Information Systems Development for Emerging Public Sector Cross-sector Collaborations

The Case of Swedish Emergency Response

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ABSTRACT

Information systems (IS) seem prevalent in modern societies and this has resulted in the rapid digitalisation of different societal sectors. One application domain of IS is *emergency response systems* (ERSs), which are responsible for delivering essential services to save lives and minimise environmental damage in both small, frequent and large-scale emergencies. Specific IS applications are in turn used in ERSs to support such aspects as decision-making, communication, information sharing and the dispatching of resources. Public sector cut-backs and a lack of professional resources have negatively affected emergency response at the same time as natural and man-made disasters (e.g. forest fires, storms, terror attacks) have intensified in recent decades. At the same time, frequent, small-scale accidents continue to occur, both in urban and sparsely populated areas. As a result, emergency response actors, first responders, are often placed under severe pressure. An emerging trend in response to these challenges, both in Sweden and internationally, is to create cross-sector forms of collaboration, by combining alternative resources from various sectors. Since these collaborations are relatively new and involve heterogeneous stakeholders, it is essential to understand the context, as well as actors' tasks and needs in related IS development processes. When the work on this thesis started, there was a perceived lack of knowledge relating to ERS cross-sector collaboration and the associated needs for digitalisation/IS support; for example, in which situations actors should be involved, what they should do, what challenges they may face and how these may affect IS.

Organisational and needs analyses are deemed essential first steps that can be used to understand the nature of these collaborations, their heterogeneous users and stakeholders, potential needs, and related opportunities and challenges. One way to do this is to enable user participation, gaining help from stakeholders who may know the context. However, despite the many perceived benefits, user participation is also associated with several challenges; for example, how to identify and involve relevant stakeholders, especially when they are numerous and heterogeneous. These challenges have been discussed in relation to the new public sector but not specifically in the development of cross-sector collaborations in ERSs. Furthermore, using different frameworks for performing organisational/stakeholder/needs analysis in new domains can help to structure them. At the beginning of the work on this thesis, there was a perceived lack of broad frameworks for ERS cross-sector collaborations that could be used as tools in the related analysis and user participation activities. Finally, at a theoretical level, it was deemed interesting to use network governance as an analytical lens to enable a further understanding of the ERS cross-sector collaboration phenomenon.

The thesis objective is thus *to explore IS-related opportunities, challenges and needs aimed at supporting heterogeneous actors in emerging cross-sector collaboration in the ERS context using the sociotechnical ensemble view* to enable and facilitate future IS-related development. The thesis is based on case study research and qualitative research methods. Sociotechnical systems theory, the sociotechnical ensemble view, and network governance are used as the analytical framework of the research. One baseline study on new actors/collaborations and three subsequent studies were performed on the 'co-location of actors', 'co-operative use of resources' and 'semi-professionals as first responders' by performing interviews, focus groups, participant observation, Future Workshops, an exercise and an after action review. In relation to IS development, the thesis also identifies challenges relevant to user participation applications in emerging public sector initiatives and suggests actions to handle them. The thesis also presents a framework that can be used in the analysis process as an instrument of inquiry or in user participation activities as a tool to facilitate stakeholder involvement. The user participation activities and framework were used/developed as a way to achieve the thesis objective, but are also presented in their own right, as part of the thesis results.

The thesis results indicate that the needs for IS vary from simple smartphone applications to manage alarms, positioning and the dispatching of new resources, to more sophisticated tools for sharing and viewing incident data. The results also indicate that these collaborations have the potential (e.g. resource redundancy, better communications, pooled competencies to increase total capacity) to improve the Swedish ERS and that they can be supported by adequate IS support. The actors also have substantial basic needs for training (e.g. fire extinguishing, CPR, information handling) and emergency supplies (e.g. fire extinguishers, healthcare kits). The major challenges are organisational, economic and juridical, and the most prominent are ambiguities in actors'

tasks and responsibilities, and how to prioritise between ordinary work and 'new' first-response tasks. These challenges must be addressed in order to enable some IS functionalities; for example, in information sharing and resource positioning. A further analysis of the results using the sociotechnical ensemble and network governance approaches also highlights several institutional factors in networks (e.g. mutual interest between members, collective problem-solving, conflicts between institutional rules) which are believed to have a key role in the success or failure of these collaborations. The key factors may also be seen as entangled parts of IS development according to the sociotechnical ensemble view. Recurrent key and context-specific factors (the role of IS, training, equipment, fear, stress) that are not currently part of the network governance literature but may be captured using the sociotechnical ensemble view were also identified.

As to the identified relevant user participation challenges, the major one was developing a future cross-sector collaboration in a context that does not yet exist, and involving stakeholders from resource-strained organisations in doing so. The stakeholders, and sometimes also the primary end-users, are partly unknown and tasks are undefined. As a response, a combination of activities based on multiple design groups, scenario-based Future Workshops, focus groups, context-specific frameworks, a practical exercises and after action review was provided. The framework has 15 dimensions presenting crucial aspects of cross-sector collaboration to explore and incorporate into the analysis and which can support user participation activities. The dimensions are: 'type/role', 'attitude', 'training', 'background', 'task and responsibility', 'availability/accessibility', 'incident type', 'communication methods', 'information technology', 'emergency supplies', 'organisational structure', 'leadership', 'costs/benefits', 'environment', and 'regulations and legal issues'.

It is argued that cross-sector forms of collaboration are a rapidly emerging trend in the public sector, and specifically in the Swedish ERS, and that related research is still somewhat sparse and fragmented. Here, the thesis makes its *primary contribution* since it provides a comprehensive sociotechnical ensemble view of the challenges, possibilities and actor needs based on three different studies, and some systematisation with regard to the framework. As a more *practical contribution* to IS development, the user participation challenges identified in this thesis are not new, but seem to be intensified in emerging cross-sector collaborations and in new public sector initiatives with elements of future services implementation. Also, the activities suggested may not, in themselves and individually, be seen as new to user participation. However, this specific combination of methods has been used in similar studies (e.g. involving Swedish volunteers as first responders) with similar outcomes, and might thus be used as inspiration when involving users and stakeholders in similar contexts. The thesis results also suggest that the new IS in the context will be much about integration and adaptation; for example, adding cross-sector collaboration functionality to authorities' and response organisations' existing IT artefacts/infrastructure. The thesis also emphasises the importance of 'infrastructuring' in emerging cross-sector collaborations since it seems crucial to address substantial aspects beyond IT artefact design (e.g. organisational, training, equipment, legal). At the same time, the need to invest substantial resources in early design work displays something of a paradox; specifically, the difficulty in engaging stakeholders in resource-strained public sector/ERS environments and initiatives that are ultimately driven by motives of increasing efficiency. In this thesis, one way to compensate for that and in line with some recent literature on user participation, the concrete outcomes of the activities were focused and, for example, training packages, lists of challenges, user needs, and an alarm management app based on the stakeholders'/users' input were delivered to relevant organisations for further implementation.

As to *scientific contributions of a theoretical character*, apart from applying the sociotechnical ensemble view, it is argued that emerging cross-collaboration forms may be characterised as hybrid forms of network governance and more hierarchical government forms. Also, the thesis points out that the fundamental role of IS as a prerequisite for and an enabler of collaborations is not currently considered a key factor in network governance. IS and context-specific key factors might have been captured by relying solely on the sociotechnical ensemble view, which has a broader scope than network governance. However, they are different perspectives with different levels of abstraction and their combined use in this thesis was deemed helpful in concretising the use of the sociotechnical ensemble view and focusing on institutional aspects that seem explicitly important and unsolved in ERS cross-sector collaborations. From a wider perspective, the research fields of political science and IS may have the potential to cross-fertilise and learn from each other when applied to cross-sector collaboration, public governance, digital government and public administration.

FOREWORD

Information Systems Development (ISD) is a research discipline within the Faculty of Arts and Sciences at Linköping University (LiU), Linköping Sweden. ISD is a discipline studying human work with developing and changing different kinds of IT systems in organisational and societal settings. The research discipline includes theories, strategies and policies, models, methods, co-working principles and artefacts related to information systems development. Different development and change situations can be studied as planning, analysis, specification, design, implementation, maintenance, evaluation and redesign of information systems. Focus is also on the interplay with other forms of organizational development, processes of digitalization and innovation. The discipline also includes the study of prerequisites for and results from information systems development, as e.g. institutional settings, studies of usage and consequences of information systems on individual, group, organizational and societal levels.

The ISD research at LiU is conducted in collaboration with private and public organizations. Collaboration also includes national and international research partners in the information systems research field. The research has a clear ambition to give distinct theoretical contributions within the information systems research field and relevant focus areas. Simultaneously, the research aims to contribute with practically needed and useful knowledge.

This work, *Information Systems Development for Emerging Public Sector Cross-sector Collaborations – The Case of Swedish Emergency Response*, is written by Kayvan Yousefi Mojir, Linköping University. He presents this work as his PhD thesis in Information Systems Development, Information Systems Division, Department of Management and Engineering, Linköping University, Sweden.

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PAPER I

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PAPER III

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PAPER IV

Yousefi Mojir, K., Pilemalm, S., & Andersson Granberg, T. (2018) User Participation in Information Systems Development for Emerging Public Sector Initiatives, Presented at 27th *International Conference on Information System Development (ISD 2018)*, Lund, Sweden.

PAPER V

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RELATED WORKS

LICENTIATE THESIS

Yousefi Mojir, K., (2016). New Forms of Collaboration in Emergency Response Systems: A framework for participatory design of information systems, *Linköping University Electronic Press*, ISSN 1401-4637, No. 119

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Kayvan Yousefi Mojir

Linköping, September 2018

IMPORTANT ABBREVIATIONS

AAR	After action review
CPR	Cardiopulmonary Resuscitation
ERS	Emergency Response Systems
ESKORT	Use of Municipal Resources for Increased Safety and Security
IS	Information Systems
IT	Information Technology
MSB	The Swedish Civil Contingencies Agency
NPM	New Public Management
PD	Participatory Design
SCOT	social construction of technology
SDLC	Systems Development Life Cycle
UCD	User-Centred Design
UI	User Innovation

THESIS STUDIES

Baseline Study	New collaborations/actors in emergency response
Study 1	The co-location of actors in Safety House, Östersund
Study 2	The co-operative use of resources and cross-sector collaborations between the fire services and the social care unit in Nyköping municipality
Study 3	Using semi-professionals in Norrköping municipality

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1 INTRODUCTION

This is a thesis relating to the area of *Information systems* (IS). IS seem ubiquitous in modern societies and the digitisation of different societal contexts is a fast process of change. In this thesis, they are seen according to the sociotechnical ensemble view of technology as a package of entangled technological, social, organisational, economic, political etc. elements, approaches and aspects which interact with each other in order to support the attainment of organisational goals (Bijker, 2010; Orlikowski and Iacono, 2001; Ropohl, 1999). *IS development* is seen as the process by which IS are conceived, analysed, designed and implemented (Avison and Fitzgerald, 2006a). Different IS development approaches have successively acknowledged that a proper understanding of users, their tasks and contexts are essential before developing a system or product (Mumford, 2006; Christel and Kang, 1992). Therefore, the early phases of IS development processes should include an analysis of the context and related user needs, i.e., *organisational analysis and needs analysis*. These analyses can, however, be difficult to achieve, especially in new contexts and future service implementation where stakeholders and end-users may be partly unknown, and their roles and tasks are not yet defined.

The thesis application area is *emergency response systems* (ERSs). In this thesis, ERSs are defined as systems, including organisations, technologies, procedures and rules, which aim to save lives and minimise human suffering and material damage in emergencies such as traffic accidents, fires and health crises, as well as in large-scale incidents such as floods, storms and earthquakes (Haddow et al., 2013). ERSs can be seen as an IS application domain. The other way round, specific IS applications or IT artefacts are used extensively in ERSs (Walle and Turoff, 2008), for example, to support decision-making, facilitate communication, enable information sharing, provide geographical information and situational awareness, and train actors (Chen et al., 2007; Walle and Turoff, 2006). Any failure in the systems may lead to unsuccessful response operations, risking people's lives.

An emerging trend in emergency response in Sweden and internationally and as a result of challenges such as lack of resources and financial cutbacks is to reorganise and create cross-sectoral forms of collaboration with other societal resources (Pilemalm et al., 2016a; Weinholt and Andersson Granberg, 2015; Waugh and Streib, 2006). Since these collaborations are new and emerging, it is essential to understand the context as well as actors' tasks and needs in order to develop appropriate IS support. The specific scope of the thesis is *to explore emergency response cross-sector collaborations and how to develop related IS support that meets user needs*. The thesis focus is thus not on the actual digitalisation of the collaborations, for example, by introducing new IT artefacts. It rather focuses on the prerequisites for IS development and subsequent digitalisation, for example, by exploring different technical, organisational and social aspects of the collaborations, collaborating with relevant stakeholders and end-users, and identifying opportunities, challenges and user needs in the collaborations. Therefore, the main work of this thesis relates to organisational analysis and needs analysis.

1.1 IS development for cross-sector collaboration in emergency response

In the Swedish ERS, a major challenge is to reduce response times, increase the quality and efficiency of response, and maintain public services during a time of scarce resources, budgetary cutbacks, centralisation of resources, and rising public expectations (Pilemalm et al., 2016a; Wankhade and Murphy, 2012). These challenges can be seen from a broader public sector perspective where global societal challenges – e.g. increasing natural disasters, migration, urbanisation, depopulation of rural areas, an ageing population, increasing socioeconomic differences, and segregation leading to social unrest – have put enormous strain on public service organisations, of which ERSs and emergency response organisations are an important part. Over the past few decades, scholars have discussed the possibility that one way to cope with these societal developments is to create *cross-sector collaborations* to combine alternative resources from various sectors, for example, private organisations, other public organisations, non-governmental organisations, and citizens (O’Leary and Bingham, 2009; Agranoff, 2007; Waugh and Streib, 2006). These kinds of new initiatives are sometimes referred to as *the new public sector* (Gruening, 2001). In theoretical terms, such collaborations are sometimes viewed as an emerging form of *network governance* (Jones et al., 1997).

In Sweden, the co-operative use of resources within emergency response in order to share competencies, equipment and capacities, and the promotion of cross-sector collaborations between the existing major professional response resources, for example, the fire services, and different societal sectors, for example, volunteers, security guards and eldercare, have been specifically highlighted (Weinholt and Andersson Granberg, 2015; Sund, 2006; Waugh and Streib, 2006; Quarantelli, 1994). In 2009, the Swedish government presented the Swedish Civil Contingencies Agency (MSB)¹ with a mission called the “strategy for strengthening societal resources for coping with emergency situations”. Basically, this means involving actors from outside of professional response organisations in particular phases of emergencies, allowing them to assist and collaborate with professional resources. This general societal need emphasised by the Swedish government, *to develop/create cross-sector collaborations in emergency response to handle contemporary public sector challenges*, is the starting point of this thesis.

In cross-sector collaborations, IS may be used; for example, to: send alarms to other sectors and dispatch actors from them, facilitate communication between actors, provide platforms for information sharing, facilitate alarm management, provide navigational help, and position actors. However, cross-sector collaboration in ERSs is a recent phenomenon and system developers need to gain an understanding of the existing collaborations and the entire context as a prerequisite for further IS development. Therefore, stakeholder identification and organisational and needs analyses are natural first steps that can be used to understand the nature of collaborations, the heterogeneous users and stakeholders, their potential needs, and related opportunities and challenges. The analyses can be used not only as a basis for designing IS but also as knowledge for implementing and developing the collaborations, for

¹ MSB is responsible for emergency management strategic questions and demands at the national level.

example, by introducing process improvements, organisational changes and policy development. As cross-sector collaboration in ERSs is an emerging domain, current related research is limited, and was even more so when the thesis work started in 2012.

1.2 Problem definition and research need

There are many perspectives on technology from which it is not deemed adequate to focus solely on the technological artefacts when developing and studying them but where many non-technical aspects also need to be incorporated. In IS development, such perspectives have been used and promoted for more than 50 years (e.g. Orlikowski and Iacono, 2001; Mumford, 1974). This thesis uses the *sociotechnical ensemble view of technology* which “stresses the importance of including the social context when describing the development of science and technology” (Bijker, 2010, p. 65). Here, technology is not solely a technical artefact or applied science but a package of various and entangled elements, aspects and approaches without any priority among them (Orlikowski and Iacono, 2001; Pinch and Bijker, 1987). The main point of the sociotechnical ensemble view is the necessity to extend the view of technology and the units of analysis. Therefore, when developing and studying IS in the ERS context, it is not sufficient to include only IT artefacts. Other elements, such as users, stakeholders, environments, policies, equipment, training routines, laws, etc. should also be considered.

The sociotechnical ensemble view has been applied to some extent to ERSs, but at a general level. For example, a set of design principles for ERS-related IS has been presented (Turoff et al., 2004), in which non-technical factors, such as the scale of incidents and the information needs and geographical position of users, are presented as critical to the proper functionality of IS. Schraagen and Ven (2011) have highlighted the importance of considering human factors such as skills in communication and sense-making. However, the specific context of cross-sector collaborations in ERSs might pose specific challenges where established professional emergency response resources (e.g. the fire services) are required to create new forms of collaboration, both with each other and with other societal resources. In other words, the emerging collaborations involve heterogeneous actors, some of whom are not even known beforehand. To date, there have been no perceived studies related to ERS cross-sector collaboration based on the sociotechnical ensemble view of IS or related needs for digitalisation/IS support.

The Swedish ERS can be seen as comparatively progressive in terms of cross-sector collaborations. There are numerous ongoing related projects, and probably more will be launched in the future. Thus, here as well there are knowledge gaps to fill in because of the recent establishment of the domain. Those previously identified include: in which situations actors should be involved, what they should do, what their needs are, what challenges they may face, etc. (Andersson Granberg et al., 2016; Pilemalm et al., 2016a). Insufficient categorisation of tasks, responsibilities, structures, skills and legal issues and uncertainties about collaboration and lack of common incentives are some reported challenges in the literature (Ramsell et al., 2017; Pilemalm et al., 2016a; Pilemalm et al., 2013; Berlin and

Carlström, 2011). At a general level, factors such as trust, legitimacy, uniform understanding of the situation, actors' level of experience, training, incident type, commitment and competence have all been claimed as challenging but as having a decisive role in response operations (Fischer et al., 2011; Palm and Törnqvist, 2008; Pelinka et al., 2004). Lack of knowledge, in turn, may negatively affect the IS development of ERS cross-sector collaborations and related public sector initiatives in general and even provide actors with incompatible IS, thereby impeding the achievement of the envisioned goals. In summary, *there is a perceived lack of the knowledge necessary in ERS contexts internationally and in the Swedish ERS specifically, to develop IS for cross-sector collaborations based on the sociotechnical ensemble view and looking beyond solely technical artefacts.*

1.2.1 To address the research need: user participation approaches

One way to fill the above gap is to gain help from users and stakeholders, who may know the context, in order to study and explore different aspects (i.e. social, technical, organisational) of the collaborations. In emerging cross-sector collaborations in ERSs, the collaborative setting is new or may not even exist yet, tasks are not clearly defined or are insufficiently experienced by heterogeneous and partly unknown users/stakeholders. It is also not clear how the collaborations should be performed, how IS can support them or what the needs for IS are. Therefore, response organisations, related stakeholders and end-users should be involved as a source of knowledge and as co-designers, i.e. it is deemed essential to enable user participation.

Since the origin of collective resources approaches in the 1970s, research has continuously claimed that various *user participation* approaches, which involve the stakeholders and end users of a system in the design and development of the associated technology, will ensure a better fit between the technology and the way people use it to perform their work (Halskov and Hansen, 2015; Shapiro, 2005; Kensing and Blomberg, 1998; Ehn, 1993; Norman and Draper, 1986). User participation has also been applied specifically to IS design and has been developed over the years by various IS scholars (e.g. Kensing et al., 1996; Mumford, 1981). Examples of user participation approaches that have been used in IS development are Participatory Design (PD) (e.g. Ehn, 1993; Schuler and Namioka 1993), user-centred design (UCD) (e.g. Gulliksen et al., 2003; Norman and Draper, 1986), and user innovation (UI) (e.g. Von Hippel, 1986).

Despite the many perceived benefits, user participation has also been associated with various challenges manifesting themselves to different extents in the abovementioned approaches. It has been argued that user participation projects may have adverse effects on project performance since they are time and resource intensive and system developers are required to make huge efforts to involve stakeholders who may not have the motivation or time to participate in design groups (Simonsen and Hertzum, 2008; Wilson et al., 1997). Contacting and motivating stakeholders, holding meetings, resolving conflicts in design groups, upholding democratic principles and evaluating results (e.g. prototypes) have been discussed as challenging tasks (Obata et al., 2012; Simonsen and Hertzum, 2008; Gulliksen and Eriksson, 2006). It has also been argued, in the case of PD, that the approach only delivers small, stand-

alone IS in contexts with low organisational complexities and homogeneous user groups (Tollmar, 2001; Besselaar, 1998). In relation to this, various researchers have argued that the challenges increase when applying user participation in large-scale projects with heterogeneous user and stakeholder groups (Karlsson et al., 2012; Dalsgaard, 2010; Simonsen and Hertzum, 2008). Also, where several independent stakeholder groups from different organisations or societal sectors are supposed to work together, they might have different cultures, goals, possibilities and interests (Pilemalm et al., 2016b; Dalsgaard, 2010; Simonsen and Hertzum, 2008; Oostveen and van den Besselaar, 2004). In addition, not all stakeholders, for example in public sector projects, are necessarily well-known or defined from the start of the project or have clearly defined tasks (Obata et al., 2012). These may include volunteers, non-profit organisations, sponsors, various steering committees and contractors, and do not always have an organisational affiliation (e.g., citizens) (Pilemalm, 2018). Diverse and unknown stakeholders are likely to become a part of the new initiatives in the public sector and in the cross-sector collaborations in ERSs.

Some recent studies also show how user participation, especially in PD, is increasingly used beyond pure product design and contributes to institutional transformation, the design and changing of policies, organisational frameworks and even stakeholders' mind-sets. This phenomenon is sometimes referred to as "infrastructuring" (Halskov and Hansen, 2015; Björgvinsson et al., 2012). User participation has thus evolved over the decades both in terms of who should be involved in user participation activities and what outcome should be expected from design work and design groups. This development is in line with current societal trends, the sociotechnical ensemble view of technology and emerging cross-sector public sector initiatives in which there are heterogeneous stakeholders and where IS embrace different social and technological elements. User participation has also been applied in the ERS context (e.g. Kristensen et al., 2006), but the existing studies identified in this literature review do not focus specifically on emerging contexts of cross-sector collaboration. Thus, when trying to fill the research gap outlined in the problem definition, *there was also a perceived lack of user participation applications and 'lessons learned' in relation to emerging public sector/ERS cross-sector collaboration initiatives*, for example regarding potential context-specific challenges and potential ways to handle them.

1.2.2 To address the research need: frameworks for IS development in ERSs

The use of different frameworks to perform organisational/stakeholder/needs analyses in new domains can help to structure the domain. Examples of relevance for this thesis include: Thomson and Perry's (2006) framework for understanding the mechanism of collaborations, Bryson et al.'s (2006) framework for analysing cross-sector collaboration in general, stakeholder theory and its related developed frameworks (Lindgren, 2013; Freeman et al., 2010), and the framework for applying sociotechnical systems design in practice presented by Baxter and Sommerville (2011). These frameworks aim to facilitate an initial understanding of the context and the related actors and stakeholders. Efforts have also been made to apply different frameworks to analyse the particular domain of ERS. For example, Ki Kim and Sharman (2006) suggest a framework for analysing IS in ERSs in which both technical and non-technical risk factors are considered. However, from the thesis point of

view, these frameworks are usually applied at a general level, i.e. they are not unique to cross-sector collaborations, and do not focus only on particular functions involved in emergency response (e.g. information filtering, user interfaces, decision-making or communication). Furthermore, they often provide a limited view by including only one set of factors (e.g. technology) while ignoring the sociotechnical ensemble view. This may result in incomplete analyses, failure of IS projects and ineffective IS for emergency organisations. Furthermore, frameworks that can be employed by the users themselves have not been found in previous user participation approach studies. Therefore, when trying to fill the research gap outlined in the problem definition, *there is also a perceived lack of broad frameworks for ERS cross-sector collaborations that can be used as tools in the related analysis and in user participation in related IS development processes.*

1.2.3 Providing the cross-sector collaboration theoretical analysis

The use of the sociotechnical ensemble view, together with sociotechnical system theory (see Chapter 3) in ERS cross-sector collaboration covers many aspects of related IS development. However, their specific focus is not on issues such as the forms that the collaborations may take, or the policies, principles and related steering mechanisms which can subsequently affect the related IS design. Meanwhile, ERS cross-sector collaboration as a phenomenon resembles in many respects the principles of *network governance*, i.e. autonomous organisations interact for service delivery and policy-making in a horizontal pattern based on their mutual interests or goals and without any visible top-down governing mechanism (Jones et al., 1997). Sometimes, ‘network governance’ and ‘cross-sector collaboration’ are even used interchangeably in the literature (e.g., Agranoff, 2007). To complement the sociotechnical ensemble view, emerging cross-sector collaborations may thus also be studied using a network governance perspective. To use network governance as an analytical lens may facilitate a further understanding of the phenomenon of ERS cross-sector collaboration by exploring whether it is a distinguishable form of network governance or not and how they may differ, i.e. if the theory is useful when analysing and developing future similar collaborations. Thus, it may pave the way to drawing more general conclusions about cross-sector collaborations in ERSs.

1.3 Research Objective

Based on the outlined problem definition and research gap, it is possible to identify a general need for knowledge about cross-sector collaborations in ERSs as part of new public sector initiatives, specifically to identify the related challenges, opportunities and actor needs as a prerequisite for the subsequent IS development, i.e. to be able to provide actors with appropriate IS support.

The overall thesis **research objective** is thus to:

- *Explore IS-related opportunities, challenges and needs aimed at supporting heterogeneous actors in emerging cross-sector collaboration in the context of ERS using the sociotechnical ensemble view.*

To achieve this, three cases of emerging cross-sector collaborations were studied, and the related opportunities, challenges and actor needs are described: 1) co-location of actors in Safety House, Östersund, 2) co-operative use of resources and cross-sector collaborations between fire services and the social care unit in Nyköping municipality, and 3) using semi-professionals in Norrköping municipality. While performing the studies and before the first study was initiated in 2012, since the research context was so new, there was a perceived need for broad frameworks, as mentioned, to organise and systemise the context to be able to explore and analyse it. To achieve this, *a framework consisting of and exemplifying central factors to consider when analysing cross-sector collaborations and related IS needs* was developed and described. This framework is presented as part of the thesis results.

Furthermore, in line with the perceived necessity to involve users when exploring the collaborations and needs for IS, user participation was performed, to various extents in the three cases. Along the way, it became evident that the specific setting, i.e., new undefined contexts with heterogeneous stakeholders and end-users, partly unknown and belonging to different societal sectors, led to substantial user participation challenges which needed to be handled. These challenges were investigated systematically in the third case and are presented as part of the thesis results, as a way to achieve the thesis objective, but also as a result in its own right; i.e., *experiences of applying user participation in emerging public sector cross-sector collaboration initiatives*. As part of this, the thesis also describes how the analytical framework may support such user participation activities.

To further understand the results, network governance was applied as a theoretical lens in order to analyse the results and locate them within a wider context, but also to assess the usefulness of the theory itself in exploring and developing ERS cross-sector collaborations. It also provided a partial theoretical grounding for the framework presented. Also, sociotechnical system theory (Chapter 3) was applied when building the framework.

