing in new actors¹, complementary societal resources and new forms of collaboration in the ERS. There are already efforts in Sweden and internationally to change the traditional ways of responding to incidents. Öckerö, Nyköping, and Örebro are examples of Swedish municipalities that have already started to use new resources such as semi-professionals² and volunteer organizations in response operations.

One way of collaboration is the idea of a community of practice; groups of actors who have the same goal and share the same concern for something they do. They learn and do their task better as they interact regularly (Lave and Wenger 1998). Another new way of collaboration is using the concept of the co-location³ of existing ERS resources. Here, main actors in the ERS such as the Police, the fire and rescue services, the ambulances, and the alarm centers are located in the same physical places in order to create an emergency response community, speed up the collaboration process and thus shorten the response time. Co-location happens not only at emergency sites but refers in general to the permanent co-placement of actors in their daily workplace. Within emergency response it seems that co-location is decided by authorities and its benefits taken for granted. There is a lack of research on permanent co-locating of emergency response actors; its benefits, difficulties and needs. Therefore, this study will provide knowledge useful for both researchers and practitioners in the field.

¹ Existing or completely new actors who are not officially an integrated part of current ERS -but who may help in an emergency situation to shorten the response time or to compensate the limited number of ordinary actors.

² Semi-professionals meaning persons whose primary profession is not to respond to emergencies but who can support the ERS on the basis of their primary profession, if they have extra training for this

³ ‘to locate together; especially : to place (two or more units) close together so as to share common facilities’

STUDY AIM AND OBJECTIVES

In this study, we explore the concept of co-location, collaboration and information technology needs in emerging emergency response communities, as exemplified in ‘**Trygghetens Hus**’ (Hereafter we call it ‘**Safety house**’) in Östersund municipality in Sweden. The general aim of the study can be further divided into two specific objectives:

The *main objective* is to investigate a new emerging form of collaboration between different actors in emergency response systems in order to find its current strengths, weaknesses, and problems, and to identify the additional needs of the involved actors in order to improve their collaboration. A *secondary objective* is to explore how information systems (IS) can support this emerging type of collaboration and communities, and what functions the communities shall include.

BACKGROUND

In this section, we define emergency response systems (ERSs). We then point to some studies which try to improve the response time and resource allocation in ERSs. This is followed by the explanation of the concept of co-location as we have used it in this study.

In this study, we define ERSs as systems that aim to save lives and minimize the human and environmental material damages in the after-math of an incident. There are different categories and sizes of incidents; from frequent traffic accidents and fires, to large scale and catastrophic storms, floods, and earthquakes. In Sweden, the main actors in the ERS are the police, the fire and rescue services, the ambulances and the alarm centers.

There are several studies which try to introduce new ways of organizing the ERS in order to shorten the response time and improve quality of the operation. They focus on how complementary societal resources may support to handle emergency situations. There are actors within a society, with basic emergency management training like cardiopulmonary resuscitation (CPR) or fire suppression that may be of use in rescue operations. Elderly care personnel, building maintenance technicians, security officers or even taxi drivers are actors in society that might intervene in an emergency situation. They can either help the professional first responders or act as first responders as in the case of the SALSA⁴ project (Hollenberg and Rival 2009) and the SMS Lifesaving⁵ project in Sweden. In the United States (US), Community Emergency Response Teams (CERT) aim to provide people with basic training to be able to partake and collaborate in emergency situations. In Finland, the government uses volunteer actors to improve safety in sparsely populated areas (Rescue Services Management Forum, 2008). In Sweden, Sund (2006) shows how using actors from different societal sectors can improve the overall response operation quality, especially in cases where the response time is crucial as in cardiac arrests. Furthermore, it has been shown that informal structures, social networks, volunteer help, and non-profit groups already play a crucial role for the safety in rural areas (Pilemalm, Stenberg, and Andersson Granberg, 2013).

The concept and theories of co-location

In Sweden, there are several municipalities that are in the process of trying to use new forms of collaboration in the ERS. There are several cities that use the concept of co-location. In Nyköping municipality, the fire and rescue services and division for social care share the same building for close collaboration on certain alarms. The province of Jämtland is implementing a new form of collaboration in which several actors involved in emergency management work together in a shared physical area in order to facilitate the process of cooperation and joint decision making.