1.4 Thesis context

This is a paper compilation thesis based on five scientific articles, two of which have been published in interdisciplinary, domain-specific journals (emergency response), two in domain-specific conferences focusing on information systems (crisis management/IS), and one at a conference on information systems development. The included studies were also part of assignments from the Swedish Civil Contingencies Agency (MSB) and the Municipal Rescue Services, and one was performed within an interdisciplinary development project funded by Norrköpingsfonden. The different studies have spanned between three months

and two years in length. The phenomenon of cross-sector collaboration in the Swedish ERS was largely unexplored at the beginning of the thesis work. All of these circumstances have contributed to the thesis being 'broad' in character, embracing several shorter studies and various perspectives, rather than exploring one case in more depth. There are, of course, pros and cons to both approaches, which will be reflected upon in the methodological reflections (Chapter 7). The thesis work aims to tie the various studies together by performing cross-study analysis and highlighting the IS-related parts, which are less visible in the individual papers.

In the thesis, user participation is employed as an umbrella term, referring to user participation in IS development and its associated challenges generally, even though many examples of challenges are taken from the domain of Participatory Design (PD) (see Chapter 3).

In relation to this, the term 'stakeholders' is mostly used in a general sense and refers to those groups that affect or are affected by IS and organisational objectives, ranging from top-level management to end-users. A stakeholder can affect or be affected by the development and introduction of new IS. The term 'stakeholder' may refer to either a representative of an organisation or the whole organisation. It has a broad definition and sometimes includes 'end-user'. However, the term 'end-user' is employed explicitly when there is a perceived need to bring extra focus to the primary end-user in terms of their need for IS.

The term 'actors' refers to those who are part of current ERSs or may be involved in future ERSs. The term is also used extensively in the thesis because the thesis work started by developing an understanding of the ERS cross-collaboration context, along with a framework to collect and systematise different crucial aspects when analysing it. Therefore, in the developed framework, the term 'actor' is used and refers to those who are involved in cross-sector collaborations, including whole organisations.

In the context of the thesis, some examples of key actors in the ERS context are: the fire services, the ambulance services, the police, the MSB, and SOS Alarm (see Chapter 2). All these actors can also be seen as stakeholders. The term end-user is employed flexibly in this thesis. For example, in the co-location collaboration, the fire services are one end-user group that is directly involved in the new collaborations, but in their collaboration with semi-professionals they remain mostly as stakeholders and semi-professionals are the main end-users who need IS support and an infrastructure to collaborate with the fire services and SOS Alarm. Exchanges between 'actors' and 'stakeholders' are thus a result of the research process and it is acknowledged that this may cause some difficulties in reading the text. This will be discussed in Chapter 7 as part of the reflections on the thesis work.

How the thesis objectives and results relate to each other and to the five papers is explained in Chapters 4 and 5.

1.5 Delimitations

The delimitations of the thesis relate to the exclusion of particular perspectives, theories and IS development phases. They are listed as follows:

- The focus will be mostly on the early phases of system development processes, i.e. the organisational and needs analysis phase. Also the challenges of stakeholder identification and involvement in new contexts are present during the early stages. To overlook the associated challenges would adversely affect subsequent phases. The thesis to some extent also embraces the later phases of IS development processes, such as design and implementation, but to design and implement all the results of the analyses is a long-term process which is beyond the scope of this thesis. As to stakeholder identification, this has been treated as an IS development activity and has been performed extensively only in later part of the thesis work in Study 3 to identify relevant stakeholders/end-users. Otherwise, the existing stakeholders in the collaborative setting have been involved and potential future stakeholders have been identified. No stakeholder analysis using stakeholder theory has been applied.
- Although some initial assessment takes place, it is beyond the scope of this thesis to systematically evaluate the identified challenges and suggestions for user participation and the context-specific framework support. Such evaluations need further investigation and more case studies. It might also be difficult to conduct similar research, exclude the use of the framework and adapted user participation and compare the results gained with the thesis results. One alternative might be to collect more empirical data about the experiences of employing user participation in similar settings. However, in this thesis, the reliability, confirmability, potential transferability and credibility of the results are discussed.
- As to the application domain, large-scale crises (e.g. earthquakes, storms) do not figure explicitly in the empirical data and are not discussed as a central theme in this thesis. However, response operations during everyday and large-scale emergencies are often managed by the same organisations, resources and personnel using similar equipment and information systems. Thus, some of the thesis results may be applicable to large-scale emergencies and consequently they are also discussed in that context. The possibility of applying the results of research on everyday emergencies to large-scale emergencies, and vice versa, is discussed in Chapter 7 in methodological reflections.
- The thesis focuses on the response phase of emergencies. Other phases and processes in emergency management, such as preparedness, recovery and mitigation, are excluded. However, the results may be relevant to other phases if these become subject to cross-sector collaborations. Also, the phases are generally related (e.g. you cannot respond without some preparations).
- Cross-sector collaborations are also currently being discussed in several other areas of research, for example in new public management (NPM) and e-government. These areas are not explicitly included in this thesis but are referred in discussion.

1.6 Thesis outline

Chapter 2 provides the concepts and background to IS based on the sociotechnical ensemble view, IS development, ERSs and cross-sector forms of collaboration. It also presents the study context. **Chapter 3** describes the analytical framework applied in the thesis, including sociotechnical system theory, user participation approaches and network governance. **Chapter 4** provides the research approach, including case study research, philosophical assumptions, and influences from participatory action research. It also describes the overall research process, and the empirical data collection and analytical methods. **Chapter 5** presents the results in relation to the thesis objective. **Chapter 6** presents a discussion of the results in relation to the current public sector problems and trends affecting ERSs and applying IS development and user participation in the new public sector initiatives, thereby outlining the potential contribution of the thesis to ERSs at a general level and to the IS field. **Chapter 7** presents methodological reflections over the thesis work including its limitations and the transferability of the results. **Chapter 8** summarises the contributions of this thesis, and the implications of the work for future research.

2 BACKGROUND

This chapter explains the concepts and background knowledge relevant to this thesis. The chapter has three sections. The first is assigned to information systems (IS) and the systems development lifecycle (SDLC) using a sociotechnical ensemble view. Then, emergency response systems (ERSs) generally and the Swedish ERS in particular, including the relevant actors, are described. The third section describes the general concept of collaboration and, specifically, cross-sector forms of collaboration. Finally, the specific thesis context, including recent collaborations in the Swedish ERS and their relations to the IS field, is presented.

2.1 Information Systems (IS) Development

This thesis is situated in the field of information systems (IS). It focuses on IS-related organisational analysis, partly including stakeholder identification, and needs analysis of cross-sector collaboration, i.e. the early phases of IS development, and also partly the design phase. The thesis results are to be seen as a prerequisite for further IS development, even if digitalisation itself or IT artefact design is not the main focus of the objective. Based on the connection between this thesis and IS, it is assumed that readers are familiar with basic concepts in the field of IS. However, it is important to clarify certain concepts that may be subject to interpretation. Therefore, a definition of IS relevant to the thesis, and descriptions of general systems development processes, including its different phases and related challenges, will be provided. User participation approaches and sociotechnical system theory will be described in Chapter 3, as they are seen as part of the analytical framework to achieve the thesis objective.

2.1.1 Information Systems (IS): the sociotechnical ensemble view

The identity of IS as a phenomena have been debated extensively by IS scholars, and a degree of controversy surrounds the borders of IS definition (e.g. Agarwal and Lucas, 2005; Benbasat and Zmud, 2003; El Sawy, 2003; Orlikowski and Iacono, 2001). It is therefore important to define the concept of IS before using it in a specific context. In this thesis, IS are understood using the *sociotechnical ensemble view of technology*, described below, which seeks to broaden the scope of technology and include *both technical and social elements, aspects, concepts and approaches in the definition of IS*. The sociotechnical ensemble view stems from the *social construction of technology* (SCOT), i.e. constructivist studies of science and technology (Bijker, 2010; Collins, 1983), which argue that “reality [here technology and technical artefacts] are socially constructed and that the processes of social construction should be the object of the sociology of knowledge.” (Bijker, 2010, p.64-65)

SCOT was developed primarily during the 1980s by scholars working on three traditions: science-technology-society, the sociology of scientific knowledge, and the history of technology. SCOT was a response to the need to criticise technological determinism, i.e. to give agency to technology and deny the impossibility of influencing technological

development (Pinch and Bijker, 1987). Therefore, according to SCOT, technology is socially shaped and does not have its own intrinsic logic. Kroes and Meijers (2006) also argue that technology has a dual nature. Firstly, technologies are designed physical structures and, secondly, they realise functions which are based on human intentionality. Later, Orlikowski and Iano (2001) tried to apply similar approaches to IS and thus conceptualised IS as a *package of people, tasks, devices, artefacts and policies*. They argued for a *sociotechnical ensemble view* which focuses on the interactions between people and technology, whether during construction, implementation, or use in social contexts. The sociotechnical ensemble view allows for broader combinations of conceptual approaches and aspects beyond a rigid systematic approach (Bijker, 2010). The term 'sociotechnical' is also a reminder that social (non-technical) factors are important in defining and developing technology and that there is no clear priority or independence of the context. The sociotechnical ensemble view of technology may help IS development in cross-sector collaborations in which IT artefact designs are likely to be influenced by different aspects of the collaboration, for example human factors, actor needs, organisational factors, policies, and laws.

2.1.2 IS according to the sociotechnical ensemble view

In this thesis, IS are seen conceptually according to the sociotechnical ensemble view and comprises IT artefacts, actors, systems, organisations, technology, procedures, rules, policies etc. In other words, the thesis definition of IS includes both technical and social elements/aspects/approaches and their effects on each other in order to analyse, design, and implement IS. Based on the sociotechnical ensemble view, IS in the context of this thesis and related to the application domain ERSs (see 2.2) are defined as follows:

- *IS are comprised of a group of different and entangled elements, conceptual approaches and factors; e.g. IT artefacts, actors, organisations, tasks, policies, rules, policies and laws.*
- *IT in this thesis is seen mostly as a technological artefact, i.e., the technical and physical component of IS used in ERSs.*

2.1.3 Information systems development: the general view

Information systems development methodology is the process by which IS are conceived, analysed, designed and implemented (Avison and Fitzgerald, 2006a). Early computer applications or computerised information systems, mostly before 1960, were designed and implemented with little or no attention to the construction of methodologies for rigorously identifying user needs (Avison and Fitzgerald, 2006b; Walters et al., 1994). The dominant methodology was rule of thumb and based on experience, tradition and common sense, which often resulted in inappropriate IT systems that were not responsive to user needs (Avison and Fitzgerald, 2006b). As a reaction to this, during the late 1950s and early 1960s, when the use of computerised systems in organisations was becoming widespread, the *Systems Development Lifecycle (SDLC)* emerged as an approach to IS development, and consequently the *waterfall model methodology* was introduced as the first IS development methodology (Lee, 1987). The SDLC consists of a general set of development phases, with the purpose of guiding the design and implementation of systems that will be suited to user needs and

helping to deliver systems on time and within budget. Although the initial SDLC and waterfall model methodology were useful for documenting activities and thus improved communication within development teams, a number of disadvantages were identified when applying it to IS development projects (Avison and Fitzgerald, 2006b; Lee, 1987; Walters et al., 1994). For example, 'system delays' occurred due to changes in user needs during development, and 'user dissatisfaction' was common when users became involved only after the system was finished. The associated costs of revising and maintaining systems in order to meet user needs were high.

In response to these issues, a number of alternative approaches to IS development emerged during the 1970s and onwards. Soft systems methodology, the strategic approach, the structured approach, incremental or evolutionary development (e.g. prototyping) and participative approaches (e.g. ETHICS) are some examples (Mumford, 1995; Martin, 1991; Checkland and Scholes, 1990). The promise that methodologies would solve most of the problems of IS development has not entirely been kept, since methodologies from different approaches were variously considered difficult to use, complex, unstable, not contingent, or built upon invalid assumptions (such as assuming the environment is stable) (Avison and Fitzgerald, 2006b). During a process of adaptation and refinement over recent decades, the emphasis has shifted to involving users, employing iterative development processes in order to adapt to emerging changes in user needs, and having contingent IS development methods. Different user participation approaches based on user involvement, Participatory Design, user-centred design (UCD) and user innovation (UI) have emerged. Agile development approaches have also emerged, which emphasise iteration in the development process, collaboration with stakeholders, response to changes, and regular delivery of products. Examples of agile approaches are extreme programming (XP) and SCRUM methodologies (Lindstrom and Jeffries, 2004).

The methods and approaches mentioned above are examples of how to carry out IS development. However, the thesis is not bound to any specific IS development method but uses the general IS development phases described below, which are part of many methods but are run and performed in different forms. Furthermore, influenced by the sociotechnical ensemble view, this thesis intends to explore various aspects of ERS cross-sector collaboration to develop IS that meet user needs. Therefore, user participation approaches (see Chapter 3) are deemed appropriate in order to explore these collaborations with help from people who have the relevant knowledge. The thesis will identify the challenges that may occur during this IS development/user participation in this specific context/partly new setting.

2.1.4 Information systems development lifecycle (SDLC)

In this thesis, regardless of the type of methodology, the system development lifecycle (SDLC) is defined as a set of general activities or phases carried out in order to create or alter a system (Avison and Fitzgerald, 2006a; Sommerville, 2004). These activities are usually iterative and often include the phases:

- **Organisational analysis, needs analysis:** This phase consists of a series of activities, including exploring the context, identification of stakeholders and elicitation of user needs, which can finally be turned into requirements results in the system requirements specification.
- **Design:** In this phase, the different components of the system, their relations to one another, the architecture, and the way in which the system will be implemented are designed and finalised.
- **Implementation:** This phase involves the realisation and execution of the design specifications. The tasks in this phase may range from programming, graphical user interface, database coding and data conversion to training users, system deployment, changing work routines and preparing organisations to use the system.
- **Testing and validation:** In this phase, IS are checked for errors. It is also verified that the system fulfils the requirement specification.
- **Review and maintenance:** This phase primarily consists of reviewing the system to ensure that it meets user needs and the estimated costs. Maintenance work (e.g. correcting errors) and responding to new needs due to changes in organisations are also included in this phase.

The focus of the thesis will be on the first phase of SDLC, which includes organisational analysis, needs analysis and partly stakeholder identification, and also to a limited extent, design (a smartphone application prototype in one of the studies). Other (later) phases are only discussed briefly, for example in relation to use of the context-specific framework.

2.2 Emergency response systems (ERSs)

The thesis application domain is *emergency response*. At a general level, Haddow (2013, p. 9) describes *emergency management* as “A discipline that deals with risk and risk avoidance”. Emergency management generally consists of four different phases (see Figure 2.1).

Figure 2.1: Emergency management generally consists of four different phases. This thesis will focus on the ‘response’ phase and ‘emergency response systems’.

The *preparedness phase* includes those actions, procedures and equipment that make response organisations and society as a whole ready to tackle emergency situations. The *response phase* commences immediately after the emergency has occurred, e.g. the *operative phase* (Haddow et al., 2013). Actors may be injured, and equipment and machinery may be damaged during this phase. The *recovery phase* (sometimes referred to as *restoration*) is intended to restore the situation to its normal state, e.g. reconstruction of property and damaged infrastructure. The *mitigation phase* (sometimes referred to as *prevention*) comprises actions carried out with the intention of reducing the frequency of future emergency situations and/or their impact on society. A *response/rescue operation* is an action taken immediately following the incident, the priorities of which are preserving human lives, assisting injured people and mitigating the consequences of the current emergency on people, infrastructure, property and the environment (Bergmark and Tollander, 2008; Civil Protection Act, 2003:778). Since the time delay between the occurrence of an emergency and the taking of response action is required to be as short as possible, there is seldom sufficient information about the situation available initially. Rescue operations are complex processes, resources must be used optimally, and the different actors involved should be well-coordinated (Fredholm, 2006).

‘Emergency management’ and ‘emergency response’ are sometimes used interchangeably in the literature. However, ‘emergency management’ has a broader scope (Waugh and Streib, 2006). In this thesis, the focus is on emergency response operations that explicitly deal with the response phase, e.g. dispatching resources to the emergency site and letting them carry out tasks there. ERSs can be seen as the application domain of IS based on the sociotechnical ensemble view. An ERS is thus defined as follows:

An ERS is comprised of an entangled ensemble of organisations, technical artefacts, procedures, roles, tasks, laws and policies which aims to save lives and minimise human suffering and material damage in emergencies, e.g. traffic accidents, fires and health crises, as well as in large-scale incidents e.g. floods, storms, earthquakes and acts of terrorism. An ERS is thus seen as an overall IS according to the sociotechnical ensemble view but can also include separate IS applications and IT artefacts.

ERSs operate differently in various countries, for example in terms of local laws, their structure, culture and control mechanisms; however, they also share many similarities, including goals (e.g. saving lives), resources (e.g. fire services, ambulances services, the police), training (e.g. fire extinguishing, smoke diving, first aid), technology (e.g. alarm management systems, map systems, communication systems, incident analysis and decision-making systems) and equipment needs (e.g. fire extinguishers, healthcare kits, transport vehicles). The Swedish response system is the focus of this thesis, but may be considered as a model for the study of ERSs worldwide. Therefore, some of these results might be relevant and of interest to ERSs in other countries which share similarities with the Swedish ERS.

2.2.1 Type of emergencies

Emergencies, ordinary or large-scale, have immediate impacts on people, property, and the environment, in terms of casualties and damage. They may occur without the influence of human factors; for example, natural disasters such as floods and storms, or as a result of machine/human errors such as nuclear power plant failures and chemical spills. They can also be initiated solely by humans, for example antagonistic attacks and threats by extremist groups.

There are both qualitative and quantitative differences between *everyday or frequent emergencies* and *large-scale emergencies*. 'Everyday' emergencies tend to occur frequently and therefore in general are not complex to manage for the rescue services and other professional actors in ERSs. Their societal impacts are usually seen within a short timeframe. However, the number of victims and the damage caused to the environment by frequent emergencies over time may be comparable to the impact of a single large-scale disaster. For instance, Bull-Kamanga et al. (2003) point out that, in large cities, traffic accidents occur frequently, and the number of people killed in these accidents each year is not seen as disastrous, even though it may exceed the number of mortal injuries in many larger incidents. Everyday emergencies are thus seen as 'normal' and are usually handled locally. Building fires, drownings and traffic accidents are examples of frequent emergencies (Danielsson et al., 2010). However, even a 'normal' emergency situation may evolve unpredictably over time and lead to a large and disastrous situation. Taber (2008) acknowledges that a seemingly small incident may quickly develop into a large-scale emergency if the variables interact in unfortunate ways; for example, the direction of the wind in the case of a forest fire.

A *large-scale emergency*, on the other hand, usually interrupts societal functions and requires a large number of resources and the co-operation of heterogeneous resources locally, nationally and even internationally. Severe weather, storms, flooding and manmade incidents such as chemical spills are some examples. Large-scale emergencies may lead to a *disaster* or *crisis* if they cannot be handled in time or if they cause tremendous devastation to infrastructure and/or loss of human life. *Catastrophes* are situations in which large proportions of infrastructure, societal services and resources are not available for a significant period. The triggers for catastrophes can be similar to those of disasters and crises (Trnka and Woltjer, 2014).

This thesis will focus on *everyday or frequent emergencies* and cross-sector collaboration in this specific context. There may not be many disasters in Sweden; however, storms, fires and floods have recently occurred more frequently. Nonetheless, frequent emergencies, for example traffic accidents and heart attacks (e.g. in ageing societies), are part of daily life in every society and here cross-sector collaboration may contribute to mitigating the consequences and shortening response times, especially in sparsely populated areas.

2.2.2 Emergency management and emergency response organisations in Sweden

In Sweden, the emergency management approach is bottom-up. The emergency is first to be managed locally, inside the municipality. In a case of lack of resources and/or knowledge,

and when facing difficulties, the situation is managed at a higher level, moving first to the regional, then to the national level. There are several different actors/organisations in the Swedish ERS. In the context of this thesis, the term ‘actors’ is frequently used for individuals who are either connected to ERSs in some way or have the potential to become involved. The level of assistance required determines the actors’ roles in ERSs (Fredholm, 2006). They range from *first responders*, who take action immediately after the emergency occurs and perform operations at the emergency site, to those who receive alarms in alarm management centres and actors at higher organisational levels and municipal authorities, such as management and decision-makers. Since first responders are involved directly in response operations, they are considered central actors in cross-sector collaboration in emergency response and need to be studied in order to determine what they require to be effective and efficient. In this thesis, first responders are defined as:

Those who usually take the first actions at the emergency site in order to save lives and prevent environmental damage.

The different actors in the Swedish ERS who are perceived as specifically relevant to this thesis are categorised and presented in Figure 2.2.

Figure 2.2: Existing and potential actors in the Swedish ERS that are relevant to this thesis².

² Other actors are also connected to the Swedish ERS but are not part of this thesis. Some examples include the Swedish Coast Guard (Kustbevakningen), the Swedish Maritime Administration (Sjöfartsverket), Media, Digital Volunteers (in social media), the Swedish Sea Rescue Society (Sjöräddningssällskapet), and the Swedish Meteorological and Hydrological Institute (SMHI).

The municipal fire services, police, ambulance services and alarm centres are usually referred to as the *main professional actors* at the operative level in the Swedish ERS and are shown in the centre of Figure 2.2. The Swedish Civil Contingencies Agency (hereafter referred to as the MSB), the municipal fire services, the police, the Swedish Armed Forces, SOS Alarm and semi-professionals (e.g. security guards, social care, facility services) have been directly involved in the data collection process for this thesis. Other actors, such as the county administrative boards (Länsstyrelsen) and county councils (Landsting), are not directly part of the empirical data, but nevertheless have a role in the Swedish ERS that is deemed relevant to the thesis. Actors such as local communities, clubs, private persons and volunteers are not part of the cross-sector collaboration studies in this thesis but are also an important part of emerging forms of collaboration (e.g. citizen involvement) and thus will be touched upon in the discussions.

The *government* of Sweden is responsible for emergency management at the national level, including strategic questions and demands. The MSB is the central actor in the Swedish ERS at the government level. However, the MSB does not manage, lead or take responsibility for other organisations within the ERS. This means that those who are responsible for a given activity under normal circumstances are also responsible for this activity in emergency situations. Instead, knowledge enhancement, supervision and strategic questions are examples of the MSB's field of activity (MSB Official Website, www.msb.se, 2017).

The *county administrative board (Länsstyrelsen)* is a state authority that creates a link between people and municipalities on one side and the government, parliament and other state authorities on the other. Administrative boards are mainly active in strategic areas such as energy, water and environmental issues (<http://www.lansstyrelsen.se>, 2017). In the Swedish ERS, the county administrative boards are responsible for the coordination of municipalities, county councils, authorities, companies and the relevant organisations in emergencies when the municipality cannot handle a situation itself and resources are not sufficient (www.krisinformation.se, 2017). Within the ERS, each county council has a programme outlining how it can use local resources (focusing mainly on healthcare and public transport) to minimise the negative effects on the region and society in case of an emergency (<https://www.skl.se>, 2017).

In Sweden, *municipalities (Kommuner)* are responsible for a large proportion of the services provided to society, such as pre-schools, care of the elderly and social services. The municipalities are the building blocks of the Swedish ERS and enable society to face and control emergency situations. According to the Civil Protection Act (2003:778), the municipalities are responsible for responding to emergency situations in their geographical areas which are not the responsibility of the state; for example, building fires, traffic accidents, drownings and forest fires. Each municipality has its own organisations (such as the municipal fire services), which co-operate under the authority of the municipality to provide rescue services in the relevant areas.

2.2.2.1 Municipal fire services

All municipalities in Sweden should have at least one *fire rescue service* that is organised by that municipality alone or in co-operation with other municipalities. The municipality should answer for all the rescue services not under the responsibility of the state in its geographical area. Fire, traffic accidents, drownings and accidents involving dangerous chemicals are examples of emergencies in which the municipal fire services are responsible for controlling the situation.

2.2.2.2 The police

According to the Police Act (1984:387), the mission of the *police* is to improve public safety by taking actions such as preventing crime, monitoring public order and safety, carrying out criminal investigations and providing related information and assistance where required. The police force is a national organisation controlled by the state and organised differently from region to region. In the Swedish ERS, in certain types of emergencies, the police may co-operate with other actors that have primary responsibility for the response operation. The main duties of the police in such situations include blocking off and monitoring the emergency site, regulating traffic, and carrying out searches and interrogations.

2.2.2.3 Ambulance services

According to the Health and Medical Services Act (1982:763), county councils and municipalities are responsible for *emergency medical services and transport*, i.e., the ambulance services. The appropriate organisations within the county councils and municipalities should provide this service. In case of an emergency, county councils and municipalities in different regions may use their resources to help each other as required.

2.2.2.4 SOS Alarm

SOS Alarm AB was established in 1973 with the aim of creating a central organisation to handle incoming alarm calls from across society. It is owned by the state, the county councils and the municipalities (SOS Alarm Official Website, www.sosalarm.se, 2017). The role of SOS Alarm is to handle incoming 112 (emergency line) calls and to coordinate and mobilise different units (e.g. fire services, ambulance services) during response operations, calling on the available resources based on the requirements of the emergency.

2.2.2.5 The Swedish Armed Forces

The Swedish Armed Forces, although not counted officially among the main response organisations, has a role in the Swedish ERS during peacetime aside from its primary mission of defending the country in case of armed attack. Transportation is the main form of assistance it can provide in case of an emergency. Vehicles such as cars and air-force helicopters and planes can be deployed as part of response operations (www.krisinformation.se, 2017).

2.2.2.6 Other actors in the Swedish ERS

In addition, there are other actors (e.g. non-profit organisations, semi-professionals, volunteers, the private sector) that sometimes intervene and assist in ongoing response

operations, as shown in the ovals in Figure 2.2. These are viewed as *potential resources or actors* in this thesis and are defined as:

Existing actors who are not an officially integrated part of an ERS, but who may help in an emergency situation to shorten response time or to compensate for a limited number of professional actors.

For example, a great many volunteers already take part in response operations in sparsely populated areas of Sweden, but are not yet counted as an official part of any response system and are not given the same attention as the main actors in order to develop the collaborations and joint IS. Such actors play important roles in the emerging forms of collaboration.

There are several different types of potential resources. *Semi-professionals* (e.g. eldercare nurses, taxi drivers, building technicians and security guards) usually belong to a particular occupational field, but may take action outside their usual area of responsibility in case of an emergency if given basic training. *Non-profit organisations* such as the Red Cross assist the ERS mainly in large-scale disasters where professional resources are not sufficient. Different *clubs* (e.g. sports clubs, climbing clubs) have the potential to assist professional response actors in situations where professional resources are not sufficient or are far from the emergency site; for example, by providing transport or helping victims in mountainous places. *Social and local communities* have important roles in rural areas to act as first responders in cases where the main response organisations are located far from the emergency site. *Volunteer groups and individuals* are other important groups that can be very helpful in emergency situations. This thesis focuses only on semi-professionals who are mostly from different sectors than professional response organisations (see Chapters 4 and 5 for the study on semi-professionals).

2.3 Collaboration

‘Collaboration’ as both a word and a concept is elusive, theoretical and difficult to put into practice (Bryson, 2004; Ring and van de Ven, 1994). Different collaboration scholars strongly support an integrative view of collaboration *as a process* “through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible and implement those solutions jointly” (Thomson and Perry, 2006, p. 23). Rapid technological societal change, devolution, scarce resources, and rising organisational interdependencies are some reasons for collaborations between different organisations (Thomson and Perry, 2006). Different terms may be used to refer to collaboration, such as: ‘working in partnership’, ‘working jointly with others’, ‘joining forces’, ‘pooling resources’, ‘acting as a team’, ‘networks’, ‘inter-organisational relations’, ‘collective actions’, ‘coordination’ and ‘co-operation’ (Gajda, 2004). However, from the point of view of this thesis, these terms do not reflect the concept of collaboration in its entirety and may be only a part of a given collaboration. For example, ‘coordination’ and ‘cooperation’ may occur during the early stages of a collaboration process.

In this thesis, the term ‘collaboration’ is used to denote a *long-term integrated process* but not as a state or destination. Therefore, the collaboration process may involve different parts or sub-processes which need to be analysed separately and be in balance.

More specifically, Thomson and Perry (2006) try to open up the black box of collaboration by defining its different dimensions. Their work is based on an extensive review of collaboration literature and also previous popular frameworks such as the antecedent-process-outcome framework (Wood and Gray, 1991), and the process framework of collaboration (Ring and van de Ven, 1994). Consequently, they define collaboration as:

Collaboration is a process in which autonomous actors interact through formal and informal negotiation, jointly creating rules and structures governing their relationships and ways to act or decide on the issues that brought them together; it is a process involving shared norms and mutually beneficial interactions. (Thomson and Perry, 2006:4)

Thomson and Perry’s definition of collaboration is used as one of the bases to define cross-sector collaboration in this thesis.

2.3.1 Concept of cross-sector collaboration

A *sector* or societal sector can be seen as the set of actors/organisations (e.g., public, private, non-profits organisations, and volunteers) whose goals are similar or related to each other. Examples are the healthcare sector, and the finance sector. In this thesis, the *public sector* refers to all governmental actors/organisations providing public services. In the context of this thesis, the cross-sector forms of collaboration in ERSs is of particular interest. Parties to these collaborations are from different sectors within the public sector or from the private sector, with different backgrounds, cultures, interests and goals. Therefore, the collaborations are inherently complex. Bryson et al. (2006) highlight and emphasise this complexity by performing a literature review and categorising the literature on collaboration. They define cross-sector collaboration as:

[Cross-sector] collaboration is the linking or sharing of information, resources, activities, and capabilities by organisations in two or more sectors to achieve jointly an outcome that could not be achieved by organisations in one sector separately. (p. 7)

Bryson et al. (2006) present a framework for understanding cross-sector collaborations (Figure 2.2). This framework has five main dimensions: a) initial conditions, b) process of collaboration, c) structure and governance, d) contingencies and constraints and e) outcomes and accountabilities. They conclude that all sections of the framework and their relations should be thoroughly understood in order to design and implement successful cross-sector collaborations, and claim that it can easily guide people (e.g. policy makers) in this respect. However, for this thesis, their framework was considered very general and too abstract. It seemed difficult to use it in a specific context and for the particular purpose of IS design, thus motivating the development of the ERS context-specific framework (see Chapters 3 and 5).

In this thesis, the phrase ‘cross-sector collaborations’ refers to those collaborations that involve actors/organisations from different sectors (e.g. governmental and non-governmental organisations, and the private sector). These collaborations already exist in some forms; for example, in Sweden, the fire services collaborate with security guards in some municipalities (the ERS sector and private sector), and social care nurses participate in emergency response operations (social care sector and the ERS sector). However, these activities are not yet an integrated part of organisations and society, and are new for the actors involved. In the past, such collaborations were not seen as important and were therefore not planned from the top down by politicians and policymakers (e.g. the Swedish Civil Contingencies Agency), and have yet to be established systematically in order to effectively overcome potential challenges (Agranoff and McGuire, 2010). Therefore, this trend is also comparatively new from a research perspective and in this thesis. Cross-sector collaborations share certain characteristics, for example the involvement of a variety of autonomous actors from different domains with different rules; as a result, they also share potential challenges in their establishment.

The definition of collaboration as a general concept by Thomson and Perry (2006) and cross-sector collaboration by Bryson et al. (2006) were deemed relevant and helpful for defining cross-sector collaboration in ERSs. Despite the differences between the two definitions given above, they also share many similarities. Actors collaborate to *achieve a shared goal and solve a problem* that is not easily solved by one or a few actors alone. At the same time, actors are autonomous and have their own identities. Their collaboration usually includes *sharing information and resources*. The collaboration is seen as a *process*, rather than as a status or destination.

Therefore a ‘cross-sector collaboration’ in ERSs is defined within this thesis as:

A process in which different autonomous actors from different societal sectors (e.g. the public sector, private sector, non-profit sector) or even within the public sector (e.g. healthcare, emergency response, social care) attempt to create a new setting by establishing new ways of sharing information, resources and capabilities by performing joint response operations in order to achieve shared goals, i.e., saving lives and minimising environmental damage.

2.3.2 Emerging forms of cross-sector collaboration in the new public sector and in ERSs

The term ‘new public sector’ became popular in the 1990s when the public sectors in developed countries (e.g. the UK) came under pressure to become more efficient and effective; for example, by establishing cross-sector collaboration (e.g. involving private-sector actors) (Brignall and Modell, 2000). As a result, we see emerging public sector configurations involving alternative societal resources to become more efficient. Examples include the involvement of citizens in e-government, the role of private-sector actors in new public management (NPM), and the creation of cross-sector collaborations, for example, in emergency management (Venema et al. 2010; Gruening 2001).

The emerging forms of cross-sector collaboration are often aimed at coping with current societal challenges in an era of scarce professional resources in public service delivery. This includes involving, among others, the private sector, non-governmental organisations, volunteers and citizens in the delivery of services (Agranoff and McGuire, 2010; Agranoff, 2007; Kettl, 2005; Goldsmith and Eggers, 2004). Cross-sector collaborations have been highlighted and studied continuously (e.g. Fleishman, 2009; Gazley and Brudney, 2007; Alter and Hage, 1993; Levine and White, 1961). It has repeatedly been claimed that contemporary public challenges, for example, climate change, environmental protection, poverty, natural resource management, natural disasters, the educational achievement gap, emergency management and other issues are difficult to address without cross-sector understanding, agreement and collaboration (Agranoff and McGuire, 2010; O'Leary and Bingham, 2009; Bryson et al., 2006; Vigoda, 2003). Greater efficiency, reduced biases, a higher quality of services, and improved organisational accountability are some examples of the perceived benefits (Alford and O'Flynn, 2012; Brinkerhoff, 2002; Salamon, 1995). However, a number of studies also argue that achieving cross-sector collaboration is not an easy task (Bryson et al., 2006; Greve and Hodge, 2005; Huxham and Vangen, 2000; Wondolleck and Yaffee, 2000). Several researchers have alluded to challenges such as distrust, uncertainty, managerial complexity, cultural conflicts, power imbalances, risk of dependence, and lack of incentive for collaboration (Berlin and Carlström, 2011; Babiak and Thibault, 2009; Gazley and Brudney, 2007; Wondolleck and Yaffee, 2000; Young, 2000).

In order to address the current challenges in ERSs, emerging forms of collaboration in emergency management have been established and discussed, both for large-scale crises and for smaller-scale or frequent emergencies. The establishment of 'mega communities' (Kleiner and Delurey, 2007) has been described as essential for large-scale crisis management, with actors from different sectors collaborating in response operations; for example, by performing first aid, providing transportation, or collecting food supplies. Equipping non-professional or semi-professional first responders (e.g. bystanders, volunteer groups) who may be the first to arrive at an emergency site has been suggested as a way to empower emergency management (Andersson Granberg et al., 2016; Jack, 2005). In the aftermath of Hurricane Katrina, a lack of good collaboration with voluntary organisations such as the Red Cross was perceived to result in the inadequate treatment of injured people (Tierney et al., 2006). At the inter-organisational level, leadership roles and inter-organisational decision-making have been considered essential in response operations in general since emergencies many times are unpredictable. (Andersson et al., 2014). The role of bystanders and volunteers in helping injured people in emergencies in rural areas after traffic accidents and drownings has been shown as important (Ramsell et al., 2017; Venema et al., 2010; Brodsky, 1984). Firefighters as medical first responders have been tested in both Australia and Sweden (Sund et al., 2012; Smith et al., 2001), and the role of security officers as key first responders in emergencies such as cardiac arrests and fire incidents has been described as positive (Weinholt and Andersson Granberg, 2015; Valenzuela et al., 2000). A community-based Emergency First Aid Responder (EFAR) system was implemented in Cape Town in order to involve local communities in creating a more effective response to emergencies (Sun and Wallis, 2012). The

usefulness of inter- and intra-organisational collaboration exercises for professional response organisations has been studied in for example, traffic accidents, ferry fires, train accidents, building fires and chemical accidents scenarios and to enable organisational learning from exercises have been emphasised as one way to improve the collaboration (Berlin and Carlström, 2015; Andersson et al., 2014). The emerging role of non-governmental actors, private parties and volunteers has been mentioned several times in the research literature (e.g. Pilemalm et al., 2016a; Gunnarsson and Svavarsdóttir, 2007; Ali et al., 2006; Larson et al., 2006; Waugh and Streib, 2006).

Modern IS applications have enabled and accelerated the emergence of different forms of collaboration in the public sector. In ERSs, cross-sector forms of collaboration are supported by such approaches as dynamic resource handling systems, optimisation systems, graphical positioning systems and mobile applications (Leknes et al. 2017; Andersson Granberg and Värbrand, 2007). New applications have been developed in parallel with the establishment of cross-sector collaboration; for example, optimising the location of ambulances and fire services (Leknes et al., 2017), designing digital simulation-based training environments (Rybing et al., 2017) or introducing new communication platforms (e.g. RAKEL) (MSB, 2010). Based on the sociotechnical ensemble view, the collaborations can thus be seen as an IS application domain and involve different non-technical elements that need to be studied before any IS development. Furthermore, the collaborations involve heterogeneous actors from different sectors with different needs for IS. Therefore, the needs and eventual possibilities and challenges in developing IS should be researched and investigated. Since the phenomenon of cross-sector collaboration in ERSs is comparatively recent, the specific research context described below is also considered to be new and emerging, even though some studies of related collaboration phenomena (as described above) do exist.

2.4 Study context

In addition to the general challenges faced by ERSs globally, Sweden, together with many other countries, faces specific challenges related to its geographical demography. Sweden is the third-largest country by area in the European Union, with a population of around ten million, and thus a low population density. The majority of the population live in the southern half of Sweden, while the northern part is relatively sparsely populated (Statistics Sweden, <http://www.scb.se>, 2017). The physical distances between response organisations and populations are long, especially in northern areas, making collaborations all the more important. At the same time, the Swedish rescue services are localised to increasingly fewer places in society, e.g. due to the closing of fire stations in favour of creating larger, centralised federations of fire services. This trend of centralisation also extends to other response organisations, for example the police (Holgersson, 2005). As a result, many response organisations have diminished or become responsible for a larger geographical area than before, and the distance between rural populations and response organisations has increased further. At the same time, in many types of emergencies, for example traffic accidents, the first actor to arrive at the emergency site is often a civil citizen rather than a professional

first responder and may be able to carry out such acts as first aid if he or she has the appropriate training and/or equipment.

These challenges have resulted in substantial ongoing re-organisational efforts to find new ways of responding to emergencies. In 2009, the Swedish government presented the Swedish Civil Contingencies Agency (MSB) with a mission called the “strategy for strengthening societal resources for coping with emergency situations”. This simply means involving actors from outside of professional response organisations during certain phases of emergencies, allowing them to combine and collaborate with professional resources. The aim of these efforts is to reduce response times and/or to compensate for depleted levels of professional resources. It is assumed that, by involving complementary societal resources, response operations can be made faster and more effective, thereby saving lives, reducing the number of casualties, mitigating damage to infrastructure and, ultimately, saving money. Cross-sector collaborations, social networks, volunteer assistance and non-profit groups, and even engaging bystanders in order to improve the overall quality of response operations, especially in cases where short response time is crucial, have also been the focus of several recent Swedish studies (e.g. Ramsell, 2017; Pilemalm et al., 2016a; Andersson Granberg et al., 2016; Sund, 2006).

Current efforts in Sweden (notably from publications, project reports, MSB policies and news) can mainly be divided into three different forms: (1) co-operative use of resources, (2) involving volunteers/citizens in response operations and (3) permanent co-location of actors (Figure 2.3).

Figure 2.3: A categorisation of emerging forms of collaboration in the Swedish ERS.

These three types of collaboration are described in the following and then the thesis projects are described in detail, together with explanations as to why they are relevant to the thesis objectives.

2.4.1 Permanent co-location of actors

The temporary co-location of emergency response and support actors during large-scale incidents is not a new phenomenon. Such settings are necessary in order to respond quickly to emergencies such as earthquakes, floods and storms in which different teams need to work together to save lives, look for missing people, transport debris, and provide food, healthcare and sanitation services. However, the permanent co-location of actors to facilitate communication between them and to respond more efficiently and quickly to frequent emergencies is a more recent phenomenon. Actors share permanent buildings and facilities and can meet and communicate easily in different situations (e.g. formal meetings, informal social events). It is believed that better communication may lead to quicker response times and better situational awareness in emergencies.

2.4.2 Co-operative use of resources

There are different semi-professional actors who may intervene in an emergency situation, either to assist professional first responders or to act as first responders themselves. These actors are frequently on duty in society, may be in different physical locations, and may have equipment such as vehicles and communication devices and/or specific competences that can be used in response operations. They may have or receive basic emergency management training such as cardiopulmonary resuscitation (CPR) or fire suppression that may be of use in rescue operations. One example is that of security guards, who are usually employed by companies providing security services and who patrol inside municipalities to monitor assigned objects or properties and report related crimes and offences. Parts of Stockholm, Öckerö, Nyköping, Falkenberg and Varberg are examples of municipalities that have already begun using semi-professionals and the co-operative use of resources. In IVPA (while waiting for ambulances), the fire rescue services are dispatched, together with eldercare nurses, in serious medical emergencies when ambulances are not immediately available or are far from the emergency site and this practice is emerging in an increasing number of Swedish municipalities. In the SALSA³ project, certain resources (e.g. taxis) were equipped with defibrillators to give aid to people suffering cardiac arrests (Hollenberg et al., 2009).

2.4.3 Involving volunteers

Another example of recent collaboration is involving volunteers in emergency response operations. For instance, volunteers can act as first responders in rural areas where the main professional actors are not located nearby in order to reduce response times in critical situations. In a project in Medelpad starting in 2015, volunteers were trained in CPR, basic firefighting, first aid and basic life support in case of cardiac arrests, traffic accidents, fires and drownings. In the event of such an emergency, the volunteers were alerted at the same time as the municipal fire services. Another project called SMS Life Saving uses SOS Alarm to send an SMS to registered volunteers in Stockholm who are situated or live nearby in the event of a person suffering a cardiac arrest. Available volunteers can then travel to the site

³ Saving Lives in the Stockholm Area. SALSA was conceived to equip vehicles other than ambulances with defibrillators and ensure that these extra resources are alerted when cardiac arrests occur. Police cars, taxis and buses are examples of alternative resources.

and start performing CPR. The concept of using volunteers has also spread rapidly to other municipalities, for example in Katrineholm and in socio-economically exposed urban settings in Botkyrka and Södertälje.

In the context of this thesis, no direct results were achieved in relation to the involvement of volunteers. This collaboration type is not considered as directly cross-sector since volunteers mostly do not have any affiliation (e.g. citizens, clubs). However, the MSB perspective on the use of volunteers has been a small part of the initial data set that was used to create the first version of the context-specific framework. Apart from this, volunteering is mostly referred to the discussion section as another type of collaboration trend to which parts of the thesis results may be applicable.

2.4.4 Studied projects in the thesis in relation to the collaboration forms

Three projects were studied in order to collect data about the co-operative use and co-location of actors. The studies' roles in this thesis are explained in more detail in Chapter 4.

Study I. Safety House (2013)

Jämtland is a sparsely populated province with a population of 112 000 people. The population becomes three times larger 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. Both professional response organisations and other actors supporting or having responsibilities in response operations reside at the Safety House (Figure 2.4). This arrangement (co-location) aims to improve alarm management in order to reduce the despatch time of professional response, reduce response time by improving collaboration between actors, allow actors to quickly gain a common understanding of the emergency situation, and create a platform and citizen-centred service for shared information management and dissemination of information to the media and the public.

Figure 2.4: Co-location of main and supportive actors at the Safety House

Safety House can be seen as primarily an inter-organisational collaboration since actors'/organisations' routines are the same as before and no major new tasks have been assigned to them. The actors involved were previously working directly or indirectly with

emergency response as one of their duties. However, some actors (e.g. the Swedish Church, non-profit organisations, the Customs) are not in the same sector as the others. Sharing the building has also created new routines for communication and decision-making and thus may lead to new challenges. Therefore, the Safety House collaboration is also seen as a partial cross-sector collaboration in this thesis, even though, in many respects, the collaboration resembles an inter-organisational one.

Thesis/IS focus: Safety House was studied in order to identify which IS needs facilitate the permanent co-location of actors and the collaboration between them. Based on the sociotechnical ensemble view, non-technical and social elements and aspects of co-location were also studied in order to find related challenges and opportunities for future IS development and use. The IS applications in use at the time of the study included mostly stationary (non-portable) tools, for example an alarm management system and a map system. Communication between actors took place via e-mail, telephone and mobile phones. Some actors also had RAKEL, which is a shared radio-based platform for communication among response organisations. However, the tools and IS applications had not been designed specifically for the new collaboration/co-location setting but were basically the same as those the actors were using before entering this collaboration.

Study II. Nyköping municipality (2014)

The co-location of resources and the co-operative use of resources in the municipality of Nyköping had the vision to create a safer society with the citizens in focus by promoting new collaborations between actors in the municipality. Another major goal was to reduce costs by sharing equipment and making efficient use of resources. Thus, a project was started involving the fire services, the social care division and the technical division in the municipality. The aim was to permanently co-locate the fire services and the municipality social care division in the new fire station premises, to share cars, and to centralise the municipality's alarm management in the new fire station. Both personal security alarms (Swedish: Trygghetslarm) and automatic fire alarms (for buildings) were placed at the fire station to be managed more efficiently by social care operators. The fire services still performed the response operations, but sometimes requested support or information, for example, exact addresses or keys to buildings. As the collaboration progressed, the technical division (caretakers) was also expected to be involved in the project and the related alarms (e.g. water damage to streets, elevators stopping in the municipality's properties) were going to be placed in the shared alarm centre. The project is seen as a cross-sector collaboration since social care, the technical division and fire services all have their own organisations with different goals and routines. In the new collaboration they share some goals (e.g. cost reduction through shared and unified alarm centres). They have also changed their physical setting, share the new fire station and have close communication with one another.

Thesis/IS focus: This collaboration was studied to identify the IS-related challenges, opportunities and actor needs in the new setting to perform cross-sector collaboration, and specifically to handle alarm management. In addition to the technical aspects, the social aspects were again studied, as emphasised by the sociotechnical ensemble view. At the time

of the study, the involved actors did not have IS applications developed specifically for the new collaboration but used the existing system of alarm management. For communication they used e-mail, telephone and mobile phones.

Study III: The ESKORT project in Norrköping municipality (2015–2017)

Co-operative Use of Municipal Resources for Increased Safety and Security (ESKORT; in Swedish: *Effektivt sambruk av kommunala resurser för ökad säkerhet och trygghet*) was a cross-sector collaborative emergency response research project, supported by participation from the municipality of Norrköping in Sweden and its fire services. The project was intended to identify, train, equip and evaluate potential semi-professionals, who include security guards, home care personnel, fire services day personnel and private entrepreneurs (facility services). Semi-professionals' primary jobs are not first response, but they patrol the community and might be closer to emergency sites than professional response resources. The project was intended to analyse such potential collaborators and provide them with the proper equipment, training, IS support and checklists to be able to collaborate with the fire services. The project started in early 2015 and finished in June 2017. It is seen as a cross-sector collaboration since it involved potential semi-professionals from sectors other than emergency response (both public, e.g. home care personnel, and private, e.g. guards), mostly with little or no previous experience of emergency response. They are assigned additional tasks, and work in new contexts with new information, rules and routines while simultaneously performing their ordinary tasks in their respective organisations.

Thesis/IS focus: The ESKORT project was studied in order to identify the IS-related challenges, opportunities in IS development and the actors' needs for IS. At the time of the study (project start) semi-professionals did not have any tools to receive alerts and respond to them. There was also no fixed method for communication between actors. The project aimed to develop a mobile app prototype for the semi-professionals involved to enable them to receive alerts and be dispatched to the incident site. Based on the sociotechnical ensemble view, the thesis study also included the surrounding infrastructure and organisational context (e.g. the required training and equipment) when involving the semi-professionals and developing IS applications.

2.4.5 Challenges in cross-sector collaboration and IS-related research needs

An emergency situation may evolve unpredictably over time, and a short response time is one of the key factors for minimising casualties and damage, for example in cardiac arrests or fire incidents (Hollenberg et al., 2009; Mattsson and Juås, 1997). ERSs are often dealing with limited, delayed and/or sensitive information, time pressure, exceptions to routines and a highly collaborative working environment with flexible teams of first responders. Collaboration with organisations from outside the immediate boundaries of ERSs, which have various functions, structures and cultures, makes an ERS an open system requiring ad-hoc coordination of different responders (Turoff, 2002). The importance of the time factor during the early phases of the response operation demands rapid decision-making and responsive IS to avoid risking human lives. However, the shortage of professional emergency response resources increasingly demands the involvement of other societal resources and

efficient use of available resources in response operations. Therefore, there are many ways to achieve this and some of them are already in use (e.g. cross-sector collaboration, involving volunteers or promoting collaboration with citizens). From an IS perspective, they need essential IS application support, for example to communicate with each other or with response organisations, or to receive alerts. Therefore, their requirements for IS should be investigated in order to provide them with proper IS applications.

The cross-sector collaborations involve certain challenges, ambiguities and difficulties, despite their potential to improve ERSs. It has been claimed that different types of potential resources, their role in emergencies, their responsibilities, tasks, and required competencies have not been sufficiently identified, discussed or categorised (Pilemalm et al., 2013). Little consideration has been given to having a uniform understanding of an emergency situation, actors' experiences, and trust between actors, despite the importance of these for the effectiveness and efficiency of response operations (Palm and Törnqvist, 2008). Different studies have also shown that research on cross-sector collaborations and the involvement of potential resources is often carried out from a limited perspective, such as medical or technical, and does not sufficiently consider organisational or social aspects (Stenberg et al., 2010; Weisfeldt et al., 2010; Hallstrom, et al., 2004). The type of emergency and the training of actors are also key factors that need to be taken into account in cross-sector collaborations (Fischer et al., 2011; Jungert et al., 2006; Pelinka et al., 2004). Leadership roles, common incentive (e.g. in the form of shared responsibilities) and the role of collaboration exercises have been discussed as important aspects for the success of collaborations, but in the main between professional emergency response organisations (Andersson et al., 2014; Asproth et al., 2013; Berlin and Carlström, 2011). Conflicting rules and policies may cause problems in cross-sector collaborations when actors come from different organisations (Christensen et al., 2013). The studies thus reveal that there are different aspects and elements that are important in cross-sector collaboration and, as a consequence, in further IS development and digitalisation processes. At the same time, it is notable that most of the current literature about cross-sector collaboration (in general and in the ERS context specifically) does not explicitly discuss or focus upon the need for IS, probably since these studies usually do not stem from the IS field but from organisational studies, public administration, policy networks, etc. (Klijn and Koppenjan, 2012; Agranoff and McGuire, 2010; Babiak and Thibault, 2009; Bryson et al., 2006). Therefore, to study the pre-requisites for IS development and the digitalisation of cross-sector collaboration can provide an important contribution to filling the identified research gap described in Chapter 1.

2.5 Summary

Chapter 2 has defined the principal terms used in this thesis, i.e., information systems (IS), emergency response systems (ERSs) and cross-sector collaboration. IS are defined based on the sociotechnical ensemble view. ERSs are considered to be an application domain of IS and thus the definition of ERSs is also based on the sociotechnical ensemble view. Therefore, the definition of IS and ERSs overlaps, since both have entangled technical and social elements

and aspects. ERSs can also use specific IS applications and IT artefacts, for example decision-support systems, dynamic-resource allocation systems, systems supporting situation awareness, mapping systems and mobile dispatch applications. Similarly, the definition of cross-sector collaborations embraces the sociotechnical ensemble view. To apply the same view allows a consideration of the similarities between the three terms and will thus facilitate the investigation of actor needs, possibilities and challenges in related IS developments.

Furthermore, emerging forms of collaboration in the public sector and ERSs have been described. Three recent forms of collaboration in the Swedish ERS, i.e., the permanent co-location of actors, co-operative use of resources and involving volunteers, were presented and the thesis focus and study context in relation to these collaborative forms were provided. Finally, challenges within cross-sector collaboration in the public sector and ERSs and the need to investigate the prerequisites for IS development were identified with help from the literature. It was argued that it is crucial to have knowledge about the collaborations and to understand the contexts and actors' tasks before any IS development goes ahead. At the same time, the related literature is scarce and illustrates a perceived lack of sufficient or systemised knowledge about emerging cross-sector collaborations in ERSs or how an understanding of the phenomenon can be gained, for example with the help of frameworks. Hence, it was concluded that this thesis may fill this gap by identifying actors' need for IS, and the related challenges and possibilities as prerequisites in IS development, and may also connect the IS field to the existing literature about cross-sector collaborations.

3 THEORETICAL AND ANALYTICAL FRAMEWORKS

This chapter describes the theoretical and analytical frameworks applied in the thesis. ‘Theory’ as a concept is defined, and different ways of applying theory in qualitative research are described. The term ‘sociotechnical systems’ is then described and an adapted sociotechnical systems model in relation to the framework development is presented. Following this ‘network governance’ is also presented as the thesis’ theoretical lens alongside the sociotechnical ensemble view and sociotechnical systems theory. Its application in the thesis is described. Finally, ‘user participation’ approaches, the associated challenges, and their subsequent application in this thesis are presented.

3.1 Theory and frameworks

In the research literature, there are different definitions of what constitutes a theory (DiMaggio, 1995; Sutton and Staw, 1995; Weick, 1995). Sutton and Staw (1995) argue that it is easier to define what a theory is *not* than to define the concept of a theory. They state clearly that data, diagrams, models, references, list of variables, definitions, and pure hypotheses and predictions are not counted as theories. Rather, they see a theory as the “answer to queries of why” and define it as follows:

Theory is about the connections among phenomena, a story about why acts, events, structure, and thoughts occur. Theory emphasises the nature of causal relationships, identifying what comes first as well as the timing of such events. Strong theory, in our view, delves into underlying processes so as to understand the systematic reasons for a particular occurrence or non-occurrence. [...] It usually is laced with a set of convincing and logically interconnected arguments. (Sutton and Staw, 1995, p. 378)

On the other hand, Weick (1995) views *theory* as a process that includes abstracting, generalising, relating, selecting, explaining, synthesising and idealising as attempts to build theories. Weick does not explicitly exclude products such as data, diagrams and variables from being ‘theory’, but rather argues that any theory building should include these components. To reject a study in its early stages of theory development is problematic since theory and theory development are based on a process and cannot be seen exclusively in terms of a complete product. Theories do not need to be strong in their initial stages and may start, for example, with the creation of models and diagrams as part of a process that may lead to progressively stronger theories (Weick, 1995).

The work in this thesis adheres to Sutton and Staw’s view of theory, which excludes certain components from being counted as a theory. Based on their view, concepts (e.g. collaboration), definitions (e.g. emergency situations), fields (e.g. ERS and IS), approaches (e.g. user participation) and methods (e.g. systems development methods) are not counted as theories. They are rather considered to be useful background, analytical frameworks or examples of applications supported by existing theories. The sociotechnical ensemble view

described in Chapter 2 is seen as an overall view of IS. Meanwhile, sociotechnical systems theory and network governance, described later in this chapter, are used as theoretical perspectives.