The general benefits of co-location in general, have been discussed by organizational theorists on ‘network governance’⁶ (e.g. Miles and Snow, 1986). Here, organizations are characterised as social systems with high degrees of informal interaction in contrast to bureaucratic structures (hierarchical control) (Jones, Hesterly, and Borgatti, 1997). Independent actors interact to provide a public goal. It has been shown that efficiency is increased in this type of organization by decentralized problem solving and distributed information acquisition. Effectiveness is also affected by the emergence of collective solutions to problems by actors inside the network (Dedeurwaerdere, 2007). There are, however, also problems associated with network governance (Christensen, Lægreid, Roness and Røvik, 2007). They include problems of politics and control in which it is not clear who has the control over the other. There are also concerns about the ambiguity of responsibility between actors. Problems of performance indicators further show the difficulty in evaluating each actor’s performance.

Co-location as an organizational principle has been used and discussed in different domains. In health care systems, co-location of services and frequent team meetings have been shown to facilitate effective communications and hence increase efficiency (Appleby, Dunt, Southern, Young, 1999; Coburn, 2001). Supplier co-location is also discussed in supply chain management system where a suppliers’ employee is permanently housed in the buyers’ organization accessing all of the data of both supplier and buyer organization (Wisner, Tan and Leong, 2011). In the case of large

⁴ Saving Lives in the Stockholm Area – SALSA means that more resources than just ambulances are equipped with defibrillators and that these extra resources are alarmed when cardiac arrests occur. The police cars, taxis and buses are examples of alternative resources.

⁵ <http://www.smslivraddare.se/>

⁶ Different literature may name it differently. We found following synonyms for ‘network governance’: network organization, network structure, organizations network and network-centric organizations.

incidents and world-wide disasters, it is often required for all actors to temporarily gather together near the incident scene to enable collaboration. Temporary co-location at emergency sites facilitates effective communication and also increases efficiency due to better information interpretation, coordination and task allocation.

A framework for the analysis of collaboration between actors in ERS

Previous research on new actors and collaboration forms in emergency response do not generally handle issues about categorization and structures of these emerging concepts and communities. New actors and collaboration forms are different in different contexts and different emergencies. This implies a need for the categorization of tasks, responsibilities, structures, competences, legal matters, equipment, technology, etc. Pilemalm et al. (2013) performed an initial categorization of potential active actors in ERSs distinguishing between *non-profit organizations*, *semi-professionals* and *individuals* and included some reasoning about the needs of these different groups, pointing out the gap above. Yousefi Mojir and Pilemalm (2013) further addressed this gap by looking at different types of actors and developed a corresponding framework. It is used for analysis of new actors in ERS in order to understand them, their tasks and context before integrating them in the ERS. The framework looks at different dimensions as suggested in Figure 1. It is believed that by using this framework the risk of missing important aspects in the analysis of specific ERSs/new actor cases is reduced. The framework was initially created for new actors in ERSs but it can be used for the analysis of all actors and their collaboration in ERSs. Apparently, it is possible to study co-location in ERSs from different points of view but we used this framework to structure our study and also explore co-location in ERS from specific dimensions that are expressed as important by this framework. Formulating interview questions, categorization of collected data and also data analysis are the main parts that we used the framework for (see Method section for more detail).

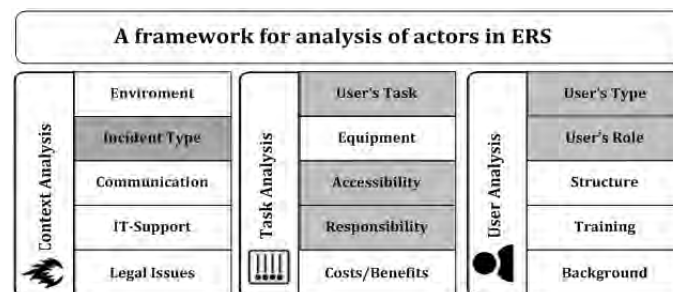


Figure 1. Condensed version of the framework. The white dimensions are those applied in this paper.