3.1.1 Different ways of applying theory in qualitative research

Theories can be used in different ways in qualitative research. For example, Creswell (2014) categorises it as follows:

- *Theory as a paradigm*: theories are most often used as a broad explanation of a phenomenon (e.g. behaviours, attitudes). Here, theories underpin the research design, shape the researchers' assumptions about social reality and determine the whole research methodology. The researcher usually begins with a theoretical model to test and address the phenomenon under study.
- *Theory as a lens*: theories provide an overall orienting lens that shapes such aspects as data analysis in the research. The research employs the theory in seeking to explain, for example, how aspects of a social reality work (e.g. analytical lens). Theories may be used to form data collection, for example, determining what questions it is considered important to ask (e.g. actors' collaboration mechanisms, responsibilities and roles) and whom it is important to study (e.g. professional response actors, citizens and volunteers).
- *Theory as emerging generalisations*: theories or some broad explanation become the end-point of the research in an inductive process of building from empirical sources. The researcher usually begins by gathering detailed information about a phenomenon and attempts to form categories and develop broad patterns and generalisations (and eventually theories) that can later be compared with the existing literature on other empirical grounds (e.g. experiences), e.g., in Grounded Theory (Urquhart and Fernández, 2013).
- *No theory*: some qualitative studies do not use any explicit theory. Such a study usually starts with observations and a prior conceptual structure and knowledge (e.g. the research background). Although the research background will have been influenced by the theoretical orientation, this kind of research is not based on theoretical grounds. In these studies, the researcher usually constructs and presents a detailed description of a central phenomenon based on observation and experience.

Sociotechnical systems theory and network governance are the two main theoretical perspectives applied in this thesis; the former is used as a *paradigm* during the initial phase of framework development, for example, as a tool in system development. Network governance is used as an *analytical lens*, as described in detail in the following. The term 'perspective' may also be used to refer to these two since they are also used as schools of thought to understand various phenomena (e.g. to understand ERS using a sociotechnical systems perspective or network governance).

3.2 The sociotechnical systems perspective for IS development

The term 'sociotechnical' comes from the work of Emery and Trist at the Tavistock Institute during the 1960s, and illustrated the need for a fit between the technical and social aspects within organisations and workplaces (Mumford, 2000; Emery and Trist, 1969). Therefore, Emery and Trist began to question the traditional 'hard systems thinking' approach that was the dominant school of thought before 1960 (Emery and Trist, 1969). They argued that, in order to understand and gain a clear picture of a system, its social dimensions should be taken into account. They used the term 'sociotechnical systems' to present the need to jointly analyse the social and technical issues when developing such systems. The term 'sociotechnical systems' stresses the reciprocal interrelationship between technology and humans and their joint optimisation in the design (Ropohl, 1999). Thus, it emphasises the interrelatedness between the social and technical aspects of a system as a whole. The outcome of applying this theory is a better understanding of how social, organisational and technical factors affect work processes and the use of technical systems, with the potential for improvements to organisational structures, work processes and technical systems design (Baxter and Sommerville, 2011; Mumford, 2006). The success of a system depends on the types of interaction between its social and technical factors, and it is impossible to separate these two (Strauss et al., 1985). It may not be possible to develop a successful technical system without considering both organisational and social systems and factors. In sociotechnical systems, humans and technology are two separate, self-contained but intertwined entities that interact with each other, affect each other and create the social context (Kaghan and Bowker, 2001).

Researchers from various fields have conducted sociotechnical analyses of systems, for example, in clinical systems (Reddy et al., 2003) and air-traffic control systems (Bentley et al., 1992). The sociotechnical systems perspective has also been used in studies in the field of emergency management; for example, in designing new command and control systems to involve environmental complexity and dynamism (Walker et al., 2008). Furthermore, sociotechnical systems theory has been used to investigate the organisational and social complexities that may lead to failure in IS (Bostrom and Heinen, 1977), the results of which indicate that the success of IS projects depends on how well the social and technical aspects are jointly optimised. Enid Mumford took this idea further and later applied it to IS development processes to emphasise the necessity of considering both social and technical issues when designing new systems (Mumford, 2000). This approach has been echoed by several other scholars (e.g. Laudon and Laudon, 1999). Enid Mumford and Frank Land were among the most influential of the researchers who initiated sociotechnical research in the field of IS (Davenport, 2008; Land, 2000). Mumford applied the sociotechnical perspective to the design of computer systems in order to emphasise the important relationship between technical and social systems and the need to work with both in IS development (Mumford, 1974). Several user participation methods (e.g. ETHICS) emerged from this perspective during the 1980s (Mumford, 1981). Mumford's work placed the social context and human needs at the centre of IS design, emphasising a humanistic approach to systems design in order to improve the quality of working life in terms of the fit between personal and organisational goals (Mumford, 2006).

The theory has also been criticised, however, as insufficient to be used on its own because it offers little in the way of prescription or instruction for how to design systems. It relies instead on general and abstract principles emphasising the joint optimisation of social and technical aspects (Parker and Wall, 1998; Kelly, 1992). Therefore, in the context of this thesis, there was a perceived need to combine and adapt the theory and to customise it for designing and analysing domain-specific systems and applications; for example, to emerging forms of cross-sector collaboration in ERSs.

Sociotechnical systems theory shares many similarities with the sociotechnical ensemble view in their perspective on technology (here IS). The main one is that both are efforts to broaden the scope of IS design and development. However, the sociotechnical ensemble view is broader and allows us to conceptualise IS as a phenomenon by incorporating different aspects and elements. It allows for a more heterogeneous combination and sees elements as entangled without any clear borders (see Chapter 2). Sociotechnical systems theory takes a systems view and sees IS as systems with both technical and non-technical components and largely clear and distinguishable relationships between them. Therefore, it may be argued that sociotechnical systems theory may restrict the definition of technology since system components should be identified in advance and are put together as a system. In relation to the work of this thesis, sociotechnical systems theory was mostly used during the early phases of the work as a paradigm in which there was a need to understand existing ERSs and as a tool to develop the framework (see below). The work was then complemented in later phases by using the sociotechnical ensemble view to observe, describe, define and understand the whole new context of cross-sector collaboration in ERSs and their emerging entangled elements and aspects. This was largely a consequence of sociotechnical systems theory being deemed insufficient and not fully feasible in the context of ERS cross-sector collaboration since it was still unclear which elements, new actors and aspects should be involved in the IS design.

3.2.1 Sociotechnical systems: thesis application

The sociotechnical systems approach was thus applied during the initial phases of the work for this thesis since there were different types of collaborations, actors and tasks, routines, rules, etc. available; however, they were deemed to be in a quite unstructured form. The researcher was new to the context and wanted to systematise it in some way in order to understand the cross-sector collaborations and related IS development. Therefore, the researcher started out by taking a sociotechnical systems perspective and trying to identify different technical and non-technical systems within the given context. The sociotechnical systems approach was thus used as the theoretical paradigm; that is, to shape the researchers' assumptions about the social reality (Creswell, 2014). Specifically, it was used while developing the context-specific framework. In other words, the use of a sociotechnical systems approach formed the author's initial understanding and assumptions about IS as sociotechnical systems which include both technical and non-technical components that affect each other. One of the perceived primary values of this theory is the empowerment of people in their workplace design and, furthermore, in technology design. At the same time,

user participation approaches attempt to achieve this practically by involving people in development processes. Therefore, the combination of sociotechnical systems theory and user participation approaches (which largely stem from the same origins), were deemed relevant for this thesis.

By using the theory as a paradigm, IS are viewed as sociotechnical systems because they are composed of social subsystems and components alongside technical ones. Actors (end-users/stakeholders), policies, different responses to emergencies (e.g., responses to incidents involving chemical substances versus responses to traffic accidents), incidents and laws are examples of the former. Technical components may include emergency supplies, processes and IT artefacts (e.g. databases, mobile apps) that are used either to perform response operations (such as containing a fire using fire extinguishers) or as support for actors in decision-making and communication (e.g. radios, telephones and decision support systems). By creating cross-sector collaborations in ERSs and involving more actors in response operations, interactions become more complex since numerous non-technical factors are involved; for example, different working environments, tasks and responsibilities; size and type of incidents; actors' training and education; and legal issues (Pilemalm et al., 2013). The sociotechnical systems view of an ERS was thus deemed helpful during the initial analysis and development of emerging forms of cross-sector collaboration in ERSs, particularly for the framework development.

In order to clearly demonstrate the relationship between the components of sociotechnical systems mentioned above, Bostrom and Heinen's model was selected to be used in the thesis for its simplicity and relevance to the field of IS. However, it has been adapted to the context of the thesis. For instance, the 'Structure' component is somewhat vague in the original model, and it is not clear whether the term refers to environmental aspects such as working conditions or to organisational aspects such as leadership. Therefore, 'Structure' was divided into two separate components: 'Structure/organisation' and 'Environment/context' to match the definition of ERS components given above. Similarly, the 'People' component was renamed 'Actors' and placed at the centre of the model, to reflect the fact that the people who are part of a sociotechnical system interact with all the other components and that actors are strongly in focus in emerging forms of cross-sector collaboration. This is also in line with user participation approaches (e.g. PD, UCD) in which stakeholders' involvement in design processes has been emphasised. In line with sociotechnical systems theory, the original model separates technical systems from social systems; for example, 'Task' belongs to the technical system. Such separation is not deemed important in the adapted model since it complicates the understanding of it. Rather than a distinction between social and technical systems within sociotechnical systems, the adapted model focuses on the importance of the relationships between technical and non-technical components/aspects and incorporating of all of them into the design processes. 'Task' may be connected to both technical and social systems, as it includes both the humans performing a task and the techniques to support that task; thus, separation of the two is deemed unnecessary. The modified model is shown in Figure 3.1(B).

Figure 3.1: A) The sociotechnical perspective (adapted from Bostrom and Heinen, 1977, p.25). B) The revised model used in this thesis.

Based on Figure 3.1(B), the components in Table 3.1 are defined for IS development in ERSs when using the sociotechnical systems perspective. It is essential to explore and involve these components in IS development processes and they were used to redesign the initial version of the framework. They helped to restructure the framework and place the dimensions in larger categories called parent dimensions. In this way, the framework was thus connected to sociotechnical systems theory, could be used as an IS development tool and was deemed easier to understand since the parent dimension stems from Table 3.1 and the theory. More details about the framework development and its connection to the theory can be found in Paper 3.

Table 3.1: Sociotechnical components in IS development for ERSs

Components to be included in IS development for ERSs
Actors: People and social components
Technology: Emergency supply and IT tools
Task and processes: Response operations
Structure/organisation: Management, organisational structure, culture and goals
Environment/context: Legal, political and environmental aspects

‘Actors’ refers to all the characteristics related to the actors involved in response operations. Emergency supply and IT tools are mostly technical components of ERSs and are generally technological artefacts (e.g. map systems, radios). Response operations are in fact the main actors’ tasks and processes in ERSs, labelled as ‘Tasks’. ‘Structure/organisation’ components

are the ways in which ERSs are organised and managed. Leadership, decision-making, organisational goals and other organisational aspects, such as cultures, can all be part of this component. 'Environmental and contextual' components are in fact hidden or absent in Bostrom's model. However, they become highlighted in the ERS definition because of the crucial role of existing legal, political and environmental aspects. All of these components are related and may affect each other. Therefore, all of them should be studied and understood in relation to each other when developing cross-sector collaborations.

3.3 Network governance

In *network governance*, organisations can be seen as flexible social systems with high degrees of informal interaction (Jones et al., 1997). The organisations involved have a horizontal pattern of decision-making and knowledge exchange, and an interdependent flow of resources (Snow et al., 1992; Powell, 1990). This is in contrast to conventional and traditional *government models* (hierarchical structures), which are based on hierarchical decision-making and have a vertical pattern of exchange in which the top levels of an organisation control the lower levels. Typical examples of government models are command and control, for example, in military or crisis response in which there are pre-defined hierarchies, including a chain-of-command and clearly defined responsibilities for every role (Walker et al., 2008). Typical examples of network governance are different forms of stakeholder involvement, citizen involvement (e.g. e-government) and public-private partnerships. Emerging forms of cross-sector collaborations in ERSs will be explored and considered in this thesis as an instantiation of network governance. Complex problems in metropolitan areas such as traffic congestion and public health issues are examples of domains that use network governance forms (Johnston and Finegood, 2015; Kickbusch, 2013; Bryson et al., 2009).

The term 'network governance' has been used in a variety of ways and without a consensus on what exactly the term means (Klijn, 2008). Therefore, it has sometimes even been used differently in different research domains (e.g. from economic, democracy, or policy-making perspectives). The term is mostly used in the literature to mean a phenomenon referring to horizontal collaboration between autonomous actors with shared interests leading to collective service delivery or decision-making. However, Jones et al. (1997) tried to perform a theorisation around the term to explain the conditions under which networks emerge, thrive and enjoy advantages. Network governance as a phenomenon and as a theory thus appears interchangeably or in parallel in the literature. In this thesis, the term 'network governance' is used both as a phenomenon/perspective to refer to the type of collaboration between actors and also as a theoretical foundation (or simply a theory) that can be used to explain key factors in the success or failure of networks.

From a historical perspective, the period from the 1940s to 1970s is often characterised as a time of hierarchy and public administration which was criticised for being inefficient, consuming too many resources and not serving citizens' interests (Dickinson, 2016). The idea of 'network governance' did not emerge suddenly but stems from different research

traditions which span about 50 years (Klijn and Koppenjan, 2012). Klijn and Koppenjan (2012) categorise the existence of network governance in at least three different research traditions.

The first tradition can be traced back to research in the 1960s (Dahl, 1961) and relies on political science which focuses on power relations, decision-making, actors' power and the associated issues. This tradition was continued and mostly used on policy communities and in policy networks during the 1980s and 1990s (Rhodes, 1988). The second tradition stems from organisational theory and adopts an inter-organisational perspective; it is highlighted mostly within the work of Rogers and Whetten (1982) on inter-organisational coordination in the 1980s. The focus is mostly on complex service delivery, networks as vehicles for service delivery, and coordination mechanisms leading to concrete products, services and outcomes (Klijn and Koppenjan, 2012; Hjern and Porter 1981). The third tradition can be placed in the domain of public administration, which embraces solving societal problems, managing horizontal relations and addressing networks in traditional institutions (with government structure). This research emerged during the 1970s on inter-organisational decision-making and implementation. This tradition focuses mostly on existing networks in order to reconstruct, manage and improve them, and on related decision-making processes (Scharpf, 1978). The research in this tradition mostly assumes that governance is a consequence of and is co-evolving with the development of modern network society and new forms of management. The three traditions have many areas of overlap and share a literature; thus, it may not be possible to draw clear borders between them. However, in the work for this thesis, network governance has been applied in very close relation to the third tradition, i.e. as modern forms of horizontal collaboration between actors. Other domains, such as NPM, also use networks but from somewhat different perspectives; for example, economic perspectives and the marketisation of public services for creating competition in a market context leading to greater efficiency in costs and service delivery (Gruening, 2001).

3.3.1 Network Governance: thesis application

The terms 'network governance' and 'cross-sector collaboration' are sometimes used interchangeably in the literature (e.g. Agranoff, 2007). Therefore, network governance was perceived as a relevant lens through which to analyse cross-sector collaborations and complement the results and the use of the sociotechnical ensemble view and sociotechnical systems theory. It is believed that approaches and theories from different disciplines can complement each other and thus enrich the thesis results. Therefore, in this thesis, network governance is compared with cross-sector collaboration in order to understand how they may resemble each other and what the differences and similarities may be. This analysis may help to create a better understanding of these collaborations; for example, by identifying additional important factors that may even be relevant for future IS development. More specifically, network governance was applied as a *theoretical analytical lens* (Creswell, 2014), i.e. an overall orienting lens that shapes such aspects as data analysis in the research. It was used in cross-case analyses and to understand the collected empirical data about cross-sector forms of collaboration in the three studies. Network governance was compared with the collaborations in order to explore whether the core assumptions of network governance are close to cross-sector collaboration in ERSs, whether key factors are present, what the

similarities and differences are, and thus whether network governance is suitable or sufficient as a theoretical perspective for the analysis or development of future ERS cross-sector collaborations. The analysis is also intended to connect the results to a wider public sector network governance context.

In relation to the framework development, network governance analysis was also used as a theoretical lens to initially assess the supportive framework; for example, in terms of completeness and relevance. The analysis may help to include those key factors that are potentially neglected in the current version of the framework and add a complementary theoretical foundation to the framework in addition to sociotechnical systems theory.

3.3.1.1 Relevant network governance principles and key factors in cross-sector collaborations

A set of elements, including core assumptions and key factors, that seems specifically relevant in relation to the thesis objectives were identified from the literature. These elements are shown in Table 3.2.

According to the *core concepts*, autonomous actors are engaged to make policies and perform service delivery based on mutual interests or contracts (Klijn and Koppenjan, 2012). These actors come from different organisations with their own rules and routines, they engage in collective action and problem solving, share resource and pool competencies. The outcome of a network is a result of the interaction of many actors' responses to complicated problems that are difficult for a single actor to handle. The absence of explicit top-down management and hierarchical control is one of the main attributes of networks, in which horizontal patterns of collaboration are apparent (Jones et al., 1997). In networks, the process of governing and the limits of government, as well as the process through which outcomes are achieved are in focus, rather than the governmental structure itself.

A network may have a governing mechanism and thus network governance is usually categorised into three major types (Antivachis and Angelis, 2015). *Participant networks governance* is the simplest form and can be either formal or informal. These networks are based on meetings and shared interests, everyone participates on an equal basis and they are markedly decentralised. A separate and transparent governance entity in the network is absent. *Lead organisation governance* occurs when an organisation undertakes the lead role in the coordination of members. The lead organisation is usually the most dominant member in terms of size, resources and legitimacy. *Network administration organisation* has a distinct and external governance entity that is not a member of the network but has the explicit purpose of governing it and its activities.

Network governance recognises different key factors in relation to the success of networks. *Democratic and horizontal decision-making, collaborative action with heterogeneous resources, decentralised problem-solving, collective solutions for problem-solving, and equal priority in interactions between members* are some of those highlighted in the literature when actors collaborate in networks (Dedeurwaerdere, 2007; Jones et al., 1997; Rhodes, 1996; Powell, 1990).

Conflicts in collaboration and institutional rules are other keys factors that are mostly related to the failure of networks. A network can be seen as a complex phenomenon since diverse autonomous actors collaborate horizontally and it is difficult to predict outcomes. One of the major challenges identified is the absence or ambiguity of a governance structure in spite of the interdependency of members as to resources and policymaking (Klijn and Koppenjan, 2014). This challenge is also called problems of politics and control, since it is not clear who has control over whom (Christensen et al., 2007). Moreover, a network includes relationships between heterogeneous actors, with different capabilities, regulations, interests and functions. Therefore, there are also concerns about the ambiguity of the actors’ responsibilities in this setting. To predict the network’s behaviour, the conflicts that may arise between actors or network outcomes is thus very difficult. There might also be various perceptions of the available information and different solutions and strategies that sometimes lead to conflicts within the networks (Klijn and Koppenjan, 2014). Institutional rules regulating members’ behaviour may also conflict with national laws, external actors’ rules, etc. (Klijn and Koppenjan, 2014).

Trust is also another key factor in network governance which can play an essential role in the success or failure of networks. Trust is defined as, first, a stable positive expectation in which actors expect each other to refrain from opportunistic behaviour even if the opportunity arises, and then to take each other’s interests into account in interactions (Klijn et al., 2010). ‘Trust’ is often seen as the core coordination mechanism in network governance and sometimes as a facilitator that reduces uncertainty in actors’ interactions (Klijn et al., 2010). Lack of trust among actors apparently causes uncertainty in collaboration processes and information sharing among network members. ‘Trust’ also enhances the possibility of information sharing among the actors and may thus have a positive impact on network performance. On the other hand, the absence of trust can cause complexities in collaboration by introducing challenges in information exchange and causing actors to avoid respecting each other’s interests.

Table 3.2: Principles and key factors identified as relevant for cross-sector forms of collaboration in ERSs.

Network Governance	
Core principles	<ul style="list-style-type: none">• Autonomous members are engaged in making policy and performing service delivery in a horizontal pattern• Members have shared interests and goals• The outcome of a network is a result of the interaction of many members, not a single one
Network Type	<ul style="list-style-type: none">• Participant networks• Lead organisation governance• Network administration organisation
Key factors: collaboration and decision-making	<ul style="list-style-type: none">• Collaborative action and complex problem-solving with heterogeneous resources• Democratic and horizontal decision-making• Equal priority in interactions between members

Key factor: trust	<ul style="list-style-type: none"> • As a facilitator of collaboration within networks • The absence of trust causes complexities in a network
Key factors: conflicts and institutional rules	<ul style="list-style-type: none"> • The interactions between actors in horizontal patterns are complex • Various and sometimes conflicting interests and strategies • Different perceptions of the information/problem by the members • Institutional rules may compete and cause conflicts in the members' interactions

3.3.1.2 ERS cross-sector collaborations as potential examples of network governance

In this thesis, the focus is on collaboration between various domains or between occupational sectors, mostly belonging to the public sector. The actors involved are autonomous, have their own organisational rules and are not managed directly by any of the other actors (e.g. professional response resources). There is thus no top-down governing mechanism visible, similar to network governance. While network governance also emphasises the processes involved, the rights of the actors in the collaboration and the decision-making, the cross-sector collaboration literature is generally about the outcome and the results of collaborations, and usually embraces an inter-organisational perspective. Certain key factors, for example, trust and distrust, have been discussed extensively in both network governance and cross-sector collaboration. Other challenges, such as the risk of dependence, difficulty in information sharing, managerial complexities and organisational conflict, can also be seen in both (Klijn and Koppenjan, 2014; Babiak and Thibault, 2009). Therefore, the network governance and cross-sector collaboration literature may be combined and complete each other in different ways. In this thesis, the use of semi-professionals in Norrköping, and the co-location of actors in Nyköping and the Safety House are thus considered and analysed as future potential examples of network governance.

In the specific case of semi-professionals, they come from societal sectors other than emergency response, are autonomous and have their own organisations. They are given limited responsibility and power to decide and act during response operations in a horizontal pattern with professional response organisations. Semi-professionals thus collaborate with a number of actors, such as fire services, ambulances, alarm centres and even other types of semi-professionals (occupational groups), to engage in collective problem-solving. They have various backgrounds, educations and training. Therefore, this study can be viewed as an example of cross-sector collaboration, probably of the type 'lead organisation governance'. This is because the fire services can be seen as the organisation that should train semi-professionals and coordinate, institutionalise and legitimise the collaborations (e.g. through various initiatives).

In the case of co-location at Safety House, and the collaboration between actors in Nyköping, the actors share their physical settings and equipment (e.g. cars, alarm systems) in order to reduce costs and improve response time to emergencies. They also collaborate closely in many financial and managerial processes related to the new co-location setting. Actors again

have their own organisational rules and routines. There is no visible top manager who controls all the actors, and actors collaborate almost horizontally in many situations. Therefore, it is possible to consider this collaboration as an instantiation of network governance in the form of ‘participant network governance’. The municipalities can be seen as the external administration organisations that manage these actors implicitly through policies, local laws, etc. However, the municipalities’ roles were not studied in this thesis. In the case of semi-professionals, cross-sector actors collaborate directly during first response at the incident site. However, in co-location the cross-collaboration might be implicit (e.g. sharing cars and information) and not be seen directly at the incident site in a single emergency operation. Nevertheless, this collaboration is an important part of the network.

The key factors in Table 3.2 were found to be relevant to this thesis because they mostly focus on the challenges and opportunities of networks. ‘Trust’ is also an important factor that may facilitate collaborations and a lack of trust can be a challenge for networks. Therefore, these key factors are used in the analysis of cross-sector collaboration (see Chapter 5). The principles of network governance in Table 3.2 are also used to characterise the cross-sector collaboration studies as instantiations of network governance. However, there are also aspects of network governance and the related key factors which were not found to be relevant to the thesis. For example ‘network management’ attempts to guide and facilitate the interaction between members in a network; for example, by activating the members and their interests (Peters et al., 2017; Agranoff and McGuire, 2010). Here, network management focuses on the internal mechanism of networks and how to change the interactions between members. However, this thesis is not about the collaboration mechanisms in cross-sector collaboration or how to change them but focuses on how the collaborations can be affected by different factors (e.g. organisational, legal, technical) and the subsequent related opportunities and challenges. Another important aspect of network governance is ‘network performance’, that is, measuring whether the goal of networks has been achieved or not (Peters et al., 2017). A strong institutional structure and strong trust between members can be seen as important factors in performance (Klijn and Koppenjan, 2014). However, performance measurement can only be assessed over a long period and cannot be measured if the networks are new (Peters et al., 2017). Therefore, this aspect, in which collaboration types are recent or have not yet been implemented was not deemed relevant to this thesis.

The summary of theory applications in this thesis is shown in Table 3.3.

Table 3.3: Summary of theoretical and analytical frameworks in relation to thesis objective

Sociotechnical systems theory	Network governance
<ul style="list-style-type: none">• As a paradigm for understanding ERSs and IS as sociotechnical systems, including human and non-human components, in initial phases of thesis work• As a tool to develop the framework and to systematise important factors that need to be involved in the analysis of cross-sector	<ul style="list-style-type: none">• Analytical lens for cross-case comparison of the studied cross-sector forms of collaboration using the core assumption and relevant key factors• As a theoretical perspective to initially assess the conceptual framework in terms

collaborations and related IS development processes <ul style="list-style-type: none"> • Incorporating the theory's values, including the balance between human and non-human parts, by introducing user involvement into the design processes 	of completeness and relevance using the core assumptions and relevant key factors
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Network governance and sociotechnical systems theory will thus complement each other in the work of this thesis. The results gained from both perspectives are then discussed and positioned in relation to each other.

3.4 User participation approaches

It has been argued that one of the major challenges in IS development is inadequate requirements and system functions that fail to meet user needs due to an incomplete understanding of users by system developers, incorrect assumptions and inconsistent requirements (e.g. Young, 2002; Boehm and Papaccio, 1988). In order to mitigate this problem, a proper understanding of users, their tasks and the context in which they work has been continuously and increasingly emphasised as crucial, especially during the early stages of IS development (Mumford, 2000, 1995; Christel and Kang, 1992; Checkland and Scholes, 1990). Checkland and Scholes (1990) argue that the understanding of an organisation depends strongly on *including* its people in the analysis. Therefore, user participation has long been an important topic in IS development as one way to include the people (stakeholders) in the development processes. User participation can be defined as “set of activities and behaviours performed by potential users or their representatives in the system development processes” (Hartwick and Barki, 1994, p.59). It is believed that applying user participation to IS development provides many benefits and can lead to democratic design decisions, a more accurate definition of IS, a user-friendly interface, and a greater acceptance rate by IS users (Markus and Mao, 2004; Maiden and Rugg, 1996; Ehn, 1993). User participation approaches are also employed in close relation to sociotechnical systems theory, in which the role of people and the inclusion of social and non-technical subsystems in the design process are emphasised as a way to design successful systems (e.g. Mumford, 1995).

Different user participant approaches designed to involve users in technology design began to emerge during the 1970s and 1980s and this has long been an important topic in IS development (Kensing et al., 1996; Mumford, 1981). User participation can be found in different approaches, mainly in Participatory Design (PD), user-centred design (UCD) and user innovation (UI). However, research shows that these approaches overlap and may not be completely separated (Marti and Bannon, 2009).

PD has its roots in Scandinavia in the 1970s when the early sociotechnical approaches were being further developed in the Scandinavian countries to empower employees to design and organise their own work environment. This led to the development of the principle of *co-operative design* (Kuutti, 1996;). The term ‘co-operation’ was subsequently replaced by

‘participation’ in the international community, and is now commonly referred to as ‘Participatory Design’ (PD). In PD, users and designers work together during the design process to ensure a better fit between technology and how people use it to perform their jobs (Kensing and Blomberg, 1998). PD is conceived, not as a particular method, but rather as a philosophy characterised by a commitment to social concerns and the relationship between systems developers and participating users (Schuler and Namioka, 1993). PD has evolved over the decades with the aim of improving technology use in the workplace for end-users in line with social trends and technological development, and it has spread to various areas, not least the field of IS (Mumford, 1981). Early generations of PD had a clear ideology of the active involvement of stakeholders, initially citizens in urban planning and, later on, workers in workplace technology design (e.g., Ehn, 1993). The leading underlying values were democracy and quality of working life, intended to achieve technology design for skilled workers and to give them control over their technology (Iversen et al., 2010; Kensing and Munk-Madsen, 1992; Schuler and Namioka, 1993; Bjerknes and Ehn, 1987). PD was later extended from a pronounced ideological focus to more practical applications in order to derive its benefits in collaborative working environments, usually within organisations, with the focus remaining on end-users (e.g. Tollmar, 2001). In relation to this, the importance of including not only end-users but also other types of stakeholders in PD projects has gained increased attention from scholars in recent decades (e.g. Dalsgaard, 2010; Følstad et al., 2004; Pilemalm, 2002). The evolution of PD also sought to enhance the approach by defining and categorising users to include larger groups (Lundman, 2006; Oostveen and van den Besselaar, 2004; Damodaran, 1996). The successive involvement of heterogeneous end-users in increasingly complex work environments and large-scale systems in the design groups also gained attention (Mainsah and Morrison, 2012; Kelly and Matthews, 2010; Pilemalm and Timpka, 2008).

User-centred design (UCD) emerged at almost the same time as PD. However, its focus was not on democracy as a foundational value but on user interface design as a starting point to identify users’ needs for IS (Marti and Bannon, 2009; Norman and Draper, 1986). Another difference is that, in UCD, stakeholders/end-users are not viewed as equal partners with system developers in the design process but rather as sources of information or advisors, and systems developers should have sufficient business knowledge to understand who the users are and what they require (Karlsson et al., 2012; Gould and Lewis, 1985).

User innovation (UI) is another user participation approach that emerged during the 1980s. It focuses on innovative system functionalities suggested by lead users, whose needs are perceived as likely to be common to other users in the future (von Hippel, 1986). UI primarily emphasises the innovative characteristics of design solutions, not the active involvement of stakeholders in the design process. Prerequisites to run UI are usually to have a specific problem in a distinct organisational context and the existence of a group of lead users who can provide innovative solutions to that problem (Karlsson et al., 2012).

Various benefits of user participation approaches have been claimed over the decades (e.g. Vines et al., 2012; Pekkola et al., 2006; Besselaar, 1998; Schuler and Namioka, 1993; Ehn and Kyng, 1987); for example:

- They can result in a more accurate formulation of requirements.
- They can ensure a better fit between the technology and the way its users perform their work.
- They can increase acceptance of a system among users, i.e. in user commitment to the implemented system.
- They can lead to innovative solutions and systems.

ERS cross-sector collaboration is a recent and somehow new phenomenon. Therefore, researchers and system developers may not be able to gain sufficient knowledge and understanding of the collaborations from previous studies, written documents or similar projects. Therefore, stakeholders/users are seen as a vital source of information and as co-designers, and it is deemed crucial to extract the relevant data from them about the collaborations and involve them in the design process. Therefore, user participation was selected as the main approach in IS development, in the context of this thesis.

3.4.1 Challenges of user participation

While several studies have claimed the benefits of employing user participation in IS development processes, scholars have also argued that there are associated challenges manifesting themselves to different extents in the abovementioned approaches. In the following, three recurrent challenges identified in the literature and deemed relevant to the thesis objective are described in more detail:

3.4.1.1. General challenges

It has been claimed that user participation may have negative effects on project performance because it can be complex, time-consuming and resource-intensive (Wilson et al., 1997). Specifically, the democratic principles of PD aiming to reach consensus are usually time and resource intensive, and time pressures may also constrain stakeholders' abilities to engage in design groups (Pilemalm, 2002; Trigg, 2000). Holding meetings, offering a focal point for stakeholder contributions, upholding democratic principles, resolving conflicts in design groups, and limited time for evaluating results (e.g. prototypes) are some of the related challenges (Karlsson et al., 2012; Dalsgaard, 2010; Heinbokel et al., 1996). Users at the shop-floor level and key stakeholders do not always have sufficient time or motivation to invest in systems development work or shared time slots to take part in joint activities (Obata et al., 2012; Simonsen and Hertzum, 2008; Gulliksen and Eriksson, 2006; Wilson et al., 1997). Furthermore, the willingness and ability of users to participate in the development process and to motivate themselves have been paid comparatively little attention and need to be explored (Holgersson and Karlsson, 2014). For these reasons, user participation approaches have repeatedly been criticised as ineffective.

3.4.1.2. Difficulties in identifying user groups and stakeholders and involving them in the IS development process

It has also been argued that, despite a strong emphasis on user involvement, user participation approaches seldom provide clear methodologies for achieving this involvement, not least in complex collaborations involving different organisations, citizens, volunteer groups and external experts, e.g. in the public sector (Dalsgaard, 2010; Simonsen and Hertzum, 2008; Oostveen and van den Besselaar, 2004). Challenges include difficulties in identifying and involving large heterogeneous stakeholder groups with different backgrounds and needs and at different organisational levels, an unclear picture of end-user groups and their associated organisational tasks, the lack of organisational belonging for participation in design groups (e.g. civil citizens) (Pilemalm et al., 2016b; Jansen, 2006; Oostveen and van den Besselaar, 2004). Furthermore, not all stakeholders, for example in public sector projects, are necessarily well-known or defined when a project is initiated (Obata et al., 2012). They may include volunteers, non-profit organisations, citizens, sponsors, suppliers, various steering committees and contractors. Diverse and unknown stakeholders and even unknown end-users might be even more prominent in 'the new public sector'; for example, in cross-sector collaborations, the recent utilisation of social resources (e.g. volunteers), and civic engagement in e-government projects. Pilemalm et al. (2016b) discuss the growing complexity of cross-collaborative work processes and the need for sophisticated IS and e-services for a broad range of stakeholder and user groups and argue that they demand a strong emphasis on stakeholder identification during the early phases of systems development processes when applying user participation. In relation to this, it can be difficult to hold user participation activities enabling joint participation by different stakeholders/end-users coming from various organisations, sectors, and backgrounds. Lindgren (2013) argues that the use of frameworks for stakeholder identification and analyses during the early phases of user participation processes is often overlooked, but is necessary for designing public e-services.

3.4.1.3. Lack of formalisation in user involvement and relevant processes

In relation to this, it has also been argued that a lack of formalisation, methodologies or clear working methods in user participation approaches, and specifically PD, has restricted them to being academic constructions, used infrequently in practice/industry or in a much weaker sense than they promise (Simonsen and Hertzum, 2008; Pekkola, 2006; Følstad et al., 2004; Tollmar, 2001; Besselaar, 1998). As a result, the products delivered have mainly been small, stand-alone IS (Oostveen and van den Besselaar, 2004). Recent studies also show that many current user participation initiatives do not focus exclusively on technology design but also need to embrace such considerations as organisational frameworks design and policy context design; for example, by changing existing infrastructures or improving processes and collaborative work, thus providing a rather broad and unstructured design context (Bratteteig and Wagner, 2016; Obata, 2012; Edwards et al., 2003). To overcome these challenges, Dalsgaard (2010) emphasises the need for new instruments of inquiry.

3.4.2 User participation in emerging public sector initiatives

In line with societal and technological development, some recent user participation studies argue for a shift in the notion of users/stakeholders to that of people/communities, where projects embrace a multi-voiced notion of stakeholders rather than focusing only on end-users (e.g. in civic engagement or e-government) (Halskov and Hansen, 2015). It has been claimed that user participation initiatives should focus on the outcomes of participation activities and stakeholder involvement where it is most needed instead of clinging to the full user participation ideal (Bratteteig and Wagner, 2016; Pilemalm et al., 2007). As mentioned above, several studies also argue that current user participation approaches are often applied to developing long-term changes in organisational frameworks, laws, policies, communities, environment, etc., not least in the public sector, and sometimes referred to as 'infrastructuring', implying that they are not limited to workplace, product and IT artefact design (Björgvinsson et al., 2012; Hillgren et al., 2011). The existence of various off-the-shelf commercial IT artefacts also contributes to the fact that increased attention has been given to IT reconfiguration and the development of the surrounding organisational settings (Pilemalm, 2018; Robertson and Simonson, 2012).

All of this seems particularly relevant to 'new' collaborative contexts, resource-constrained environments and projects with heterogeneous and partly unknown stakeholders; for example, in future service implementation projects and/or emerging public sector initiatives (Obata, 2012; Simonsen and Hertzum, 2008). Pilemalm et al. (2016b) argue that the challenges associated with user participation become intensified when IS are required to function in line with new societal trends (e.g. cross-sector collaboration and involving citizens), in which it may not be clear who should be involved in user participation and what outcome should be expected from design work and design groups. Pilemalm et al. (2016b) similarly suggest that traits of user participation must adapt to contemporary trends of cross-sector collaboration and e-government, involving heterogeneous stakeholders and users; for example, volunteers, non-profit organisations and citizens.

Of direct relevance to this thesis, the recent cross-sector collaboration configurations in the public sector and ERSs also often result in heterogeneous end-user and stakeholder groups with divergent needs and perspectives. Therefore, a thorough analysis of cross-sector collaborations and the active involvement of relevant stakeholders in IS design is deemed crucial.

3.4.3 User participation: thesis application

User participation was applied in relation to the work in this thesis when exploring all three cases. It is motivated by the context itself, as described above. It is also motivated by the sociotechnical systems view and situations where in particular PD was initially partly developed by the same scholars and where it is important to consider and understand a broad range of elements when developing IS.

According to the abovementioned definition and challenges, 'user participation' is used in this thesis as an umbrella term referring to various kinds of stakeholder involvement in the

field of IS with a specific focus of infrastructuring in the public sector (Björgvinsson et al., 2012). It thus includes the design of IT artefacts and changes in organisational infrastructures, with the subsequent aim of digitalisation or change in existing IS to improve cross-sector collaborations in ERSs. Therefore, it has a broad application, is seen as a flexible approach which can be adapted or customised to the context and where the focus is on *outcomes* of user participation activities rather than achieving such things as democratic values. To focus on and to have concrete and visible user participation outcomes from these activities is seen as a way to compensate for full stakeholder participation, as emphasised by Bratteteig and Wagner (2016) and Pilemalm et al. (2007). Therefore, some activities (e.g. focus groups, interviews, exercise) in the studies may not be counted as user participation activities in their own right but have been used in combination with more traditional activities within user participation (mainly Future Workshops). User participation is seen as a development approach in the entire study and it was decided to consider the activities as user participation activities in this thesis as long as they contribute to stakeholder involvement and yield outcomes based on user needs. The associated challenges to user participation are also considered generally, even if many examples and references are taken from the domain of PD.

The term ‘user participation’ is employed in this thesis in two senses. First, it was the main development approach applied when exploring cross-sector collaboration in the Swedish ERS and related IS needs. The analytical framework was used as a support in user participation activities for stakeholder involvement and partly for identifying the relevant stakeholders. Second, associated challenges, both general and specific, when employing user participation during the early phases of development of ERS cross-sector collaboration were more systematically identified and some suggestions on how to handle them were provided, drawing on the third case (see Chapter 4). The user participation challenges, potential solutions and the framework role are presented as a part of the thesis results in Chapter 5. The choice to lean on user participation as an overall approach, rather than, for instance, focusing on PD, is further discussed in Chapter 6.

4 RESEARCH APPROACH AND METHODS

This chapter explains the overall research approach and its theoretical and philosophical assumptions. Then, the case study research as applied in the thesis is explained and the studied cases are presented, followed by a description of the data collection and data analysis performed.

4.1 Research timeline and content

The work on this thesis started in 2012 and lasted until early 2018, including one baseline study and three case studies: 1) the co-location of actors in Safety House, Östersund, 2) the co-operative use of resources and cross-sector collaborations between the fire services and the social care unit in Nyköping municipality, and 3) using semi-professionals in Norrköping municipality. In this thesis, the case studies may be referred to interchangeably as Study 1 or Safety House study, Study 2 or Nyköping study, and Study 3 or Norrköping study. Five papers and two reports were produced during the research process. Summaries of the papers are presented in Chapter 5. The main research approach is that of qualitative case study research. Figure 4.1 shows the timeline of the thesis work, i.e. the studies performed, the writing of the related papers and the theoretical frames.

Figure 4.1: The timeline of the research process and the work included in this thesis.

This is a *paper compilation thesis*, attempting to present and discuss the articles together and in more detail. It provides an opportunity to expand upon the research background and its relations to the field of IS, to clarify assumptions, to answer the objective in more detail, to perform a cross-study analysis and to discuss the results from a broader perspective. Therefore, the thesis includes some elements which are not in any of the papers 1 to 5. First, the results of Study 2 (Nyköping) have not been published as scientific material, but are included in the thesis compilation. Paper 2 includes only a summary of the results from the Safety House study (Study 1) regarding actor needs for IS. However, more comprehensive results on the empirical base are presented in the thesis compilation. Finally, the cross-study comparison analysis does not exist in the individual papers but has been added to the thesis.

Table 4.1 gives an overview of the research methods and study design used in this thesis in relation to the thesis objective and also in relation to developing the context-specific framework and identifying user participation challenges.

Table 4.1: Summary of research methods applied in this thesis

Research	Research method
Research approach and type of data inquiry	Qualitative research
Research strategies	Case study research (exploratory, descriptive, explanatory), action research Case: emerging forms of cross-sector collaborations in ERSs
Methods for data collection	Interviews, literature reviews, focus groups, participant observation, Future Workshop, exercise and After-Action Review (AAR)
Data analysis	Open coding, axial coding
Evaluation method (discussed in Chapter 7)	Credibility, Transferability, Dependability, Conformability

4.2 Research process and research design framework

A *research process* includes various activities that represent the different steps taken to achieve the objectives of a research project. A framework developed by Myers (2009) presents *philosophical assumptions, research methodology, data collection techniques, data analysis approach* and *written record* as the different steps or tasks in a general research process. These steps are deemed useful because they show how research is conducted from a practical point of view. However, Myers’ framework only demonstrates these steps in sequence, and therefore may not be relevant to research carried out in iterative phases. The role of theory is not included in the framework. Furthermore, it does not explicitly include the step of quality assessment, as insisted on by other frameworks for research design (e.g. Creswell, 2013). However, Myers’ framework was used as a point of departure for this research design

because of its simplicity and the possibility to customise it. It was therefore modified for the purposes of this thesis. The adapted framework is shown in Figure 4.2.

Figure 4.2: The general research process, showing the different tasks carried out in the thesis work.

First, the research process iteration was visualised, implying that the results were gained cumulatively; that is, studies were adjusted based on experience and feedback from previous iterations, the framework was developed stepwise and some data collection methods were somewhat adapted (e.g. scenario-based Future Workshops). Second, to clarify the role of theory in the research process, the application of theories was added as input. Third, quality assessment was incorporated. Fourth, instead of ‘research method’, the phrase ‘research methodology’ was used because, in this thesis, case studies are referred to as a research methodology containing philosophical views and assumptions, rather than as a research method including solely techniques. Fifth, all tasks were placed in an appropriate order to reflect the whole research process. Finally, the research output and contribution were made visible. Different parts of the research process are explained in the following sections.

4.3 Theoretical and philosophical assumptions

The research approach in this thesis is qualitative in character. Denzin and Lincoln (2011) define qualitative research as an interpretative and naturalistic approach to the world. It is used to understand and interpret the study objects in terms of the meanings that people bring to them (Boland, 1991; Orlikowski and Baroudi, 1991), resulting in multiple interpretations. In this thesis, for example, the interactions between different actors in the Swedish ERS in the case of new collaborations, the challenges in general, and related to IS development in particular (e.g. stakeholder involvement), are viewed as social phenomena reflecting the qualitative aspects of ERSs.

The corresponding philosophical view of the world is based on *interpretivism*, by which researchers assume that access to reality is achieved only through social construction and its instruments, such as shared meaning, language and consciousness (Creswell, 2014; Myers, 2009; Klein and Myers, 1999). It is perhaps the most common paradigm in qualitative research, and a pre-assumption in many qualitative research approaches. One of the main critiques of the approach is the influence of researchers on the interpretation of data and the researchers' preconceptions of the social context (e.g. people) which may lead to problems of bias or subjectivity in results (Creswell, 2014; Walsham, 1995). To mitigate this problem, Myers (2009) argues that the interpretation of data requires prior knowledge of the related vocabulary, context and social conventions. Thus, gaining the proper prior knowledge is a prerequisite for transparency, for example, in data collection and analysis (Klein and Myers, 1999). In this thesis, emerging forms of cross-sector collaborations in ERSs are studied and understood by using an interpretive perspective and social engagement methods including interviews, focus groups, participant observation, Future Workshops, exercises and an after action review (AAR). The positivist approach, which assumes that reality is objective, stable and can be quantified and described by measurable indicators, is not suitable in this context, since the main goal of the thesis is not theory verification or measurement and quantification (Myers, 2009), but rather to help generate knowledge and to understand social constructions (here, the sociotechnical ensemble view of IS and cross-sector collaboration).

Independent of the philosophical view of the research, the logical paths to knowledge or analytical reasoning may be categorised as *inductive*, *deductive* and *abductive* approaches. In *inductive* approaches, the results of research are derived purely from the data without preconditions. *Deductive* approaches are concerned with the confirmation of current theories in the empirical data by developing propositions and testing them. *Abductive* approaches attempt to capture the benefits of both inductive and deductive approaches, for example, in theory development (Dubois and Gadde, 2002). The results concerning cross-sector collaborations, that is, IS-related challenges, opportunities and actor needs, stem mainly from the empirical data gathered in Studies 1, 2 and 3. However, the sociotechnical ensemble view is used as the theoretical point of departure to define what can be considered IS or IS-related. Furthermore, many data analyses were performed based on the framework, which is partly based on sociotechnical systems theory. In the cross-study analysis, network governance was used to further analyse the data. Therefore, the overall research approach is abductive because both empirical and theoretical foundations have been used during the research

process. The only inductive element of the thesis work might be the initial version of the framework developed directly from empirical data. However, even this cannot be seen as purely inductive since the researcher's background and literature review are elements that might have affected the result, even though the literature was not initially used in the very first framework version. The results concerning user participation challenges are also abductive since they are based on observations of the development processes and their relation to previously identified challenges in the literature.

4.4 Case study research

Case study research is used to investigate a contemporary phenomenon in its real-world context (e.g., an organisation, a change or an individual) where researchers have little or no control over behavioural events (Yin, 2013; Stake, 2000). The context is part of the case study and cannot be separated from the phenomenon. The purpose of a case study is to gather data from multiple source of information about a real context (e.g. people, organisations) in order to make an original contribution to knowledge (Myers, 2009). Case study research often focuses on a single case, but it may explore multiple cases (Yin, 2012). There are three main types of case study. *Exploratory research* is used on a particular topic and during the early stages of research to *discover* the relevant factors, features and issues that might apply in other similar situations (Creswell, 2013; Myers, 2009). *Descriptive research* seeks to describe a phenomenon; for example, by revealing patterns and describing its characteristics (Tobin, 2010). *Explanatory research* explores and describes a phenomenon through detailed analysis, explaining causal relationships and can be used, for example, to test a theory (Yin, 2013; Myers, 2009). One of the most widely cited books on case studies is by Yin (2013). While his book is very helpful and valuable, Yin's view of case studies is mainly based on a positivist approach in which he recommends using the prior theoretical propositions and hypotheses in case studies; for example, in data collection. Yin thus judges a case by paying attention to its internal and external validity. Such a view of case studies may not be entirely appropriate for an interpretive case study, such as in this thesis, since there is no need or recommendation to use propositions or hypotheses in the research (Myers, 2009).

Flyvbjerg (2006) reviewed different works on case study research to identify related misunderstandings, critiques and challenges. He summarises the most common critique as follows: the results of an individual case are not generalisable, not suitable for theory building, and are biased by the pre-assumptions and aims of researchers. However, Flyvbjerg argues that these are misunderstandings stemming from generally accepted beliefs about case study research in the positivist approach, which are not applicable to case study research in the social sciences. Terms such as 'valid', 'invalid' and 'generalisable' stem mostly from positivism and may not apply to all case studies. Similarly, Ragin and Becker (1992) argue that the main goal of case studies is not ultimately to prove something, but rather to explore a social phenomenon and learn from it in order to accumulate knowledge about a subject. To assess a case study, other qualitative measures such as *credibility*, *transferability*, *dependability* and *conformability* are frequently cited in the literature (e.g., Bryman, 2012;

Lincoln and Guba, 1985). The *credibility* of a study is concerned with whether the research process adheres to scientific methods and principles and whether the findings are reasonable and acceptable to others. *Transferability* refers to how generalisable a research result is. *Dependability* refers to making all phases of the research process (e.g. problem formulation, interview transcripts, selection of participants, data analysis) accessible to others as auditors. *Conformability* concerns the way in which results have been achieved from the data and the impact of the personal values of researchers on the results. How the thesis attempts to handle these criteria will be discussed further in Chapter 7 in methodological reflections.

The main case, or phenomenon, explored in this thesis is *emerging forms of cross-sector collaboration in the Swedish ERS*. The case is thus a social phenomenon related to a growing trend in ERSs. The thesis belongs chiefly to exploratory studies, as the studied phenomenon has emerged relatively recently and there is comparatively little existing research available. However, the thesis also includes descriptive elements, since the results, the identified opportunities, challenges and actor needs, were described and connected to different themes and connected to key network governance factors, and since the results include a framework.

Applying user participation in cross-sector collaborations is also a social process that can be seen as a rather recent phenomenon. Therefore, the case study is in part exploratory and in part descriptive since the identified challenges are connected to the previously identified user participation challenges from the literature. The challenges were described, and some solutions were suggested. Regarding the framework and its role, a descriptive approach has been used to structure, describe and categorise the important factors characterising the collaboration and to present them as a framework. The thesis also embraces some limited explanatory elements. First, the researcher attempts to discuss and clarify the causal relations in user participation challenges, i.e. why some specific user participation challenges become intensive in the thesis context. Second, the researcher uses network governance in the thesis, describes the similarities and differences between ERS cross-sector collaborations and network governance, and tries to explain why they take place.

In total, four separate studies, including the baseline study and three individual studies on three emerging ERS cross-sector collaboration forms, were performed in different organisational and physical settings, and related to the overall case/phenomenon. Study 3 was also used for the observation and study of user participation applications and the associated challenges. Figure 4.3 describes the overall case and related studies.

Figure 4.3: The performed baseline study and case studies.

The included studies are:

- **Baseline study:** The main aim of this study was to gain an initial understanding of the thesis background; that is, different kinds of new collaborations/actors in ERSs in general and specifically in the Swedish ERS. The data was gathered at the strategic and operative level from two Swedish response-related organisations (MSB and a security guard company where the security guards were engaged as first responders). This initial study helped the researcher to recognise different new forms of collaboration in ERSs and to develop a tentative framework for performing the subsequent analysis. The published Paper 1 was based on the results.
- **Study 1 (Safety House):** The co-location of actors at the Safety House as a form of new collaboration in the Swedish ERS was studied. The aims at this stage were to understand the phenomenon of co-location and IS-related challenges and opportunities and to perform an IS needs analysis. A brief network governance analysis was also performed. The initial framework was used to perform an organisational and needs analysis using a common user participation tool (Future Workshop). The perceived benefits and challenges of using the framework were identified. Theoretical groundings were added to the framework in order to improve it and to extend its application to the field of IS. Furthermore, the framework was developed according to feedback from its application in the Safety House. The published Papers 2 and 3 were based on the results of this study.
- **Study 2 (Nyköping municipality):** The co-operative use of resources and partial cross-sector collaborations between the municipal fire services, the social care unit and the technical division of Nyköping municipality was studied in order to understand the challenges, opportunities and actor needs in this new setting. An organisational analysis and needs analysis were again performed with the help of the framework. A project report in Swedish was produced and sent to the municipality of Nyköping.
- **Study 3 (Semi-professionals in Norrköping):** The potential cross-sector collaboration between fire services and semi-professionals in Norrköping municipality were studied in order to understand the challenges, opportunities and actor needs in

this new setting. A network governance analysis was also performed to investigate the similarities and differences when comparing network governance to ERS cross-sector collaboration. Paper 5 and a project report presented the knowledge gained about the studied collaboration as an emerging form of network governance. The study was also used as the basis for investigating applied user participation activities and the framework supportive role (since, in retrospect, achieving user participation was experienced as somewhat challenging in Studies 1 and 2). The study spans several phases of a system development process. Therefore, the user participation challenges were observed and investigated systematically using participant observation and literature reviews. This part of the study is reported in Paper 4.

The scope of these studies in relation to the IS development phases performed in each study is shown in Figure 4.4. The implications of the different lengths and scopes of the three studies will be reflected upon in Chapter 7.

Figure 4.4: The scope of the studies in relation to IS development phases

4.4.1 Influences from action research and participatory action research

Action research may be defined as a cyclical process of diagnosing (identifying the problem), action planning, action taking, evaluating and specifying learning by which the researcher not only studies the setting, but also introduces changes into it for further improvements (e.g. Myers, 2009; Susman, 1983). For action research to be successful, first, a setting where there is a problem (such as an organisation) should provide the possibility, the support and the desire to solve the problem, and it should be a problem that is of interest to scientific communities (Baskerville and Myers, 2004). Action without research is known as consulting (Baskerville and Myers, 2004). Another similar approach is participatory action research, in which a research process is conducted together with the people connected to the subject under study (Reason and Bradbury, 2013). The key difference compared to action research

might be the importance of the direct involvement of domain participants in the research and the acquisition of local or domain knowledge (Cornwall and Jewkes, 1995).

In the past, case studies have been successfully combined with action research to allow for both the interpretation/understanding of a setting and performing intervention/change within it (Stenmark, 2000; Vidgen and Braa, 1997). The work in this thesis may thus also be viewed in part as action research, since the aim of the studies in the long term is not only to understand cross-sector collaborations in the Swedish ERS but also in some sense to intervene and change them. This thesis is connected to the national mission of the Swedish government to create, improve and enhance new forms of collaboration in the Swedish ERS. In its mission statement, MSB has emphasised that the research process should begin at a strategic level. Therefore, the researcher initiated the process by performing data collection at MSB about emerging forms of collaboration in the Swedish ERS; this forms the study baseline. The following stages involved other actors from the Safety House and the municipalities of Nyköping and Norrköping. The results of studies have been published both in the form of practitioner reports and as scientific articles. The reports were sent specifically to the involved municipalities and actors.

The thesis also contains elements of participatory action research (Reason and Bradbury, 2013; Cornwall and Jewkes, 1995), in the sense that user participation and enabling actors to interact with researchers and systems developers and participate in design groups was central to the means to achieve the study objective. Specifically, later versions of user participation, which insist on involving a broader set of stakeholders than merely end users, were used as inspiration. The Future Workshops were conducted to gather stakeholders'/end-users' different perspectives and to involve them in the design process with a view to actively improving their own setting. Thus, the researcher also considered himself to be a system developer in the studies, especially in Study 3. What again may differ is that the researcher was not responsible for implementing the suggested changes or solutions to identified problems and IS needs, even though the research results have been provided to the involved response organisations. For example, Study 3 led to the implementation of several results when they were sent to the municipality; for example, the fire service started to train semi-professionals, equip them and involve them in real emergency responses. For this reason, the phrasing "inspiration from action research and participatory action research" is used.

4.5 Data collection

The methods used include literature reviews, interviews, focus groups, participant observation of collaborations, Future Workshops, observation of an exercise, AAR and writing a project diary while observing participation activities. The data collection steps in each study are shown in Table 4.2 and are explained in more detail in the following sections.

Table 4.2: Data collection performed as part of the research process.