Study context

In Sweden the costs associated with emergency response might be reduced by using new methods or by improving the existing methods in response operations as for example demonstrated in Sund (2006). The municipalities' budgets have been substantially reduced in recent years, and this has consequently affected the resources that can be spent on making the ERS more effective. Jämtland is a sparsely populated province with a population of 112 000 people. The province has a population 3 times higher during the high season because of tourism. The 'Safety house' building is located in the city of Östersund which is the capital of Jämtland province. It is the name of the building where response actors are located and work together (Figure 2). Both professional response organizations and others supporting or having responsibilities in response operations reside here. The new type of collaboration aims to 1) improve alarm management in order to shorten the discharge time of professional response teams (the police, the fire and rescue service and the ambulances), 2) to reduce the costs of response operations and to shorten the response time by improving the collaboration between actors, 3) to help actors quickly gain a common understanding of the emergency situation (situational awareness), 4) to create a platform for shared information management and information dissemination to media and press and 5) develop a citizen-centered service by placing citizens' needs at the core of service provision.

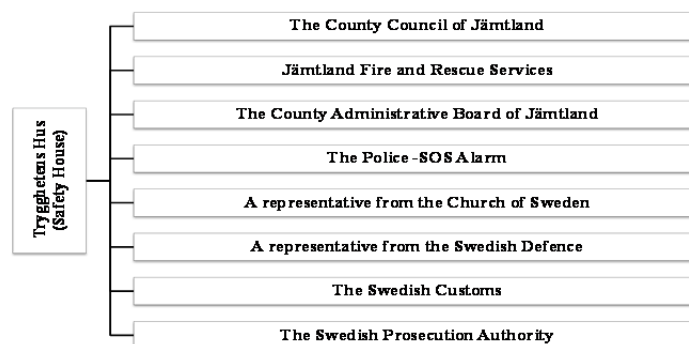


Figure 2. Organizations which share the same building/physical work space in the 'Safety house'

This study is focused on the response phase of emergency management. Therefore, in the study we focus on the

collaboration between those actors in the 'Safety house' who have a more visible role in the response phase of an emergency situation such as the police, the fire and rescue services, SOS alarm, the ambulances and also the Swedish Defence.

METHODS

The study is based on qualitative research methods often used in case study research. Case studies are suitable when there is little control over events; or the focus is on a contemporary phenomenon within a real life context (Yin, 1993). Case studies can be of an explorative, descriptive or explanatory character (Yin, 1993). This study mainly belongs to the first category, focusing on the present form of collaboration between actors in the 'Safety house' and how IS may help to improve the collaboration. Interviews and future workshops were used as main data collection methods for the current case study.

Semi-structured interviews

Interviews are commonly used to gain an understanding of peoples' experiences and their perspectives (Seidman, 1998). Semi-structured interviews involve some pre-formulated questions or themes that keep focus on the subject but there is no strict adherence to them. Thus it gives the interviewee the opportunity to add important insights as they arise during the course of the interview. The risk of losing focus is high in unstructured interviews while the risk of losing new insights is high in structured interviews (Myers, 2009). Therefore semi-structured interviewing was chosen as for this study.

Semi-structured interviews were performed with four actors: 1) the 'Safety house' project manager, and representatives from 2) the police, 3) the fire and rescue services and 4) the Swedish Defence. The chosen interview respondents were those who were responsible for this new way of collaboration (co-location) in their respective organizations. All interviewees were interviewed about their respective organizations' experience in co-location and collaboration regarding perceived strengths, problems and their further needs. Questions were designed using the analytical framework, further explained below. Interviews were both documented in memory notes during the course of the interview and were audiotaped for further transcription. Transcribed interviews were used in order to not miss important points mentioned by the interviewees.