Baseline Study: New actors/emerging forms of collaboration in the Swedish ERS		
(2012)	Literature review 1	To gain an understanding of new actors/collaboration in ERSs worldwide and to some extent the related challenges and opportunities. The results of the literature review were later compared to the framework to test its dimensions, e.g. whether the initial inductive/Swedish framework version was in line with other international studies.
(2012)	Interviews 1, 2 and 3	To understand and explore the intention of involving new actors in the Swedish ERS and related challenges.
(2012)	Interview 4	To study and understand the specific case of collaboration between security guards and fire services and the related challenges and possibilities at the operative level.
Study 1: Co-location of actors at the Safety House		
(2013)	Interviews 5, 6, 7 and 8	To understand and explore the meaning of co-location of the main actors in the Swedish ERS and related challenges; to apply the framework to an organisational and needs analysis.
(2013)	Participant observation	Same purpose as above.
(2013)	Future Workshop 1	To reflect upon the co-location of actors at the Safety House, problems/challenges related to the collaborations, possible IS needs and solutions to identified problems/challenges and to apply the framework to a needs analysis.
(2013)	Literature review 2	To place the framework in an IS development context and identify general user participation challenges.
Study 2: Co-operative use of resources and cross-sector collaborations between fire services and social care in Nyköping municipality		
(2013/ 2014)	Interviews 9, 10 and 11	To understand and explore the meaning of co-operative use of resources between the fire service, social care division and possibly the technical division in Nyköping's new fire station building; to apply the framework in organisational and needs analysis.
(2014)	Future Workshop 2	To reflect upon the co-operative use of resources in Nyköping, problems/challenges related to the new setting, possible IS needs and solutions to identified problems/ challenges. To apply the framework in needs analysis.

Study 3: Cross-sector collaboration between fire service and semi-professionals in Norrköping municipality		
(2015/ 2016)	Literature review 3	To find specific challenges of PD applications in cross-sector and new public sector projects
(2015)	Future Workshop 3	To understand the concept of semi-professionals, identify potential cross-sector collaborations and related opportunities, challenges and actor needs. To apply the framework in needs analysis.
(2015)	Focus groups 1, 2,3 and 4	Interviews with operational personnel from potential semi-professional organisations to gain a collective view of cross-sector collaboration in Norrköping and the related challenges/possibilities and actor needs. To apply the framework in organisational and needs analysis.
(2015)	Focus groups 5 and 6	The same as above but involving managers.
(2016)	Future Workshop 4	To involve end-users in identifying actor needs for emergency supply, training and IS support in the new cross-sector collaborations. To apply the framework in needs analysis.
(2016)	Participant observation and after action review of an exercise	To test the identified needs and challenges in the collaboration between fire services and semi-professionals.
(2015/2016)	Observation of user participation activities (project diary)	User participation activities were observed, and the challenges related to stakeholder identification and involvement were noted in a project diary.

4.5.1 Literature and document reviews

A literature review is defined by Robinson and Reed (1998, p. 58) as “a systematic search of published work to find out what is already known about the intended research topic”. It is widely used in case study research to identify sources for data collection (Yin, 2013; Travers, 2001). A literature review helps to reveal any gaps in knowledge about the chosen topic and to understand the impact of research methods in previous studies (Bless et al., 2006). Different texts have been written for different purposes. Researchers should be aware of this and the literature review should include critical and analytical judgement and interpretation by the researcher (Myers, 2009).

In this thesis, the initial literature review (Literature review 1) was carried out in parallel with the first round of interviews in order to grasp the picture of emerging forms of collaboration in ERSs. It was intended to enable the researcher to perform the following data collection (i.e. interviews, participant observation, focus groups and Future Workshops), and to gain sufficient knowledge of the research topic to be able to hold discussions with interviewees. The results of the literature review were also used later to test the framework, that is, to see whether the dimensions of the initial framework were somewhat in alignment with previous

international studies. The literature review included both academic papers and public project reports. Around 50 papers and reports in the ERS context were included. Search terms such as: ‘new actors + emergency management’, ‘first response actors + emergency management’, ‘effective use of resources + emergency management’, ‘cross-sector collaboration in emergency response’ were used to gain an understanding of the research subject. The results were categorised as: a) *different new forms of collaboration in ERSs* and b) *associated challenges*.

The second literature review (Literature review 2) concerned user participation based IS development generally and its related challenges in ERSs and the public sector; for example, in terms of cross-sector collaborations dealing with heterogeneous actors. Specifically, the aim was to gain an understanding of the application of sociotechnical systems theory and user participation approaches in IS development, especially participatory design, to position the thesis results within the field of IS. Around 50 papers in this field were included and examples of search terms are: ‘IS development + emergency management + challenges’, ‘IS development + sociotechnical systems’, ‘IS-development + cross-sector collaboration’, ‘Participatory Design + heterogeneous stakeholders + challenges’ and ‘Participatory Design + new/cross-sector public sector’. The results of these searches were categorised as: a) *general IS development and related challenges in emergency management* and b) *Participatory Design and related challenges*.

The third literature review (Literature review 3) was specifically assigned to identify user participation challenges in cross-sector and new public sector projects. The aim was to gain an understanding of the challenges discussed in the literature and to use them to categorise the observed user participation challenges in Study 3. The literature review was started by including papers from PD, since PD challenges and its use in the public sector were quite visible in the literature. Therefore, about 30 papers on related user participation were studied and 50 others were skimmed using their titles and abstracts, mostly from the PDC (participatory design conference) of the last 20 years. Examples of search terms are: ‘PD challenges in large-scale projects’, ‘new PD issues’, ‘Participation + large-scale system’. During later phases of the review, the researcher realised that other user participation approaches (e.g. UCD and UI) may expose the same challenges. Therefore, more general keywords were used to embrace other approaches. Examples of these key words are: ‘user participation challenges + public sector’ and ‘user participation in large-scale projects’. The search resulted in many overlaps with previously used key words; however, about 20 new papers were identified and added to the review. The results of the review, i.e. recent challenges of applying user participation in public sector initiatives, were categorised as: a) *difficulties in identifying appropriate stakeholders and end-user groups*, b) *difficulties in creating participation* and c) *the lack of formalisation and need for new toolboxes in PD*.

4.5.2 Interviews and focus groups

Interviewing is one of the most important and commonly used techniques for data collection in qualitative methods and specifically in case study research (Myers, 2009). Researchers use interviews to focus on a subject and gain a rich understanding of subjects’ experiences and

various perspectives on a topic (Seidman, 1998). However, the quality of data gained from interviews depends on how well the questions are articulated and on interviewees' level of knowledge of the subject (Yin, 2013). Interviews may be of several different types (Yin, 2013). *Structured interviews* are composed of strictly pre-formulated questions and require detailed planning beforehand. Structured interviews are useful for creating consistency across multiple interviews on the same subject by adhering to exactly the same questions each time. However, this method runs the risk of neglecting new insights since strictly formulated questions may delimit the answers. Conversely, *unstructured interviews* may include only a few general questions or themes and interviewees may speak more freely. The aim here is to stimulate creativity in order to gather new and possibly unanticipated ideas. One disadvantage of unstructured interviews is the difficulty of managing interview sessions and keeping the focus on the subject at hand. *Semi-structured interviews* offer the advantages of both structured and semi-structured interviews, and were therefore selected as the interview method for this thesis. A set of pre-formulated questions or interview templates about emerging forms of collaboration was constructed. The questions asked were taken from the template, which in turn was created using the context-specific framework as input in Studies 1–3, but interviewees were also free to narrate beyond the questions and provide additional information about emerging forms of collaboration which they considered important. In addition, unplanned questions about interviewees' unique experiences and observations were asked in order to encourage new insights.

In total, 11 interviews were conducted with 13 respondents who were knowledgeable about cross-sector/new forms of collaboration and co-operative use of resources, or who knew the emergency response context. Respondents were officially located at different organisational levels, including *strategic*, *operative* and *administrative*. Respondents were asked about their experiences of emerging and cross-sector collaborations and co-operative use of resources regarding perceived strengths, problems and their needs. Three of the interviewees were MSB employees with several years' experience in current Swedish ERS changes; for example, in the evaluation of response operations and strategies for strengthening response resources. They had also held other positions within the Swedish ERS in the past, such as fire engineer, researcher and project manager. The subjects of the fourth interview were one security guard and the safety coordinator for the municipality of Södertälje. Security guards may perform certain response tasks, such as containing small fires or supporting the fire services by providing maps and keys for buildings and information about incidents. Interviews 5 to 8 concerned the co-location of actors and were with the project manager, a representative from the police, a representative from the fire services, and a representative from the Swedish Defence at the Safety House in Jämtland, respectively. Interviews 9 to 11 took place in the municipality of Nyköping with representatives from the fire services, social care and facility services. Interviews 1 to 4 were performed by two researchers, including the author of this thesis. Interviews 5 to 11 were performed by the author of this thesis alone.

All interviews were conducted by presenting the research subject to interviewees. All interviews followed the same procedure. However, questions were adjusted each time by removing unsuitable questions and inserting appropriate replacements. Interviews were

recorded in the form of notes and audiotaped for later transcription. Each interview lasted 50–75 minutes. A summary of the interviews conducted is provided in Table 4.3.

Table 4.3: Eleven interviews conducted to gather data about new forms of collaboration in the Swedish ERS.

Activities	Source	Organisational Level	Interviewees
Interview 1	MSB	Strategic	Expert working on strengthening the response capacity of the Swedish ERS.
Interview 2	MSB	Strategic	Expert working on strengthening the response capacity of the Swedish ERS, specifically by involving volunteers.
Interview 3	MSB	Strategic	Expert working on strengthening the response capacity of the Swedish ERS, specifically by co-operative use of resources.
Interview 4	Södertälje Municipality	Operative/ Administrative	A representative from the security guards and the safety coordinator for the municipality.
Interview 5	Safety House	Administrative	The project manager.
Interview 6	Safety House	Operative	A representative from the police.
Interview 7	Safety House	Operative	A representative from the fire services.
Interview 8	Safety House	Operative	A representative from Swedish Defence.
Interview 9	Nyköping	Managerial	Fire services
Interview 10	Nyköping	Managerial	Social care unit
Interview 11	Nyköping	Managerial	Technical division (facility services)

Another form of interview is the focus group interview, in which an interview is conducted with a group of people in order to gain a collective view of a particular topic (Myers, 2009). The interviewers usually have the role of moderators to trigger a discussion between participants and keep the course of the interview on the right track related to the subject and questions. While focus groups can result in dynamic interaction, various perspectives and rich views and understandings, they are time-intensive and expensive to run (Myers, 2009). In total, six focus groups were conducted in Study 3 for the purpose of organisational analysis, as shown in Table 4.4. At least two and sometimes three researchers conducted the focus groups. The author of this thesis took part in all of them. Each focus groups took about 90 minutes and the participants' answers and discussions were recorded in the form of notes

and audiotaped for later transcription. Also, in the focus groups, the context-specific framework was used as an inquiry instrument, that is, as a support and point of departure when designing the focus group templates.

Table 4.4: Focus groups used for organisational analysis in cross-sector collaboration in Study 3.

Activities	Source	Organisational level focus	Participants
Focus group 1	Fire services	Operative	Three respondents from fire service day personnel + three researchers.
Focus group 2	Home care	Operative	Four respondents from home care + two researchers.
Focus group 3	Facility services	Operative	Two respondents from facility services + two researchers.
Focus group 4	Securitas	Operative	Three respondents from security guards + two researchers.
Focus group 5	Fire services/Home care	Managerial	Fire service management + home care management + two researchers.
Focus group 6	Facility services/ Securitas	Managerial	Facility service management + security guards management + two researchers.

4.5.3 Future Workshop

Future Workshop as a technique was originally developed by Jungk and Müllert (1987) in order to allow participants to develop innovative ideas to enhance their situation in real life; for example, in public planning. This technique was later used in PD. Future Workshop is a common technique in PD (Kensing and Munk-Madsen, 1992) and is usually divided into four phases: the *preparation* phase, the *critique* phase, the *fantasy* phase and the *implementation* phase. The first phase is an introduction to the methods, rules and subjects under study. The second phase aims at reflecting on the individuals' own work situation and areas for improvement. In the third phase, participants attempt to imagine future possibilities and focus on solutions for improvements to the current situation. Suggested solutions in this phase are not restricted by technical or organisational constraints. In the fourth phase, the solutions identified in the previous phases are evaluated regarding their practicality and their transformation into realistic, organisationally and technically feasible implementations (Kensing and Madsen, 1992).

Four Future Workshops were carried out to involve stakeholders who were knowledgeable about their work context and environment. Future scenarios about cross-sector collaborations for frequent emergencies (e.g. traffic accident) were used in Future Workshops 3 and 4 to trigger discussions because the context was deemed new for stakeholders. The context-specific framework work was used in all Future Workshops as a frame of reference

for discussions and inquiry and inspired the scenarios used in the Future Workshops 3 and 4. Therefore, the framework was used somewhat as a support tool in inquiry processes and user participation activities for performing organisational/need analysis (see 5.5). The workshops and their participants are shown in Table 4.5.

- **Future Workshop 1 (Safety House):** A half-day Future Workshop was arranged at the Safety House. The participants were chosen from among actors at the Safety House, based on their accessibility and their role. Four of the Safety House interviewees were also among the participants. The workshop mainly used the original format as in the PD toolbox. The focus of the workshop was on challenges and potential improvements regarding collaboration at the Safety House. Specifically, the aim was to find solutions to current problems and obstacles and to identify user needs for developing IS support for the new settings; that is, the co-location of actors. It was also intended that the results of the Future Workshop could be used to complement the data gathered from other sources by means of data triangulation. The Future Workshop was documented on post-it notes and discussions were audiotaped and then transcribed.
- **Future Workshop 2 (Nyköping municipality):** A full-day Future Workshop was arranged at the new fire station in Nyköping. Three of the participants had already taken part in interviews. The workshop mainly used the original format as in the PD toolbox/suggestion by Kensing and Madsen (1992). The focus of the workshop was on challenges and potential improvements regarding co-operative use of resources and the new collaboration in the new fire station. Specifically, the aim was to identify current opportunities, problems and obstacles and to identify user needs in the new setting. The Future Workshop was again documented on post-it notes, and discussions were audiotaped and then transcribed.
- **Future Workshop 3 (Norrköping municipality):** A full-day Future Workshop was arranged to discuss and identify the possibilities and limitations of various occupational groups (semi-professionals) and to choose possible candidates for the potential cross-sector collaboration in Norrköping. The intended cross-collaboration context was new and thus an adapted version of the workshop was applied to trigger discussions. First, two moderators (researchers) presented a short description of the project and also provided an initial list of different potential occupational groups (e.g., school personnel, the facility services, the church, social care personnel, energy firms, security guards) and types of emergencies (e.g., fires, traffic accidents and heart failures). Then each group was asked to discuss a variety of situations, for example, drownings, traffic accidents, floods, fire in buildings, and persons stuck in snow, in which cross-sector collaborations can be helpful. Subsequently, the participants prioritised potential semi-professional groups. The participants made notes on post-it notes, the researchers took notes and the discussions were audio-recorded. Examples of post-it notes are shown in Figure 4.5.

- Future Workshop 4 (Norrköping municipality):** An additional full-day Future Workshop was held for needs analysis and involved three semi-professionals (here fire services day personnel) as end-users. Three researchers and the representative from the fire services also took part in the workshop. The context was again new for the end-users and thus, to trigger the discussion, the Future Workshop was scenario-based and a smartphone app prototype for emergency response was demoed to users. Since the number of participants was low, the researchers modified its format during the course of the workshop. The focus was narrowed to discuss and identify specific actor needs for training, equipment and information technology support. The participants wrote their ideas down on paper, the researchers took notes and the discussions were audio-recorded.

Figure 4.5: Example of post-it notes produced by participants in the third workshop

Table 4.5: Future Workshops used for organisational analysis and needs analysis to identify opportunities, challenges and actor needs in cross-sector collaborations in emergency response.

Activities	Participants
Future Workshop 1	Eight participants from the police, the municipalities in Jämtland, the fire services and a representative from Swedish Defence.
Future Workshop 2	Ten participants from the fire services, social care and the technical division of Nyköping municipality.
Future Workshop 3	Four researchers, three representatives from the fire services, three from the municipality, one from the police and one from the healthcare sector in Norrköping municipality.
Future Workshop 4	Three fire service day personnel as main end-users and a representative from the fire services in Norrköping municipality.

4.5.4 Participant observation

Participant observation involves observing a phenomenon in its real-world setting and recording it for scientific purposes (Angrosino, 2007). Phenomena can be of different types; for example, activities, interactions, actors, a particular setting, or conversations during the observation period (Creswell, 2013). DeWalt and DeWalt (2002) claim that participant observation improves the quality of data, facilitates the interpretation of situations and simplifies the development of research questions and hypotheses. However, participant observation has also been criticised for the fact that it is only appropriate if researchers already possess adequate information about the context and the people involved. Otherwise, researchers may be misled as they attempt to formulate their findings, and may in turn mislead others with incorrect conclusions (Munck and Sobo, 1998). One way to avoid this potential problem is to select informants who are competent in the study topic. In this thesis, participant observation was used in several senses.

First, participant observation was employed along with interviewing in Study 1 to explore the phenomena of emerging cross-sector collaboration and co-operative use of resources in the Swedish ERS. This involved observing the new settings and actors performing their tasks within them. The researcher's role was chiefly that of *participant observer* (Creswell, 2013), which involved observing the actors, their physical setting and the collaboration without intervening in their daily routines. In the first observation, the researcher spent half a day visiting actors at the Safety House, including the police, the fire services and the alarm centre. The researcher was given an opportunity to ask questions of the police director and the fire and rescue director during the observation. The same was not possible in the case of the alarm centre due to the risk of interfering with actors' ability to answer emergency calls. The participant observation data was documented through memory and personal field notes. It is possible to argue that the observation period was not substantial, and may not necessarily qualify as participant observation from a social sciences perspective. However, the observation represents only one of several complementary data sources. The observation was also part of a development process whereby a needs specification was to be delivered to Safety House; thus, using a somewhat pragmatic approach was required.

Second, the author of this thesis, along with two other researchers, performed participant observation of an exercise in Norrköping municipality (Study 3). The exercise was a simulated traffic accident involving two semi-professionals. The aim of the exercise in the context of this thesis was to evaluate the study results in a practical way since the identified tasks of semi-professionals had not been experienced in practice. The observation took about one hour, which was short but still led to new empirical data. Longer observation in this case was not possible since to create and launch an exercise is complex and resource-intensive work, and the focus was on immediate first response, which needs to be performed effectively over a short period of time. The researchers took notes about semi-professionals' actions at the emergency site and their collaboration with the fire and ambulance services, to investigate whether the challenges and needs were in line with the results of the interviews, focus groups and Future Workshops. Additional challenges, opportunities and actor needs were noted and later added to the previously gained data.

An after action review (AAR) was also conducted after the exercise, in which the researchers, the two semi-professionals and actors from the fire and ambulance services, along with the victims, discussed the exercise. AARs are explicitly used to gain participants' feedback on an event/action and have been used in military contexts (Smith and Allen, 1994). In the AAR, the researcher had the opportunity to learn all the stakeholders' opinions about the collaboration, including the perspectives of the fire and ambulance services. Therefore, the AAR complemented the participant observation. For example, ambulance services and victims pointed out some concerns that were completely new and did not exist in the previous data. The AAR took about 45 minutes, notes were taken regarding the possibilities, challenges and actor needs, and the discussion was audiotaped and later transcribed for further analysis.

Third, participant observation of user participation activities and the associated challenges was carried out as part of Study 3. This was a consequence of facing some challenges in Studies 1 and 2; for example, problems in identifying unknown stakeholders, and involving stakeholders themselves simultaneously while holding Future Workshops (main user participation activity) in their original form. Therefore, in Study 3, the researcher decided to perform a systematic observation of user participation and the associated challenges in order to be able to provide relevant suggestions about how to handle them. Therefore, an a-posteriori analysis of the user participation activities was performed. In total, two Future Workshops, six focus groups and an exercise/after action review (AAR) were observed. Ten project meetings were also held, lasting an average of 2.5 hours, with five participants per meeting. The meetings were also considered to be user participation activities in the context of this thesis since the members tried to take collective actions and decisions in relation to such issues as design activities, project plans and user participation outcomes, and were thus included in the observation. Three researchers performed the observations; however, one of these, the author of this thesis, took part in all the meetings and was also the main person responsible for organisational/needs analysis. He observed the user participation activities described above and gathered data in a project diary. The diary was used to note the observations from user participation activities and contained the challenges related to stakeholder identification and involvement in user participation activities and related experiences of the framework use. It also included the spontaneous actions (e.g. modifying the Future Workshop) or planned actions (e.g. the use of scenarios) that were taken to resolve the challenges and mitigate their consequences. An example from the project diary is shown in Figure 4.6.

The project diary was also shared with the two other project researchers to gain feedback on the retrospective interpretative analysis and to discuss further whether they agreed on the identified challenges, their causes and consequences, how these challenges might be handled and what the results were (see Chapter 5 and Paper 4).

ESKORT Project diary example
User Participation Activity: Future Workshop 1, April 2015
Aim: Stakeholder identification
Number of participants: 13
Participants: Fire services (3 persons), home healthcare (2 persons), municipality safety representative (1 person), the police (1 person), emergency medical services (1 person), security guard company (1 person), researcher group (4 persons)
Work method: To discuss in two groups to identify potential semi-professional candidates, related stakeholders and potential challenges. The context-specific framework was presented and used to guide participants. The group discussed the current status of emergency response in the municipality, what the problems are, how and in what emergencies semi-professionals can contribute, who can be a semi-professional, how they can be engaged and what the related primary challenges and needs are.
Example of observed challenges: Participants mentioned that it was difficult to discuss the intended cross-sector collaboration when they did not have enough related experiences.

Figure 4.6: An example of the project diary used to categorise challenges in Study 3.

The different participant observations performed are summarised in Table 4.6.

Table 4.6: Participant observation used to explore the thesis objective.

Participant Observation	
Participant observation (Study 1, Safety House)	To observe the physical setting of Safety House and how actors are located in the shared building.
Participant observation of the exercise (Study 3, Norrköping)	To observe the new cross-sector collaboration using semi-professionals in a simulated traffic accident.
After-Action Review	As a complement to the participant observation of the exercise to include other stakeholder perspectives from the fire services and ambulance services taking part in the exercise.
Participant observation of user participation activities	To observe the user participation activities (e.g. Future Workshops and use of design groups) regarding the challenges and framework support.

4.6 Data analysis

All the studies performed involved at least two researchers, with three taking part in Study 3. The author of this thesis had the leading role and responsibility for analysis of all the studies except the exercise/AAR in Study 3 in which other researchers also gathered and

analysed data in parallel (partly for other purposes). The author also performed the primary data analysis in all the studies.

4.6.1 Data analysis regarding the exploration of cross-sector collaboration

The overall data analysis method to achieve the objective of the thesis, exploring cross-sector collaboration, is thematic analysis, also called coding (Myers, 2009). Coding can help to reduce the size of the dataset since many overlaps can be revealed and omitted and this can speed up the analysis. Therefore, the transcribed and written data from different sources (e.g. focus group interviews, Future Workshops) were organised into text units in all four studies. These text units then were read in order to understand it as a whole and then an attempt was made to divide them into different themes. These themes can be derived from the data itself or from the existing literature (Myers, 2009).

Baseline Study. In the baseline study, themes were based on open coding, which is the initial coding of data that attempts to assign labels and identify dimensions and categories within the data (Corbin and Strauss, 2007). The motivation behind this choice is the emergence of new forms of collaboration within ERSs as a relatively recent phenomenon on which there has been no explicit theorising to date. While some research exists on the subject (see Chapter 2), its focus differs slightly from that of this thesis. The phenomenon was also new to the researcher, who entered the research process without prior knowledge or pre-formulated results on the subject. Open coding stems from the data itself by, for example, observing the repetition of topics and their importance. The central question guiding the data analysis was: *“What are the important factors affecting emerging forms of collaboration between actors?”* Line-by-line analysis of the transcribed interviews was deemed suitable in this case since it generated more detailed results about emerging forms of cross-sector collaboration and to some extent the related challenges, weaknesses and strengths. The analysis was performed by identifying different concepts/themes, labelling them and generating categories. For example, transcribed interviews that concerned actors’ tasks and related challenges were labelled ‘Task’ and categorised with the same name. Categorised texts were then compiled to give a clear definition of the category ‘Task’, including exemplifications. The results of the analysis provided an initial understanding of different types of collaboration within ERSs. The themes were used directly to develop the initial version of the context-specific framework. The second researcher reviewed the categorisations of data (e.g. definition and scope of each category) and the initial version of the framework several times. The framework was later used in the organisational and needs analysis, and user participation activities, in the subsequent studies.

Studies 1–3. In Studies 1 and 2, the relevant themes were derived directly from the supportive framework. Such pre-defined themes are called axial coding (Corbin and Strauss, 2007). However, not all of these themes were used because some of them were not deemed relevant to the cases (see Chapter 5). The data was thus categorised into relevant themes. The second researcher reviewed the results of Studies 1 and 2 through commenting on the relevance of gathered data to each category and in relation to international literature, and involving in joint publication of related papers and a report. The use of the framework in

Studies 1 and 2 revealed many overlaps between dimensions, leading to the repetition of data in different themes. For example, the dimensions of 'role' and 'task/responsibility' may have the same meaning. Therefore, in Study 3, the themes were combined into even larger themes to fit the data gathered. These themes were: 1) Responsibility, availability and attitude, 2) Laws, regulations and work environment, 3) Training and emergency supply, and 4) Information Technology and communication. Data was sorted into each category and the texts in each theme were categorised further into those including challenges, possibilities and actor needs. Two other researchers (second researcher above and a third researcher), who were also project members, provided feedback on the collected data during the entire study period. The second researcher reviewed the gathered data and was also involved in merging categories in the abovementioned themes. The third researcher participated in focus groups data collection and also reviewed the final results (e.g. the needs list, challenges). Both researchers were involved in the joint publication of Paper 5. The results from Studies 1 and 2 were also re-categorised using these four themes. Therefore, the same themes were used for the analysis of all three studies in the thesis, leading to the same structure in the results, and there was thus an opportunity to perform cross-study comparisons (see Chapter 5). Also, an additional analysis was performed in which the data was interpreted by comparing it with key factors in network governance, to investigate how emerging forms of collaboration may resemble network governance.

4.6.2 Data analysis regarding the conceptual framework development

The initial categorisation of data in the baseline study comprised the dimensions of the initial framework. The framework development was then continued by comparing it with the results of the initial literature review and using sociotechnical systems theory as the theoretical foundation. The feedback, experiences and challenges of using the framework (as part of user participation activities) in Studies 1 and 2 were used as further empirical foundations. Therefore, the initial framework was slightly modified, developed and matured after Study 1. This involved clarifying each dimension by providing more examples, combining interdependent dimensions and adding new dimensions. Theoretical insights in terms of sociotechnical systems theory were also applied in order to relate the framework to the field of IS and broaden its application. Therefore, the framework dimensions were successively revised. Although the use of the framework was also observed in Study 3, the data gained was not used in the further development of the framework and will only be used for discussions in later chapters. For example, there will be a discussion of which benefits of the framework may support user participation and which challenges may inhibit user participation activities. The details of the framework development can be found in Paper 3.

4.6.3 Data analysis regarding the identification of user participation challenges

The identified challenges in user participation are based on the data analysis gained from observation and the project diary in Study 3. However, there are also some other inputs to the data analysis. First of all, Studies 1 and 2 revealed some user participation challenges that were not expected by the researcher. Examples are: lack of competencies and unknown stakeholders in the Future Workshops, and difficulties in trying to involve stakeholders jointly (during the same time slot). Moreover, two related literature reviews were performed.