Future workshops

Future workshops allow users (participants) to reflect upon their own work and situation, potential problems, and needs for improving the situation such as using IT-technology (Kensing and Munk Madsen, 1995). It is usually divided into 3 phases: the critique phase, the fantasy phase and the implementation phase. The first phase is aimed at reflecting upon the individual's own work situation and needs for improvement. Futuristic solutions to the needs for improvement are the main focus in the second phase. Suggested solutions in this phase are not restricted by technical or organisational constraints. In the implementation phase, those solutions identified in the previous step are transformed into realistic, organisationally and technically feasible implementations (Kensing & Halskov Madsen, 1991). Motivation for the use of future workshops is to involve end-users who know their own work context and environment in order to find relative and innovative solutions.

A half-day future workshop was arranged in which 8 actors from the police, the municipalities in Jämtland, the fire and rescue services and the representative from the Swedish Defence participated. People in the workshop were chosen by the Safety House project manager based on their accessibility and role in 'Safety house' operations. The people from the interviews were among the participants. All participants had good experience of working in the 'Safety house'. The focus of the workshop was on the improvements regarding collaboration in the 'Safety house' and in related response operations, including solutions for current problems and obstacles.

Data analysis

The condensed version of the framework is shown in Figure 1. For the purpose of this study, we did not use all dimensions while mostly focusing on the main actors in ERS (i.e. actors who react to emergency situations as their major task). Thus, some of the dimensions such as actors' type, role, task, responsibility, accessibility and incident type are not covered here since these are already described in the Swedish ERS laws and principles. Data gathering and analysis were based on a selected sample of those dimensions in the framework that were deemed relevant to the task at hand (Figure 1). This means that we formulated questions based on the perceived strengths of the new collaboration forms, its weaknesses, obstacles and problems and related those to the selected dimensions. For the data analysis we tried to categorize the results according to the dimension we chose in the first step. We thus analysed, documented and transcribed interviews based on the selected dimensions from the framework. We aimed to keep our focus on the important dimensions of the ERS that the frameworks point to, so as not to become distracted and do a shallow analysis of data from too many different aspects. The framework was also introduced to workshop participants and we also categorized the workshop data to extract strengths, weaknesses and needs for improvements related to the selected dimensions.

RESULT AND ANALYSIS

In this section we first describe the collaboration and co-location principles in the ‘Safety house’. Then, the data from interviews and the future workshop are categorised and described according to the research themes and selected dimensions in the framework (Figure 1): *Environment or workplace, communication, IT-support, legal issues, equipment, cost/benefits, background or qualification*.

Each theme is followed by an analysis in which we identify actors’ needs in the ‘Safety house’ and suggest potential solutions. The solutions are sometimes mentioned by the respondents themselves and sometimes are suggested by the researchers based on experience and literature. Table 2 shows a summary of the results.

Collaboration and co-location principles

The involved actors in the ‘Safety house’ share their work place and equipment for better collaboration in their day-to-day work. Different actors can access each other easily since they work in the same building and their offices are located nearby. They also use shared areas for social events such as eating and informal meetings. There are two formal meetings between actors; one is daily, and the other is weekly. The weekly meetings are conducted on Mondays. In the daily meeting the police, the fire and rescue service and SOS alarm gather and discuss the events of the day before and the day after. The perceived benefits of this meeting are mostly about gaining the same understanding of the status of the region the actors are jointly responsible for. In the weekly meeting, more actors participate. Representatives from the municipalities in Jämtland province, the County Council (in charge of Ambulances), the police, the fire and rescue service, the Swedish Defence, prison and probation service, and County Administrative Board discuss the events of the previous and the following week. The main goal of the weekly meeting is again to gain a common understanding of the province’s status. Actors find the meetings helpful because they become aware of news and each other’s views on the different events in the province. At the end of the meeting a clear understanding of the current status of the province is expected. Table 1 shows the different actors who take part in the meetings. Finally, there are also on-demand meetings which are usually held before a response operation. In these meetings, depending on the scale and character of the emergency, different actors take part and discuss the ways they can manage the situation. The goal of this meeting is to shorten the response time as well as to utilize the professional response team resources effectively and efficiently.

Everyday meetings	Every Monday meetings	On-Demand Meetings	Informal Meetings
• The Police • The fire and rescue service • SOS alarm	• Municipalities in Jämtland province • The County Council • The Police • The fire and rescue service • The Swedish Defence • The Prison and Probation Service • The County administrative board	• Mostly reponse professional team • Other actors if needed(e.g municipalities, County administrative board, Swedish Transport Administration)	• All actors that works in Tygghetens Hus

Table 1. Different types of meetings at the ‘Safety house’

All interviewees and participants in the future workshop noted improvements in the collaboration with other actors from the date they started working at the ‘Safety house’. The respective actors spend less time on the coordination of response teams. Joint decision making processes have become faster. The professional response resources are used more efficiently in that the required numbers of professional response resources with suitable competences to handle the situation are calculated more effectively. This is due to response actors gaining the same understanding of the situation. The main reasons for increased shared understanding as mentioned by the interviewees were the regular meetings, implying social face to face contacts instead of only digital based communication, and quick access to each other.

Both interviewees and participants in the future workshop also mentioned different difficulties experienced in their new collaboration. These varied from technical to organizational to legal issues. The most important were secrecy, lack of a shared information technology platform for data exchange, lack of a good map system, difficulties in using gained abstract knowledge - from their training regarding collaboration - in real response operations, and problems in communication with other actors (volunteer organizations, Swedish Transport Administration, etc.).

1. Communication and collaboration

The ‘Safety house’ is perceived to have valuable effects according to the actors. *Regular meetings* and *social contacts* between actors increase the familiarity of actors about each other’s organizations, their tasks and their skills. This is considered by the actors to be an important factor in collaboration in response operations. When people get to know each other it seems that it is easier to identify who they should communicate with or have contact with in case of response to an incident. They also discuss their respective work and experience of response

operations and the new way of collaboration with each other more informally. Thereby, they increase each other's competence by pointing out different perceived problems and strengths in their mutual collaboration.

The representatives from the police and the fire and rescue services emphasized the positive impact of receiving feedback about response operations from the respective actors in regular, short, joint, formal and informal meetings, following the operation. Feedback is usually related to the performance of respective actors and the lessons that can be learned from the current operation. Social events like having lunch in a shared area were named as a moment where actors exchange feedback. Everyday meetings and Monday meetings also are important times to give and receive feedback. However, the main theme of these meetings is something else, as mentioned above.

The interviewees and workshop participants claimed that the collaboration between main actors is satisfying. Face to face communication before a response operation is perceived as leading to the more accurate interpretation of information about an incident. Digital information (emails, digital records) may be interpreted and understood differently by different actors while in verbal communication it seems this problem is less visible. All actors gain the same understanding of the situation and they do it faster, the respondents claim. One reason is they already know each other and have background information about each other's work which in turn facilitates the process of communication and decision making. They look at data, pictures, videos and maps and discuss together in order to gain a common picture of the situation.

All actors mentioned the usefulness of the RAKEL⁷ communication system. By using RAKEL they can talk to each other using a shared platform individually or in groups. The area coverage of RAKEL is quite acceptable for actors in the 'Safety house' in comparison with the limited coverage of mobile phones in forests and mountains, the respondents claim. However, the system is quite expensive and requires more investment in order to be used by all actors.

Identified needs and solutions: to expand collaboration and to have a common communication system

The police and the fire and rescue services note the need to involve municipalities and the County Administrative Board in regular meetings. These authorities should have the same understanding of the situation as the other actors in the 'Safety house' in order to make better decisions in case of an emergency. Also, these municipalities and the Swedish Transport Administration cannot communicate with RAKEL or use all of its functions. Even the representative from the Swedish defence claims that they presently use telephone and email which is different from RAKEL that is used by the others. Therefore, there is a need to equip all important actors with RAKEL.

Identified needs and solutions: to document and formalize the collaboration between all actors

To formulate and document the collaboration between actors can help all actors in a response operation. For example responsibilities of actors, decision makers, and the hierarchy of different actors are important factors that should be formalized in documents and be spread to all actors. Presently, there is no common documentation about the collaboration of all actors in response operations. Each actor has its own documentation. A shared documentation system among all actors about response operations may help to evaluate the operations and thereby learn from past events. Refining report template attributes, based on organizational learning theories can help create double loop learning and thus improve the collaboration between actors (Pilemalm, Yousefi Mojir, Andersson, 2013).