In Literature review 2, the general challenges of user participation (mostly PD) regarding stakeholder involvement were studied. The review was completed by performing Literature review 3, focusing on user participation in the public sector. The identified challenges were categorised as: 1) general challenges (e.g. lack of necessary time, motivation, competences), 2) difficulties in identifying user groups and stakeholders and involving them in the IS development process, and 3) Lack of formalisation in user involvement and relevant processes. These three themes thus stem from the visible, relevant and discussed challenges in the literature (see Chapter 3).

In Study 3, the project diary contained detailed information about participants' challenges and behaviours during user participation activities (see Figure 4.6). The project diary was analysed by the researcher to identify the root causes of challenges. The data analysis was based on a thematic analysis of the observation of user participation activities (specifically Future Workshops) and how design groups worked or did not work as intended. An attempt was made to identify challenges that were related to, or within the scope of, the three themes of the literature reviews and to identify potential new challenges. For example, the challenge in Figure 4.6 occurred since the context was new to participants and the intended cross-sector collaboration did not exist; thus, the participants did not have any experience upon which to reflect in user participation activities or the related discussions. All entries in the project diary were analysed in the same way and four major themes/challenges were identified regarding the new public context. These challenges were: 1) developing a collaboration, which does not yet exist, in a resource-strained environment, 2) unknown end-users and stakeholder groups, 3) a lack of shared understanding between stakeholders, and 4) a lack of sufficient competencies (see Chapter 5 and Paper 4).

5 RESULTS AND ANALYSIS

In this chapter, section 5.1 presents a summary of the five papers included in the thesis. Following this, the results are divided into three sections. Section 5.2 presents the main results concerning the thesis objective and thus gives the results of three studies with a focus on IS-related opportunities, challenges and actors' IS needs in emerging forms of cross-sector collaboration in the Swedish ERS. Furthermore, a combined network governance analysis and sociotechnical ensemble view using and comparing the cases is presented. In sections 5.3 and 5.4, the work on the context-specific framework and identifying and handling user participation challenges as part of achieving the thesis objective are presented.

The main thesis results, that is, the identified opportunities, challenges and IS needs in ERS cross-sector collaboration are published in Papers 2 and 5 and the related framework in Papers 1 and 3. The methodological aspects of how to apply user participation in public sector/cross-sector collaboration initiatives are presented in Paper 4. The Nyköping municipality study has only been published as a Swedish report and is thus new to the thesis results section.

5.1 Summary of included papers

The five papers are: 1) *A Framework for 'New Actors' in Emergency Response Systems*, 2) *Emerging Communities of Collaboration: co-location in emergency response systems at the Safety House in Sweden*, 3) *Actor-Centred Emergency Response Systems: a framework for needs analysis and information systems development*. 4) *User Participation in Information Systems Development for Emerging Public Sector Initiatives* and 5) *Semi-professionals: emergency response as an additional task in current occupations*.

5.1.1 Paper 1

Yousefi Mojir, K. & Pilemalm, S. (2013) A Framework for 'New Actors' in Emergency Response Systems, *Proceedings of the 2013 Information Systems for Crisis Response and Management (ISCRAM) Conference*, Baden Baden, Germany, pp. 741–745.

This first study was motivated by the need for a systematic method to perform a rigorous analysis and to gain a profound understanding of new actors in emergency management and the related collaboration mechanisms, in order to identify the needs of new actors in this context and develop corresponding IS solutions. The main objective was to propose a tentative framework that would include the key aspects to be considered in the analysis of new forms of collaboration.

The framework presented in this paper is based on empirical data drawn from interviews with experts active in involving new actors in emergency management and working at the Swedish Civil Contingencies Agency (MSB). Three interviewees were working on strengthening the response capacity of the Swedish ERS by involving volunteers and by co-operative use of resources at the strategic level. The main aim of an initial literature review was to explore the role/s and the concept of new actors in the ERS context and to investigate the study's potential for international generalisation, but not to build the framework from it.

The major result is an initial framework consisting of 14 key dimensions that should be investigated before involving new actors in response operations. These are: 1) the *actors' type and identity*; 2) their *roles* in emergency management; 3) the *type of incident* in which they intervene; 4) the *type of training* they receive or should receive; 5) the *problems* they encounter in response operations; 6) their *accessibility*; 7) their *structure and organisational form*; 8) the *legal issues* around involving them in emergency management; 9) the related *costs and benefits* of their involvement; 10) their *responsibilities*; 11) the *type of equipment* they use; 12) their *competence* in emergency management; 13) the kind of *IT support* they already receive or require; and 14) their *communication methods* with the other actors.

The results of the literature review reveal many similarities in roles, tasks, resources and routines in ERSs worldwide. It may therefore be possible to adapt and apply the framework to ERSs outside Sweden. It was concluded that, by covering different aspects of involving new actors in ERSs, the framework could provide a good starting point for performing an adequate and rigorous analysis of their collaboration with the main actors. It was also argued that these kinds of analyses may be useful in IS development for actors.

5.1.2 Paper 2

Yousefi Mojir, K. & Pilemalm, S. (2014) Emerging Communities of Collaboration: co-location in emergency response systems in the 'Safety House' in Sweden, *Proceedings of the 2014 Information Systems for Crisis Response and Management (ISCRAM) Conference*, Pennsylvania State University, USA, pp. 548–555.

Temporary co-location at emergency sites facilitates effective communication and may increase efficiency due to better interpretation of information, co-ordination and task allocation. However, there is a lack of research on the permanent co-location of main actors and supportive actors in order to investigate the benefits, emergent problems and actors' needs in the new setting. For this purpose, a case study was carried out at the co-location of response organisations and supportive actors at 'Trygghetens Hus' (Safety House) in Jämtland, Sweden.

The main objectives of the paper were twofold: 1) to investigate the strengths and weaknesses of the co-location of actors, and to identify actors' needs for the development of collaborative procedures and appropriate IS support; and 2) to test the initial framework and to highlight its benefits, challenges and weaknesses.

The methods applied included four interviews at the Safety House with the project manager, a representative from the police, a representative from the fire services, and a representative from the Swedish Defence. Participant observation was performed to observe the actors in their daily physical setting. A Future Workshop was also conducted in order to gain a richer, future-oriented set of data about actors' needs. Network governance theory was used as a lens through which to understand the co-location of actors, to analyse the interactions between actors, and to describe the existing related challenges.

The co-location of actors at the Safety House was seen as a form of network governance in which independent actors with their own organisations collaborate in a horizontal pattern. The results revealed that the actors at the Safety House were positive about the recent changes. They felt that the permanent co-location had increased the efficiency of use of professional response resources and shortened response times. This had been achieved by close collaboration between independent actors, collective problem solving and establishing a common understanding of the situation. Informal meetings and feedback had also had a strong influence on the perceived improvement of this network structure. However, the new collaboration also presented some problems. It seemed to be difficult to satisfy emerging needs and to implement changes in this new setting, since it was not always clear who should make certain decisions and whose tasks and assignments took priority over others. These opportunities and challenges are also in agreement with network governance theory and are seen in the related literature. Evaluation of the current performance of the new structure in comparison with the previous one is even more problematic, as it is difficult to foresee the practical impact of improved social relations and interactions. A number of primary and general needs were also identified by the respondents. Firstly, actors' responsibilities should be documented, formalised and circulated to make them clear and transparent to all actors. Secondly, the need for a steering group to implement changes in the setting and handle feedback about the new setting was mentioned several times. Finally, any legal issues should be identified from the beginning when establishing co-location in order to be able to address them. In terms of IS, the needs mentioned included a shared IT communication system for actors, a documentation system and portable and sophisticated tools with which to view incident information.

In relation to the second objective, the framework was found to be useful in performing the analysis and covering relevant themes and questions in the data collection. It was also deemed helpful to consider the new form of collaboration from different perspectives/dimensions. Having selected the relevant framework dimensions for the co-location study, it was perceived as relatively simple to formulate relevant questions and to perform the analysis effectively and comprehensively.

It is argued that, without using a framework, there is a clear risk of overlooking important aspects; for example, legal issues. However, the use of the framework also revealed some challenges. Above all, strict adherence to the framework dimensions became problematic since it was not possible to follow the structure of the framework for all categories and there were deviations. It became clear that the framework needed to be further developed and complemented in order to achieve greater flexibility.

5.1.3 Paper 3

Yousefi Mojir, K. & Pilemalm, S. (2016) Actor-Centred Emergency Response Systems: a framework for needs analysis and information systems development, *International Journal of Emergency Management*, 12 (4), pp. 403–434.

The use of IS can support more effective and efficient response operations and facilitate collaboration between actors. Various factors, such as actors' different roles, tasks and responsibilities in operations and the legal frameworks within which they work in this new setting, can influence actors' needs for IT solutions. However, these points have not yet received sufficient attention in research. Therefore, it is argued that IS development processes should be adjusted to the ERS context in order to incorporate the specific characteristics of new forms of collaboration (e.g., cross-sector collaboration or involving volunteers).

The main objective of this paper was to revise the framework, to ground it theoretically in sociotechnical systems theory, and to describe its different dimensions and how it can be used in IS development. A further point of discussion was its potential role in formalising PD and improving the identification and involvement of stakeholders during the early phases; that is, organisational analysis and needs analysis.

The initial framework from Paper 1 was developed in several steps. First, the dimensions were reorganised, combined, renamed and elaborated upon with the help of feedback from the testing of the framework in Paper 2. Then, it was placed within the field of IS by applying sociotechnical systems theory and with inspiration from the PD approach. The dimensions in the framework were re-categorised into five main dimensions: *People, Task, Technology, Structure and Environment*. The term *Task* was then replaced by 'task/response operation' and 'people' was replaced by 'actors' to reflect the ERS context. Taking inspiration from PD, the 'actors' dimension was placed at the centre of the framework in order to emphasise the importance of actors' (users') role in the processes of analysis and IS development. The centrality of 'actors' means that all the other dimensions in the framework should be analysed in association with actors' identities, roles, backgrounds, education and qualifications. The literature review from Paper 1 was complemented by reviewing the literature related to IS development; for example, in the context of cross-sector collaboration. The aim was to identify aspects of IS in analysing new forms of collaboration in ERSs and in the public sector generally, and to demonstrate the potential international relevance of such collaborations.

The new framework version included 15 sub-dimensions in total, grouped under the parent dimensions. These are: *Type/Role, Attitude, Training, Background, Task and Responsibility, Availability/Accessibility, Incident Type, Communication Method, Information Technology, Emergency Supplies, Organisational Structure, Leadership, Costs/Benefits, Environment and Regulations and Legal Issues*. The literature reviews indicated that this framework is in line with and overlaps other ERSs and public sector efforts globally aimed at new forms of collaboration. Therefore, it was argued that the framework may have the potential to be adapted to an international context and/or to the public sector.

Regarding IS development processes, an initial suggestion was presented about how to use the framework for stakeholder identification, organisational analysis and needs analysis during the early phases of PD. It was suggested that the first step should be to gain a brief initial understanding of the current project, key organisations, involved actors and required IS without

using the framework. In the next step, the dimensions relevant to the project should be selected from the framework in order to study them further. Then, relevant users and stakeholders who have adequate information about the preselected dimensions should be identified and involved in the project to explore each dimension in depth. It was argued that, by focusing on particular key dimensions, it becomes easier to formulate data collection, since the point of departure is explicitly provided by the framework and does not need to be investigated from scratch. To perform needs analysis, primary users can be identified by analysing the results of stakeholder and organisational analysis; however, most of these users are likely to be clear from the beginning of a particular project. The framework was again deemed helpful to formulate templates used in interviews, observations and Future Workshops, thus saving time and resources. For each relevant dimension, it should be determined how needs can be satisfied and what challenges may inhibit them. The framework may also be used during the later phases of systems development to evaluate and investigate how final systems solutions satisfy user needs, and to handle the potential challenges identified. It was also argued that using the framework might offer similar benefits in similar cases. Without the framework, analysis may remain more rudimentary and lead to projects which are less grounded in user needs and organisational and societal prerequisites. The framework also presented some challenges, such as difficulty in selecting relevant dimensions due to insufficient knowledge about the project, multiple and subjective interpretation of dimensions, and neglecting emergent and new dimensions in the collected data. However, these can be addressed if the researchers using the framework are fully aware of them and are prepared to manage them in appropriate ways. Possible future work may be to develop and standardise the framework or develop similar frameworks which are fundamentally targeted or adapted to specific contexts. These kinds of frameworks may have the potential to address some perceived challenges in PD, including the lack of formalisation in sub-processes, difficulties in identifying important stakeholders and difficulties in involving them.

5.1.4 Paper 4

Yousefi Mojir, K., Pilemalm, S., & Andersson Granberg, T. (2018)

User Participation in Information Systems Development for Emerging Public Sector Initiatives, *Presented at 27th International Conference on Information System Development (ISD 2018)*, Lund, Sweden.

To design and implement successful information systems, one prerequisite is to understand the context, and to identify stakeholders and end-user needs. Studies have repeatedly argued that user participation approaches, e.g. Participatory Design (PD), user-centred design (UCD), and user innovation (UI) may lead to a better fit between the technology and the way in which people use it to perform their tasks. On the other hand, different studies show that applying user participation is not an easy task, especially in large-scale projects with heterogeneous stakeholder/user groups or in the resource-strained public sector.

There has been a trend in emergency management organisations, as part of the public sector, to involve alternative societal resources in the creation of cross-sector collaborations to address public challenges; for example, budget cuts and lack of professional response

resources. To apply user participation in this context requires involving heterogeneous stakeholders from resource-strained organisations. This study explored the application of user participation in the design of IS for cross-sector collaborations involving semi-professionals (e.g. security guards and homecare personnel) in emergency response. The organisational setting did not yet exist, stakeholders were heterogeneous, primary end-users were partly unknown at the outset and were to be assigned extra tasks for which they had no previous experience. In particular, the study aimed to: 1) identify general and context-specific user participation challenges in involving heterogeneous stakeholders/end-users when using the approach in cross-sector collaboration, and 2) address how these challenges might be handled.

The study was carried out as case study research taking place in the context of the *Co-operative Use of Municipal Resources for Increased Safety and Security* (ESKORT) project. The authors used a project diary in which the challenges in user participation activities that were experienced, the actions that were taken to resolve them and their implications were noted.

Four major challenges were identified during different phases of the development process. The first was starting the project with end-users and a stakeholder group who were largely unknown. As a response, a core design group was formed by involving known stakeholders. Lack of sufficient competencies in this core design group to explore all aspects of stakeholder identification emerged as the second challenge. Therefore, an extended design group was formed by involving other important potential stakeholders, thus resulting in the interaction of different design groups. A third challenge was the lack of shared understanding of the project among stakeholders because of their divergent interests, knowledge and backgrounds. Brainstorming and open discussions were used to gain an overview of the project, the key organisations and the intended cross-sector collaboration, and was completed by a literature review performed by the researchers in the core design group. The fourth challenge was the most prominent, manifesting itself in various forms and degrees throughout all the user participation activities. It concerned the dilemma of developing a cross-sector collaboration, which is entirely new and for which the tasks and organisational setting did not yet exist or had not been defined. To address these challenges, a scenario-based Future Workshop supported by an emergency response context-specific framework, focus group interviews supported by the framework, a prototype-based Future Workshop and a scenario-based exercise with a following after action review (AAR) were used as complementary methods to design group work, providing input to be handled by the project's core design group.

Several of the identified challenges were not new to user participation or in the public sector context but had previously been mostly discussed in relation to large-scale projects. However, the study showed that future services implementation projects do not need to be large-scale to pose similar challenges. It was also claimed that, while some of the activities performed (e.g. Future Workshop, focus groups) were not new to user participation approaches, others (e.g. multiple design groups, AAR) were more novel. However, the main argument was that the specific combination of activities that applied in this study may be used as a source of

inspiration for other similar public sector initiatives. Context-specific frameworks may facilitate the analysis process, identifying stakeholders and creating a shared understanding in design groups when the context is new. Furthermore, it was argued that the framework may be used as a point of departure in user participation to keep the focus of design groups on topic. The study also confirmed the findings of previous user participation studies claiming that user participation in current IS development activities often goes beyond technology design and embraces social infrastructure development; for example, laws, policies, mind-sets and organisational frameworks.

5.1.5 Paper 5

Yousefi Mojir, K., Pilemalm, S., & Andersson Granberg, T. (2018) Semi-professionals: emergency response as an additional task in current occupations, *International Journal of Emergency Services*, <https://doi.org/10.1108/IJES-11-2017-0059>.

Governments have become increasingly dependent on creating and maintaining redundancy in societal resources in order to achieve their goals during times of public challenges. As one response to such challenges, horizontal government structures or *network governance* forms have emerged. Similarly, many emergency response organisations, such as the fire services, attempt to create cross-sector collaboration with other societal resources and promote the co-operative use of resources, including involving other occupations as first responders. However, this is still a rather recent research area and there are many challenges and needs that should be addressed, not least because any failure in collaborations may risk victims' lives and put mental pressure on the first responders involved.

This study aimed to: 1) identify various occupational groups called semi-professionals who have the availability and capacity to be involved in cross-sector collaboration network forms of emergency response; and 2) identify related opportunities and challenges, as well as actor needs for training, equipment and information technology. A further analysis was performed using network governance as an analytical lens to situate the results in a wider context and to assess whether this perspective may be useful in developing and evaluating future cross-sector collaborations in emergency response.

The study was carried out as case study research using a qualitative interpretive approach. The data inquiry consisted of two Future Workshops, six focus groups, and an exercise followed by an after action review (AAR). The thematic data analysis resulted in four themes: 1) Responsibility, availability and attitude, 2) Laws, regulations and work environment, 3) Training and emergency supply, and 4) Information Technology and communication.

Security guards, home care, facility services and fire services day personnel were chosen as potential semi-professional candidates out of many occupational groups. This selection was based on factors such as: the availability of resources in the municipality, individuals' ability to interrupt their current work when receiving alarms, their qualifications and training, and the geographical spread of resources. The most important opportunities identified in this intended cross-sector collaboration are: the availability of widespread heterogeneous

resources and competencies with previous relevant training, the ability to interrupt current tasks at a time of emergency and the lack of visible organisational hindrances. Highlighted challenges include: ambiguities in responsibilities, prioritising between current and new tasks, fear and stress when acting as a first responder, and a lack of proper insurance/supportive laws. Primary needs include: clarification of tasks and responsibilities, regular training, introducing supportive laws and the proper insurance. The needs for training include: CPR, basic fire extinguishing, traffic rules, controlling other people at emergency sites, risk assessment and stress management. The identified needs for emergency supplies were: mobile phones, blankets, reflective vests, warning triangles, pocket breathing masks, warning lights and mobile car chargers. The needs for IT support included: smart-phone-based alarm management systems, navigation functions, a loud and entirely different alarm signal, functions to send information on semi-professionals' availability status, an acknowledgement function, information about other dispatched resources, and a function to call the professional response resources directly.

The network governance analysis showed that there are similarities between cross-sector collaboration forms as compared to network governance core principles and some key factors. This includes, for example, the existence of heterogeneous actors with independent organisations and shared interests for collaborative decision-making and actions and the importance of trust as a facilitator of collaboration. On the other hand, more explicit hierarchical control mechanisms could be seen in which the fire services regulate the tasks and responsibilities of semi-professionals and limit the scope of their decision-making, and the perceived need for steering was substantial. Additional factors, such as fear and internal trust (trust inside an organisation between members) and the need for training and IT support, were identified in the study, but are usually not included as key factors in network governance theory.

The study indicated that semi-professionals have great potential to increase the capacity of ERSs since they are widely distributed geographically and may act as first responders to perform basic but vital actions, while waiting for professional resources to arrive. The major challenges are legal and organisational and may extend beyond the scope of the studied case. The needs for IT support, training and emergency supplies are basic but need to be met and are possibly similar for other municipalities, and perhaps also for other countries because of similarities in tasks, routines, resources and goals. The occupational groups identified in this study may not be the best candidates in all cases and the selection process should be performed actively in every given context. In terms of network governance, it is argued that ERS cross-sector collaborations involving semi-professionals should be seen as a hybrid form of network governance and hierarchical government. Network governance may thus assist in analysing and developing organisational and institutional aspects of the collaborations. However, actors' basic needs for supplies and the role of IT and relevant training are not covered by the theory and should be included when developing the ERS cross-sector collaborations. Furthermore, other theoretical perspectives, such as new public managing, public administration and network policies, can be used in a complementary manner.

5.2 Results: IS-related challenges, opportunities and needs in cross-sector collaborations

The thesis objective was:

To explore IS-related opportunities, challenges and needs aimed at supporting heterogeneous actors in emerging cross-sector collaboration in the context of ERSs using the sociotechnical ensemble view.

The results regarding the objective stem from organisational analysis, needs analysis and, partly, design phases in the three studies. They are presented under four themes. These are: 1) *Information Technology (IT) and communication*, 2) *Responsibility, availability and attitude*, 3) *Organisational aspects: laws, regulations and work environment*, 4) *Training and emergency supply*. As mentioned in Chapter 4, these themes stem from merging the framework's 15 dimensions into larger groups. Therefore, the themes as presented here stem from the sociotechnical system perspective which is the theoretical ground of the framework, thus being divided into separate themes. The sociotechnical ensemble view was involved in later phases (e.g. the cross-case analysis in 5.2.4). The themes were used in Study 3 to mitigate the data-overlap problem seen in the previous two studies and were re-used in this thesis for the re-categorisation of the results gained from Studies 1 and 2. The results in Paper 5 are partly repeated in the thesis for the purpose of readability.

Several IT functions and IS are suggested throughout the text, but it is believed that all parts of the results are relevant to IS development in some way. For example, a legal issue or an organisational need may affect the subsequent IS design. The results are also relevant to overall organisational development processes; for example, with the aim of improving collaborations.

5.2.1 Study 1: Co-location of actors at the 'Safety House'

This section presents and analyses the results gathered at the Co-location at Safety House in more detail, in relation to the themes above.

5.2.1.1 Theme 1: Information Technology (IT) and communication

Opportunities. The interviewees and workshop participants claimed that real-life face-to-face communication before a response operation often leads to a more accurate interpretation of the situation surrounding an incident. For example, the interviewee from the fire services said:

"If there is anything we want to share with each other then we call for a quick meeting in this [shared] room. Then we inform each other. This is the information I want to know. It's about having a short meeting. It only takes a few minutes."

The interviewees also claimed that they already knew each other, and this was perceived as facilitating the process of communication and decision-making. Actors could gain a shared understanding of received incident data by looking at pictures, videos and maps and discussing them together. Relying solely on digital data, for example, emails and digital records, may not be

as effective as face-to-face communication since different actors may have their own interpretations, which sometimes conflict with each other. All interviewees also mentioned the usefulness of the RAKEL⁴ communication system. With RAKEL, they could talk to each other using a shared platform, individually or in groups. Although the cost of RAKEL is high, its area coverage is quite acceptable for actors in the Safety House in comparison with the generally limited coverage of mobile phones in forests and mountains, the interviewees claimed.

Challenges. Nevertheless, not all actors have RAKEL. For example, the interviewee from the Swedish Defence said they used mobile phones, which had limited coverage in mountains and forests, to communicate with other actors at the Safety House. They also used email as another way of communicating with others. They claimed that RAKEL was expensive and not all actors were able to afford or prioritise this technology. The interviewees from fire and rescue services and the police mentioned that it was difficult to access other actors' information (e.g. their position or their status), or information about an incident that other actors have. Regular meetings and face-to-face conversations might resolve the need for digital information sharing in the case of small incidents. However, they are not deemed sufficient in larger emergencies involving more information and more response actors and where different actors have different needs and use different types of information. It was discussed in the Future Workshop that actors had had difficulties with information exchange because they might not know exactly what kind of information was needed by other actors. The interviewee from the fire services mentioned difficulties in viewing and browsing information from the incident site because of the absence of more sophisticated tools and equipment, especially mobile tools for use in cars and outside. Moreover, not having sufficient communication channels to exchange information with the public had inhibited one of the main aims of Safety House, which was to provide a citizen-centred service and to focus on citizens' needs.

Needs. All interviewees emphasised the need for a shared platform for communication since they used different systems (e.g. mobiles, phones, RAKEL, email) to communicate. They also pointed out the need for an IT system that provides the facility for actors to share and spread both visual and spatial information about incidents. Specifically, a shared IT platform for information exchange, including a shared map system, was identified by both the fire services and the police as a key need. The interviewee 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. A shared platform for data exchange in response operations could also facilitate a shared understanding of a situation and subsequently support improved situational awareness. The interviewee from the fire services mentioned the need for sophisticated portable tools to view, analyse and disseminate information. Examples could be portable digital maps with updated information from all the actors in a response operation. Participants in the Future Workshop discussed using a document management system, which can assist in the documentation of collaboration and feedback gained. Such a system

⁴ RAKEL is the Swedish national digital communications system used by the fire services and others in the fields of civil protection, public safety and security, emergency medical services and healthcare (www.msb.se, 2017).

could further facilitate incident information seeking and learning from existing documented experiences in the future.

5.2.1.2 Theme 2: Responsibility, availability and attitude

Opportunities. The interviewees and participants in the Future Workshop all confirmed the benefits of their new work environment. They said that in the new setting they shared the work building and facilities that they use. In this way, actors can access each other easily since their offices are located close to each other. They had also shared meeting rooms in case they needed to exchange information or discuss and find a collective solution to a problem. For example, the interviewee from the police said:

“[...] This close communication and neighbourhood, it [workplace] is completely different from what it used to be in the past.”

Challenges. All actors in the Future Workshop pointed out the ambiguities in actors' roles, responsibilities and tasks in response operations when working in the new setting. One example that was discussed was who/what response organisations can command the others. There was no documentation about such decision-making in current response operations. Each actor had their own documentation, rules and routines.

Needs. All actors in the Future Workshop thus saw the need to formulate and document the roles and responsibilities of actors and the hierarchy of different actors (who commands others) at the Safety House. It was believed that such a formalisation could facilitate actors' collaboration in a response operation.

5.2.1.3 Theme 3: Organisational aspects: laws, regulations and work environment

Opportunities. The interviewee from the fire services said that there were three types of defined meetings between actors: daily, weekly and on-demand. In the daily meeting the police, the fire services and SOS alarm gathered and discussed the events of the day before and the day after in order to gain the same understanding of the status of the region for which the actors are jointly responsible. In the weekly meeting, more actors participated (e.g. the County Council) to gain a shared understanding of the province's status and become aware of news and each other's views on the different events in the province. Finally, there were also on-demand meetings, which were usually held before a response operation. The goal of these meetings was to manage the situation and shorten the response time, as well as to utilise the professional response team's resources effectively and efficiently. Actors also used shared facilities (e.g. dining halls) for social events such as eating lunch and informal meetings.

All actors agreed that regular formal meetings, social contacts and informal meetings between actors had increased their knowledge about each other's organisations, their tasks and their skills. Such knowledge might lead to greater trust between actors and was thus considered to be an important factor in collaborations. When people know each other, it seems that it is easier to search and call for the necessary contacts when responding to an incident. For example, the interviewee from the Swedish Defence said:

“The fact that the Safety House has done things this way [to share facilities] has resulted in me knowing people in all the sections available here, including SOS, the police and ambulance services. I know exactly who I should call if I need to collaborate with someone.”

The interviewees from the police and the fire services emphasised the positive role of receiving feedback about completed response operations in the aftermath meetings from the actors who had participated. Feedback was usually related to the performance of various actors and the lessons that could be learned from the operation. They might also discuss with each other their respective experience of response operations and their collaborations in the informal meetings. Thus, almost all actors thought that pointing out different perceived problems and strengths in their mutual collaboration might lead to improving each other's competence.

Challenges. Both the police and the fire services mentioned the issue of information confidentiality (secrecy) as a problem inhibiting the sharing of information between different actors. Secrecy might cause difficulties when different actors want to exchange pictures, movies and other data relevant to an incident. The interviewee from the fire services said, for example:

“We [fire services] have a secrecy rule, the county council has another secrecy rule [regarding ambulance services] that is a bit stricter than ours, SOS has its secrecy and the police its own. Here, we have at least four different secrecy laws that steer collaborations.”