Identified needs and solutions: to create a steering group

Feedback is presently informal and is received from different sources such as people inside the involved organizations, from citizens, researchers, and politicians. However, it is not stored in a standard format in order to evaluate and implement it. There was a sense among respondents that documenting and handling feedback is an important step to improve the intended 'Safety house' concept. A steering group is needed to handle the internal feedback as well as the questions from authorities, academia, and citizens in order to further develop the collaboration between different actors. Creating formal feedback templates and allocating part of formal meetings to feedback will be required. Documentation of collaboration and feedback can be done using a document management system to make the information seeking and learning process easier in the future.

2. IT-Support

A shared IT platform and especially a good map system for information exchange is reported as missing, by both the fire and rescue service and the police, for example when they need to access other actors' information (e.g. their position or their status). The representative from the Swedish Defence also mentioned the potential usefulness of an integrated IT system for exchanging information with other actors located physically outside the 'Safety house' but needing to exchange information with those actors inside. Regular meetings and face-to-face conversations can solve problems of digital information sharing in the case of small incidents. The face-to-face conversation however, is not sufficient in larger emergencies involving more information and response actors. All interviewees pointed out the need for an IT system that provides the ability for the actors to share and spread both visual and spatial information about incidents.

⁷ RAKEL is the Swedish national digital communications system used by the emergency services and others in the fields of civil protection, public safety and security, emergency medical services and healthcare (www.msb.se, 2013).

Identified needs and solutions: shared platform for exchanging and displaying information about incidents and response operations

There are many sophisticated and powerful map systems in emergency management (for example Ushahidi, 2008; Sahana, 2009; Samaraweera and Corera, 2007). This need in the 'Safety house' seems more of an organizational than a technical one. The actors have problems about what kind of information they need or how they should exchange the information using maps. Since different actors have different needs, they use different types of information to take part in response operations. A needs analysis regarding the information actors need can be a starting point here. A shared platform for data exchange in response operations help the common understanding of a situation and subsequently support improved situational awareness. According to (Comfort, 2007; Kraak, 2001) situational awareness between response teams is a crucial factor in the success of response operations.

Identified needs and solutions: better tools to view information

The respondent from the fire and rescue service mentioned the absence of more sophisticated tools and equipment to view the information from the incident site, especially mobile tools for use in cars and outside. Most of the current IT systems support portable devices such as mobile phones and tablets. For example, the systems suggested above have portable device versions. Again a focused needs analysis, can be a starting point in the 'Safety house' in order to explore how portable devices can help response operations.

3. Education and training

In the interviews, the respondents from the police and the fire rescue services mentioned the problems of transferring gained abstract knowledge about the new type of collaboration to practical work. The received knowledge comes mostly from common education of different actors and also from feedback exchange between actors. As an example, the respondent from the police referred to the police being trained in the area of information confidentiality and what should or should not be shared with others. However, in the daily routines the personnel do not exchange information about response operations because of the false understanding that all information is confidential. The fire rescue service representative mentioned that all actors in the 'Safety house' receive education about each other's organizations and their work. In practice, however, they do not know how to use this knowledge properly for better collaboration. .

Identified needs and solutions: to transfer abstract knowledge into practical work

There is thus a mentioned lack of methods for transferring theoretical training/knowledge to practice. The respondents asked for more regular and practical joint training to make the personnel more ready to act according to the previously gained joint theoretical knowledge. New methods to transfer abstract knowledge to practical, operative knowledge and joint exercises can be beneficial in the 'Safety house'. For example, simulation systems as demonstrated by several studies can be used for learning purposes and for creating practical knowledge from theoretical ideas. (Turoff, Hiltz, Plotnick and White, 2008; Reuter, Pipek and Müller, 2009)

4. Legal issues

The issue of *Information confidentiality* (secrecy) was mentioned both by the police and fire rescue services as a problem inhibiting the sharing of information. The problem is more applicable in police work since they have a higher level of information confidentiality than the fire and rescue services. The representative from the police thinks there is still much information (e.g. about work methods, video and photos of incidents, etc.) that can be exchanged without breaking the rules - if the personnel express or use it in the correct way. However, some kind of training is needed that informs people in recognising the type and handling of information as well as the correct restrictions on information exchange between actors. Secrecy may cause problems when different actors want to exchange pictures, movies and other data about an incident. Secrecy also causes problems when different actors need to access each other's information systems or documentation to retrieve information about an incident, as was claimed by all interviewees.

Identified needs and solutions: identifying legal problems and challenging them

Secrecy seemed to be a big obstacle in the 'Safety house'. However, with the proper education regarding information handling, and knowing each other well this problem seems to be controllable and resolvable. Some of the proposed IT-support must be analysed and developed in accordance with current laws and some proposed solutions may even need law revisions at national level, to be applicable.

5. Involving the others

Involving complementary societal resources and actors, who are not the main actors at the 'Safety house', in response operations is seen as a challenge today. The police currently cooperates with volunteer organizations such as 'Missing people'⁸ and with private persons in searching for missing persons because they usually know the region, forests and mountains very well. The police representative, however, refers to the difficulties in

⁸ Missing people is a non-profit organization which helps to search missing and disappeared persons with by help of organizing individual volunteers people(<http://missingpeople.se> : 2013)

organizing these kinds of actors, especially spontaneous volunteer individuals. Qualification is another important factor. Some of these actors may not have enough training to take part in response operations. For example, they need more knowledge on how to survive when they are performing a response operation in harsh weather in forests. The fire and rescue service representative sees the problem of involving other actors as even more obvious. There is usually not enough knowledge about volunteer organizations, their skills, their capacities and their work. There are also no routines or methods available to involve important authorities such as the Swedish Transport Administration and media in response operations, for instance in large car or train accidents.

The representative from the police mentioned that Sweden is partially moving toward centralized emergency management by establishing more national management centres. One recent example is the removal of the local SOS Alarm center from the city of Östersund and replacing it with a national center. The interviewee sees a problem with this centralization. He claims small response teams should be localized in different regions close to the population. The knowledge about the geographical area is a crucial factor in response operations and in the efficient use of resources. Also the respondent from the Swedish Defence pointed out his experience about cooperation with national alarm centers as problematic since the operators tend to be unfamiliar with the region. When the response operation is managed from a national center the first responders usually do not have enough knowledge about the geography and the topography of the area, before arriving at the incident site. Local people and local response teams on the other hand usually know the region. Also in the case of neighbourhood fires citizens may know the buildings and their residents which can be helpful to the rescue team.

The 'Safety house' also aims to provide a citizen-centered service and to focus on citizens' needs and safety. The challenge is not having enough communication channels to exchange information with the public.

Identified needs and solutions: to involve new actors

All actors pointed out the importance of new actors in the 'Safety house'. The police mentioned the importance of 'Missing people'; the fire and rescue service listed the information from local people, the representative from the Swedish defence referred to the Swedish National Home Guard as an important volunteer resource. Presently, however, there is no established method to involve such actors in response operations. For example, there should be introduction meetings and courses where main actors can become familiar with new actors, their skills and services. New actors also should learn about the organizational structure of professional actors in the 'Safety house' in order to know how and when they can help. Basic education and work methods are important before involving complementary societal resources. Information channels to gather information from the local inhabitants is also non-existent in many cases. It is not clear how information should be gathered, where it should be stored and how it should be used. To involve new actors such as volunteer organizations requires bi-directional organizational knowledge. At the moment, there is a lack of a good digital repository to store the organizational information such as structure, skills, availability, rules, and contact persons.

Category	Strengths	Difficulties	Needs improvement
Communication and collaboration	- Regular meetings and social contacts - Feedbacks exchange - Identical information interpretation (common understanding)	- To equip actors with RAKEL system is quite expensive - Hierarchy, decision makers, and responsibilities are not clear enough - There is no method to handle feedback and questions	- To involve other important authorities - To document and formalize the collaboration between all actors - To create a steering group in order to handle feedback
IT-Support	Using photos, video to discuss the incident	- To share spatial information is difficult. - There is currently no good portable tool for viewing information about incident	- Shared platform for exchange and display of information (maps, pictures, movies of incident) - Better tools to view information
Education and Training	Common education	To transfer theoretical education to practice	- More joint exercises - Methods to transfer abstract knowledge to practical knowledge
Legal issues		Information confidentiality (secrecy)	To identify legal problems in collaboration and to challenge them
Involving the others	- Local knowledge is important - Eager to involve other actors - Citizen-centred	Communication with other actors (e.g. volunteer organizations, citizens)	- To involve other actors such as volunteers and citizens with local knowledge - To involve citizens

Table 2. Summary of results from data analysis in the 'Safety house'

Identified needs and solutions: to involve citizens

Currently the role of citizens is not clear or visible. More communication channels are needed in order to receive information from citizens and to give information to them. An important group is young people who use digital

communication channels such as social networks and web platforms. Involving citizens in the 'Safety house' demands creation of more digital communication channels and electronic contents⁹ exchange.

In this study, we explored the concept of co-location of emerging response communities, as exemplified through the 'Safety house'. This study helps other researchers and practitioners to understand this new collaboration better and to be able to extend and apply it to similar situations. Co-location in the 'Safety house' as a form of network governance has clearly increased the efficiency in using professional response resources and shortening the response time. This was achieved by close collaboration between independent actors, collective problem solving, and common understanding of the situation. Informal meetings and feedback has also had important influence on the improvement of this network structure. These are all in agreement with the characteristics of network governance as suggested by e.g. Dedeurwaerdere (2007) and Jones, Hesterly, and Borgatti (1997). As we have shown, the 'Safety house' actors have several needs to further improve collaboration. However, it seems difficult to satisfy the needs or implement changes, because the individuals responsible for the changes are not known. This is also in agreement with the problem of control and politics in network governance theory in which it is unclear who decides and who has priority over the other (Christensen et al., 2007). Evaluation of the current performance in the new structure in comparison with the past, when they were located outside the 'Safety house', is another difficulty. Abrahamsson, Hassel and Tehler (2010) mention the difficulty to foresee the performance of any socio-technical system because of the impact of social relations and interactions. This is also in agreement with network governance theory (Christensen et al., 2007).

Application of the framework

The case study was done in a Swedish context but the framework is a general one based on both national and international research/experience (Yousefi Mojir, et al., 2013). Therefore, the results should be of interest in other countries and contexts. By using the framework, it is also possible to compare different studies by choosing the dimensions that are needed to study and then replicating them across other cases. The main objective of this study was to find the problems and needs in the 'Safety house'. Applying the framework was deemed helpful in doing a thorough investigation, covering relevant themes and questions. Without using a framework, the risk of missing important aspects such as e.g. legal issues may be high. The use of the framework in this study showed its benefits but also some problems. It was deemed helpful to look at the new form of collaboration from different views. After selecting the dimensions suitable to the study of co-location of main actors, we could formulate the questions and perform the analysis more effectively, adequately and comprehensively as the framework covered most important aspects of the current ERS. The research process also seemed more coherent. On the other hand, using the dimensions strictly became problematic when categorising and analysing the gathered data. It was not possible to follow the structure of the framework in all categories. We handled it by partly creating our own categorization in the analysis section. The framework needs to be developed and completed to maintain a greater degree of flexibility. There are also some dimensions (e.g. Cost/Benefit) where the interviewees and participants in the workshop did not provide any data, even though we asked for it. On the other hand, by using the framework, we knew we could not cover this dimension due to lack of data, not because we neglected the aspect, and we can collect complementary data from other sources to cover these aspects. There is a small risk that we have missed some aspects of ERS which the framework does not cover since the framework is still a work-in-progress.

Information systems and future work

In this study, a number of IS related solutions were suggested for the identified needs. One of the challenges and future tasks is to design ISs and IT solutions that are suited for the organizations with network governance structures where social interaction, network structure and secrecy problems play important roles. Moreover, change implementations and performance analysis in emerging response communities with network governance structures can be seen as a future task. In the current research, we will next use this framework for the case of co-location in Nyköping, Sweden where the fire and rescue services, division for social care and technical staff (e.g. building maintenance technicians) closely collaborate on certain alarms.

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⁹ Electronic contents are emails, websites, twitters, digital records, SMS, etc.

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