Secrecy also causes difficulties 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. The police and the fire services also mentioned that it is difficult to make some decisions without the presence of other actors, such as municipalities, in the meetings. For example, the participant from the police said:

“It is the municipality in which everything happens and takes place regarding people's daily life. Everything is controlled by the municipality. The municipality is the most important platform for infrastructure, social care, children, schools and everything. It must be part of the setting [Safety House].”

Participants in the Future Workshop said feedback was currently very limited and informal and was received from sources such as people inside the Safety House, or on occasion from citizens, researchers and politicians. However, it was not stored or referred to, even less evaluated or implemented.

The interviewee from the police mentioned that Sweden is partially moving towards centralised emergency management by establishing more national management centres. One recent example is the removal of the local SOS Alarm centre from the city of Östersund and replacing it with a national centre. The interviewee saw a problem with this centralisation. He claimed that small response teams should be localised in different regions close to the population. Knowledge about the geographical area is a crucial factor in response operations and the efficient use of resources. For example, he said:

“The response operations are based on your knowledge about the area. You know exactly what it looks like here [in the area]. You know how long it takes to go [to the incident site]. And from a

workplace perspective, I think it's really important to know the area I'm going to work in. Unfortunately, it [the future emergency response service] is getting worse."

Also in the Future Workshop, the representative from the Swedish Defence described his experience about cooperation with national alarm centres as problematic since the operators tend to be unfamiliar with the region. The interviewee added that, when the response operation is managed from a national centre, the first responders usually do not have sufficient knowledge about the geography or topography of the area before arriving at the incident site. Local people and local response teams on the other hand usually know the region. And in the case of neighbourhood fires, citizens might know the buildings and their residents, which can be helpful to the rescue team.

Needs. Secrecy seemed to be a big obstacle in the Safety House for all interviewees and Future Workshop participants. However, they also discussed how such difficulties could be mitigated if legal issues are identified and discussed in advance. Organisational changes, new processes and technology designs at the Safety House should consider these issues from the very beginning. The police and the fire services also noted the need to involve other actors, such as the municipalities and the County Administrative Board, in regular meetings at the Safety House. They thought that this would facilitate the process of decision-making, specifically in important decisions such as evacuating people from an incident site. All actors pointed out the need to involve other actors who have local knowledge and can be used as redundant resources. The representative from the police at the Future Workshop mentioned the importance of 'Missing people'; the fire services pointed out local people (citizens), and the Swedish defence referred to the Swedish National Home Guard as important volunteer resources.

Another need that was brought up by all participants at the Future Workshop was a steering group to handle internal feedback as well as questions from the authorities, academia and citizens in order to further develop the collaboration between different actors. For example, the participant from the police said:

"Now we have grown and developed, and we're so complex that we need an official group/function that can drive issues ... internally we cannot answer all development queries and feedback because of the limited resources we have. It's an obstacle to development."

Similarly, the workshop participant from the municipality said:

"[...][the lack of a steering group] is also an obstacle to the formalisation of collaboration. [For example,] what are the obstacles that need to be resolved? Who decides? Who can control the others?"

Participants agreed that, to create formal feedback, templates and allocating part of the formal meetings to feedback will be required. There was a sense among participants that documenting and handling feedback is an important step to improve the intended Safety House concept.

5.2.1.4 Theme 4: Training and emergency supplies:

Opportunities. The interviewees from the police and the fire services mentioned that actors at the Safety House had gained basic knowledge about each other’s organisations, the new collaborations and information exchange. This knowledge came from regular work-related education, feedback exchange between actors and informal meetings. Such knowledge may increase the trust between actors and facilitate collaborations between them.

Challenges. The interviewees from the police and the fire services mentioned the difficulties of applying the knowledge gained about the new collaboration to their practical work. In practice, they did not know how to use this knowledge properly for better collaboration. As an example, the interviewee 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 their daily routines, personnel did not exchange any information about response operations because of the false understanding that all information is confidential.

Needs. Participants in the Future Workshop claimed that there is a lack of methods for transferring theoretical training/knowledge about the new collaboration into practice in terms of practical training and simulations of new collaborations. The participants also asked for more regular and practical joint training session to make the personnel more ready to actually act according to the theoretical knowledge gained. The interviewee from the police thought that, despite existing strict rules about information sharing, there is still much information (e.g. about work methods, videos and photos of incidents) that could be exchanged without breaking the rules – if the personnel express or use it in the correct way. Therefore, regarding secrecy, there was a need for regular education that informs people about the correct handling of information and appropriate restrictions on information exchange between actors. In line with this, the project manager at the workshop said:

“We thought it [secrecy] was a bigger problem than it really is. We received training and could find good ways to not break the secrecy rules while communicating.”

A summary of the results achieved on Safety House co-location is shown in Table 5.1.

Table 5.1: The results of Study 1: Co-location of actors at the Safety House

Study 1: Co-location of actors at the Safety House			
Themes	Opportunities	Challenges	Needs
Information Technology (IT) and communication	-Face-to-face communication facilitates the process of decision-making. -RAKEL as a shared communication platform	-limited RAKEL due to its expense. -Limited coverage of mobile phones - The absence of sophisticated tools to access and view information -The lack of communication channels with the public	-A shared communication platform -A shared map system -Portable sophisticated tools to view, analyse and disseminate information. -A document management system for the documentation of collaboration and incident information

Responsibility, availability and attitude	-Shared buildings, facilities, meeting rooms -Easy access to each other	-Ambiguities in actors' roles, responsibilities and tasks in response operations -No integrated rules, routines or documentation.	-To formalise roles, tasks and responsibilities in the new setting.
Organisational aspects: laws, regulations and work environment	-Regular shared formal meetings -Informal meetings and social events -Better acquaintance and increased trust	- Information sharing difficulties because of confidentiality (secrecy). -The lack of evaluation methods for the new collaborations -Centralisation of emergency response organisations	-To identify, discuss and consider legal and organisational issues in advance -To involve more actors -To create a steering group to handle the feedback and develop the collaboration
Training and emergency supplies	- Basic training in organisational structure and the new collaborations	-To use theoretical knowledge in the new work setting	-Practical joint training and simulations of new collaborations -Training in information handling and restrictions on information exchange

5.2.2 Study 2: Co-operative use and co-location of resources in Nyköping

This section presents the results of the study of co-operative use of resources and co-location of actors in Nyköping municipality.

5.2.2.1 Theme 1: Information Technology (IT) and communication

Opportunities. The participants in the workshop pointed out that the use of RAKEL can lead to a robust and shared communication platform. They thought that it has already shortened the response time to the personal security alarms and has simplified positioning of the night patrols. Therefore, it has improved work safety for the social care division. The interviewee from the fire services mentioned email and telephone as communication mediums between personnel inside the organisation. For example, emails and paperwork are the methods for sending response operation reports. The interviewee further said:

“We also work with the other actors in the house and have close contacts in matters that concern us. For example, we have a good opportunity to meet in conference rooms.”

Participants in the workshop believed that the new collaborations could lead to a better and faster situational awareness between actors because they can communicate with each other easily and have close collaboration. Therefore, meetings and response plans can be initiated in a shorter time.

Challenges. The interviewee from the fire services mentioned that they are very dependent on IT services and systems. The IT must work and there should be backup plans in case of electricity cuts or battery malfunctions in related devices and systems. The interviewee from the social care division mentioned that they have many different systems, which are not integrated and this makes it difficult to handle inter-organisational information. This interviewee argued that the lack of information and knowledge sharing prevented them from informing actors about the vision, aims and results, experiences and lessons learned from the

new collaboration. The technical division said that they do not have RAKEL to communicate with other actors but that they had thought of using it in their daily work.

Needs. The interviewee from the fire services mentioned that the most important information is the geographical location of an event and having a shared understanding of the emergency and a map of the emergency site. This interviewee mentioned the need for a resilient IT service, including back-up plans, especially during crises. The technical division said that brief information about the incident, the location and the relevant building is initially sufficient. But, in addition, the public expects to receive information about what is happening through, for example, digital channels. IT can here be used to reduce the gulf between organisations and the public by providing proper information.

The social care division believed that an alarm management system handling incoming calls is a necessary tool in the new setting, enabling them to collaborate with the proper resources efficiently and effectively. Extracting relevant statistics from existing data and information is another area that IT can support. A shared platform for accessing information is important in the future when sharing information; for example, between fire services and social care. Being able to document directly during the night patrol using IT is also a key requirement, is what the interviewee meant. During the Future Workshop, participants from the fire services and the social care division again voiced the need for a forum because a joint setting for thoughts, ideas and other IS support could simplify the development of new collaborations.

5.2.2.2 Theme 2: Responsibility, availability and attitude

Opportunities: The interviewee from the fire services saw them as a very resource-intensive organisation but not adequately utilising current resources today. For instance:

“We pay 33 part-time firefighters in four municipalities, but we do not use them in an efficient way compared with the police, who have six resources in the same area.”

Similarly, the interviewee from the social care division pointed out the 30 staff who worked for them as good resources to keep in mind. The interviewee added that their night patrol can help other actors; for example, they can help the police to report an event, as they are patrolling at night. The police can also turn to the social care division to ask for keys to properties and buildings in certain situations. The interviewee from the technical division mentioned some other examples, such as providing lifting assistance, and intervening in incidents of damage to property, streets, parks and ports. Participants in the Future Workshop argued that many new tasks can be performed by co-operative use of resources. For example, they thought that municipal alarms can be managed completely within the municipality alarm centre, including camera surveillance and burglar alarms.

Challenges: It seems that ambiguity as to who has the responsibility for given tasks is one of the most important questions for interviewees. The representative from the fire services believed that fire services in big cities are more specialised (e.g. in Stockholm) while the responsibilities of the fire services in Nyköping are very broad. He further mentioned that examples of important questions are:

“Who is responsible (and for what) when performing a response operation with the social care division or other actors? How many new tasks can one take on while simultaneously doing the regular work? For example, if the social care personnel help the fire services, they may not be able to carry out their ordinary tasks and vice versa.”

In the Future Workshop, all participants agreed that, despite the benefits of the new setting, conflicts can occur when tasks and responsibilities are not clear. It is also somewhat unclear who is responsible for the work environment when the building is shared. Financial and management questions arise in this case.

Needs: The representative from the fire services emphasised that the workload in the new setting must be reasonable and there must be a balance between ordinary tasks/roles and new ones:

“The aim must always be to help those who are in the greatest need of help – but how should one prioritise this?”

This interviewee continued that therefore there is resistance from some actors about working in the new setting. This is not unexpected, but it is important to convince these actors that it is a good way of working. By demonstrating a clear goal for the project, a clear mission, leadership and vision, it is possible to persuade other actors. Actors should know what their roles are and how their responsibilities and tasks can differ in the new setting. Similarly, the interviewee from the technical division emphasised that it is important to know in advance how to act in different emergencies. The interviewee from the social care division said that having knowledge about each other and each other's tasks is important in order to reach a clear understanding of the joint mission. All participants in the workshop also emphasised that it should be clear to every person what is included in each actor's role and tasks.

5.2.2.3 Theme 3: Organisational aspects: laws, regulations and work environment

Opportunities. In the Future Workshop, all participants believed that shared cars and premises had reduced costs and created better communication between actors. It was also mentioned that the centralisation of municipal alarms and their efficient management had worked well and that essential money could be saved in this way. For example, one of the participants from the fire services said:

“Instead of paying external actors like SOS Alarm, you can build safer buildings in the municipality with the saved money.”

Challenges. The interviewee from the fire services pointed out information confidentiality (secrecy) as a substantial barrier to expanding the co-location of emergency response organisations; for example, between ambulance services and fire services. This interviewee mentioned that, according to the county council in Södermanland, it is not possible to build

a permanent shared premises for fire services and ambulances due to existing confidentiality laws. However, in contemporary constellations this is possible:

“[...] at the scene of the accident, they [fire services and ambulance] can suddenly collaborate without problems [...]”

One question is whether confidentiality itself is the main problem or whether other factors (e.g. economics, the attitudes of the actors involved) play an important role, the same interviewee suggested. On the other hand, the interviewee from the technical division said that privacy is not a big problem for them, perhaps because the division generally deals with alarms in which the information does not require secrecy. The participants in the Future Workshop, however, agreed that confidentiality is a common problem when different actors collaborate and share information.

According to all interviewees, one of the most important objectives of the Nyköping project was to reduce costs. However, when it comes to actually calculating the costs and benefits, there is no concrete figure or even an approximate answer as to whether the new collaboration is profitable. The interviewee from the fire services said:

“It’s very hard to calculate costs and benefits. It’s mostly in theory that you can do it. But the benefits may be to use resources/equipment more efficiently and thus provide a better response service.”

Participants in the Future Workshop also agreed that calculating costs and monetary benefits is neither clear nor simple. Similarly, the social care division also said that it is difficult to determine whether costs have decreased or not. However, they believe that sharing several cars and centralising alarms in the municipality should have reduced costs.

Needs. The interviewee from the social care division saw privacy as a key problem. This interviewee added that the solution is to be aware of the confidentiality issues, to raise questions and discuss them in advance. The participants in the Future Workshop also said that they should revise the decision-making methods in the Nyköping project because currently decisions are based on old principles and agreements. An important example is how to allocate money and budgets to the involved organisations in cases of co-location of actors. They believed that the budget allocation should be revised when there are new experiences and perspectives on the project. Participants in the Future Workshop also pointed out the lack of a forum where actors involved in the project can sit down and talk about what they can do together, answer various issues and discuss new ideas and ways of interacting.

5.2.2.1 Theme 4: Training and emergency supplies

Opportunities. The participants in the Future Workshop said that staff in the social care division and the technical division have ‘municipal training’ in risk management, fire and healthcare and learn how to act in different situations.

Challenges. The interviewee from the fire services said that there is currently no dedicated training focusing on the co-operative use of resources or the co-location of actors. All the participants in the Future Workshop confirmed that municipal training was not specifically aimed at the new collaborations.

Needs. The representative from the fire services said that the scope and description of the task should be clear to all actors. Based on the task, actors should have the required competence and receive training about co-operative use of resources within the given framework. Having general skills is good, but the specific competencies needed for the new tasks must always be clear. In addition, he said:

“You should also receive training and knowledge about each other’s roles to be able to have a better interaction. As an example, when actors have shared tasks, sometimes an actor may not intervene in an emergency because they may think that another actor is going to intervene and solve the problem and that is because roles and responsibilities are not clear.”

The interviewee from the technical division believed that education is sometimes important; for example, when responding to alarms. However, this interviewee did not think that training for new collaborations has the same importance to them as for the fire services:

“In many cases and situations, it is handwork that is needed.”

However, changing actors’ attitudes to enable them to function within the new collaboration could be facilitated through proper training because actors understand and learn the benefits of the project and the balance between their new tasks and roles, the interviewee continued. Joint training can be a part of creating consensus on the new collaborations and its benefits. The interviewee from the social care division also believed that training for alarm management and the categorisation of alarms is central:

“We need to be able to handle alarms better. IT support and proper training play an important role.”

Also, several of the workshop participants believed that training for alarm categorisation and management systems can be important when categorising alarms, responding to them and invoking on-call resources.

The interviewee from the fire services mentioned RAKEL, mobile phones, computers and workplaces as the most important equipment for performing the tasks and collaborating with others. This interviewee also believed that knowledge about the purpose and goals of new collaborations is an important tool for their successful implementation.

A summary of the Nyköping municipality results is shown in Table 5.2.

Table 5.2: The results of Study 2: Co-location of actors and co-operative use of resources in the municipality of Nyköping

Study 2: Co-location of actors and co-operative use of resources in the municipality of Nyköping			
Themes	Opportunities	Challenges	Needs
Information Technology (IT) and communication	<ul style="list-style-type: none"> -RAKEL as a shared robust communication platform -RAKEL shortened the response time and improved the positioning of resources -Close communication -Better situational awareness in emergencies 	<ul style="list-style-type: none"> -Not all actors have RAKEL -Many existing systems which are not integrated -Lack of information and knowledge sharing about the collaborations -Actors are dependent on resilient IT and back-ups. 	<ul style="list-style-type: none"> -To gain shared understanding -The map system -To provide the public with proper information -To learn from the past (existing data and information) -Alarm management system -Shared IT platform for accessing incident information -Tools for documenting incident reports
Responsibility, availability and attitude	<ul style="list-style-type: none"> -Positive feelings about sharing their human resources and equipment -Municipality alarm centre as the main alarm management system 	<ul style="list-style-type: none"> -Ambiguities in tasks and responsibilities -Broad range of actors' tasks in the new setting -Difficult to prioritise between current and new tasks -Ambiguities in financial and managerial processes -Resistance from some actors in new collaborations 	<ul style="list-style-type: none"> -Balance between ordinary tasks/roles and new ones -To clarify goal, vision and mission of the project -To define actors' roles, responsibilities and tasks
Organisational aspects: laws, regulations and work environment	<ul style="list-style-type: none"> -To reduce costs -To create better communication -To share cars and premises 	<ul style="list-style-type: none"> -Information confidentiality (secrecy) -To calculate monetary costs and benefits 	<ul style="list-style-type: none"> -To discuss and solve secrecy issues in advance -To revise old organisational principles, for example, in budget allocation -A forum to discuss the issues and opportunities
Training and emergency supplies	<ul style="list-style-type: none"> -All have basic training in risk management, fire and healthcare 	<ul style="list-style-type: none"> -'Municipal training' is not sufficient for the new setting - No dedicated training focusing on new collaborations 	<ul style="list-style-type: none"> -Training and required competencies based on the given actors' tasks -To gain information about each other's roles/tasks -Joint training -Training in alarm management

5.2.3 Study 3: Co-operative use of resources as semi-professionals in the municipality of Norrköping

This section presents the results of using semi-professionals in the municipality of Norrköping. The study involved personnel both at the operational level and the management level. To refer to management interviewees, the word 'manager' is used, e.g., 'the manager interviewee from the home care unit'. To refer to interviewees from operational personnel only the word 'interviewee' is used, e.g., 'interviewee from the security guards'.

5.2.3.1 Theme 1: Information Technology (IT) and communication

Opportunities. All the interviewees emphasised their preference for smartphone-based solutions for receiving alarms and for communicating with others. For example, they can use a smartphone application to receive alarms, and the phone camera to take photos of emergencies. Interviewees from home care and the security guards said that they already receive work-related alarms concerning urgent events on their mobile phones. However, as they and other people in their organisation often have both private and work mobile phones, they were reluctant to add an additional device to the currently existing ones. The security guards also already had extra equipment for communication, such as handheld PCs.

In the exercise/simulated car accident AAR, the ambulance personnel acknowledged that the information that can be received from semi-professionals at the emergency site is useful and sometimes vital for both themselves and the alarm centres. For example, if they receive the exact GPS positioning of the semi-professionals already at a traffic incident on a highway (where their own coordinates are not very precise) they can arrive at the site more quickly.

Challenges. In a purely mobile-phone-based system, the semi-professionals would have no additional means of communication, and network coverage might be inadequate in some areas, such as forests, rural areas and the basements of buildings. For example, the interviewee from facility services said:

“[...] one problem can be when you are in the basement of a building or working in some underground centres [...] and there is no mobile phone coverage. This can be a problem since you spend a lot of time there, at least I myself often work in underground centres.”

One of the interviewees said that more comprehensive information systems are not an important part of their current job. Furthermore, they do not have any personal system (such as an alarm management system or positioning system to locate resources) that can be used in their new tasks. Lack of integration with the professional response organisation's system was also indicated in the exercise, when the car accident victims acknowledged that they became more stressed because they could not receive correct information from the semi-professionals, such as when the ambulance would arrive.

Needs. All interviewees in general pointed to the need for a stable communication channel and the possibility to talk to the alarm centre and the professional resources if they need to get more information. They emphasised the need for a dedicated IT system for receiving alarms, which, however, should be integrated with their current mobile phones; for example, in the form of an app. The system should provide brief and precise information about the type of incident, its location and a brief description of the incident, and provide a navigation function. They also requested that the system should provide information about when professional resources would arrive. The interviewees from facility services and the fire services day personnel said that the alarm signal should be loud and entirely different from other notification signals on their phones. The interviewees from home care mentioned the possibility of easily sending information (e.g. videos, photos, and text) relevant to an emergency to the alarm centre or fire services. Interviewees from the fire services day personnel and home care pointed out the need for an acknowledgement function through

which semi-professionals can inform others that they are at the emergency site. They also mentioned the need for a system in which they can inform the alarm centre whether they are available or not. For example, they may be in another city or on leave.

In the second workshop, representatives from the fire services day personnel confirmed all of the IT-related needs. They also suggested another set of functions; for example, to support reporting after the response operation, to have voice-guided navigation and to automatically inform their employers about interrupting their current work task. A status function is also viewed as an important feature through which a semi-professional can inform others (e.g. the alarm centre) when he or she is on the way, has arrived or needs extra help. It would also be beneficial if the application could inform actors when other resources have arrived at the emergency site, eliminating the need for more semi-professionals to go. Some other advanced functions, such as voice-based instructions about the response operation or quick checklists about what a semi-professional should do in a specific emergency, were also identified for future development. During the exercise/AAR, new needs also emerged; for example, to change the smartphone application so that it automatically informs others that semi-professionals are at the emergency site (since one of them forgot to do so).

5.2.3.2 Theme 2: Responsibility, availability and attitude

Opportunities: The interviewees from the operational personnel as well as the managers regarded the new role of semi-professionals as an organisational bonus and development and as an emerging social trend and thus, in general, were positive. The interviewees from the security guards and home care already had some limited experience related to emergency response; for example, security guards use extinguishers to control small fires and home care personnel respond to their customers' alarms and take care of their customers' health. Therefore, they saw working as a semi-professional as being quite close to their current tasks.

The manager interviewee from facility services mentioned that they have 50 cars and are available in most parts of the municipality, but have few on-call resources at night. The manager from the security guards, on the other hand, said that they have more mobile resources during night-time (about ten cars), than during daytime (one patrolling car), when most security guards were stationed at hospitals, shopping centres, etc. The fire service day personnel only work office hours and are mostly located at the fire stations. However, some of them travel frequently all over the municipality. The home care services have numerous resources spread all over the municipality, especially during daytime. However, in the city centre, many of them lack cars, and cannot travel long distances quickly. Moreover, all the interviewees, except home care, agreed that, if they received an alarm, most of the time they would be able to interrupt their current tasks and leave within about five minutes.

The interviewees from home care and the security guards named a variety of tasks they can perform at the emergency site, such as stopping simple bleeding, extinguishing smaller fires, calming shocked people, performing CPR, dispersing other people, putting warning triangles into the road at traffic accidents and putting injured individuals into the recovery position. Security guard interviewees mentioned that they are familiar with performing basic first aid and extinguishing fires during their work-related alarms.

Challenges. All interviewees claimed that it would be challenging, in general, to define and explain their tasks and responsibilities in an emergency. The facility service interviewees, in particular, pointed out that they do not have any experience of emergencies and are not sure what they should do. The interviewees mentioned potentially fearing to take part in incidents, specifically in traffic accidents on the highway or complicated medical emergencies, since they may make incorrect decisions and put people's lives in danger or even risk their own lives. For example, one interviewee from the fire services day personnel said:

"One must learn a lot about traffic rules; where to park [on a highway]. Where is it dangerous? I do not know as a private person if I would stop on the E4 highway; depending on the traffic, it's very dangerous."

Needs. The interviewees and the fire service participants in the second workshop mentioned the importance of clearly defined expectations and responsibilities for semi-professionals, as well as clearly defined tasks at an emergency. They emphasised the need for training and knowledge about being a semi-professional in order to overcome their fear and dare to take part in response operations. The interviewees from facility services and the security guards also said that there should be support to handle potential stress, as well as emotional or psychological consequences. Interviewees from the fire services day personnel said they would feel safer if two semi-professionals could work together at an emergency site. The interviewees, including the manager from facility services, claimed that motivations such as a higher salary might encourage a specific group of people, but not everyone, to take part in emergencies, while the other groups felt that this would not be a good way to motivate people.

5.2.3.3 Theme 3: Organisational aspects: laws, regulations and work environment

Opportunities. None of the interviewees saw any need to change the current work setting as long as the number of alarms remains relatively low. According to the manager interviewees, there is no formal organisational obstacle, regulation or law to prevent them from acting as semi-professionals in emergencies. For example, the manager of facility services said:

"Of course, if there is an accident or injury where we can help, certainly we can dispatch our resources, it is possible for us and it does not feel at all strange to me."

All interviewees except the facility service personnel also mentioned that they were already familiar with the rules relating to information confidentiality and privacy in their current work environment.

Challenges. The interviewees from facility services stated that, despite the scattered resources, it might sometimes be hard in specific cases to prioritise between new and current tasks:

“[...] while fixing a big water leak in a school [...], we might receive an alarm about an accident nearby. To leave the school would lead to very great damage but, of course, if it’s a matter of life and death you need to attend to it [the accident] first. But there can be complications.”

Similarly, the home care interviewees mentioned:

“You may think that it’s easy to interrupt a stroll [to go and help others in an accident], but it’s not possible to just leave an old person [client] in the street and walk away.”

The manager from home care also argued that there is no culture of being a semi-professional and taking part in response operations in the organisation. This is because elderly customers are very dependent on home care employees and cannot manage by themselves if employees interrupt their tasks. Even though there are no formal obstacles, there is not sufficient flexibility in the current municipality organisation to implement the collaboration smoothly since their personnel have a high workload and need to work efficiently.

The manager interviewees all emphasised that it is not clear who is responsible and what the consequences are (e.g. in terms of insurance coverage) if a semi-professional is harmed at an emergency site or unintentionally harms another person; for example, a victim. They also mentioned that there is not any particular law at either the organisational or national level concerning the new cross-sector collaborations.

From an ethical point of view, some interviewees from the home care and fire services day personnel were not comfortable with being continuously positioned by a dispatch system. As mentioned earlier, interviewees from facility services and fire services day personnel claimed that traffic rules are not clear when they drive their car to save somebody’s life. For example, an interviewee from fire services day personnel said:

“I think it’s a bit stressful [...] You know that you are on your way [to help a dying person] but you cannot exceed the speed limit.”

The interviewees from the fire services day personnel also claimed that being semi-professionals can include stress factors; for example, it might be stressful to know that you might suddenly receive an alarm. This might prevent them from being able to perform their new tasks correctly, which might be harmful to themselves or others and also cause sadness or depression.

Needs. The manager interviewees emphasised the need to address and clarify all the challenges mentioned above. The fire services participants in the second workshop, in particular, pointed out the need for clarification about the legal and ethical aspects of working as semi-professionals; for example, what they are allowed to do, how they should deal with alarm information, and what kind of insurance they need. The need for clarification about legal issues concerning the distribution of medicines and remedial action was evident in the AAR following the exercise, as was the need to inform victims and professional resources about the role of semi-professionals.

The interviewees from facility services mentioned the need for a system through which they can inform their managers that they have left their current workplace to help others. Similarly, the manager said that they need to know the number of resources and the amount of time that their employees should spend as semi-professionals.

The interviewees from home care and the fire services day personnel said that it is also important that other people inside the organisation know about semi-professionals' responsibilities. Otherwise, they might be challenged by their colleagues; for example, if they fail to do something or if the people they are trying to help die.

5.2.3.4 Theme 4: Training and emergency supply

Opportunities. Most of the interviewees said that they had received some training in CPR, and also in basic firefighting as part of their current employment contract. Interviewees from home care knew that some home care personnel also had training as assistant nurses. Security guard interviewees pointed out that they had been trained to act specifically as first responders. Interviewees from the fire services day personnel mentioned that there are even a few of them who have worked as firefighters or fire engineers. Regarding equipment, all interviewees except home care said that they have cars with equipment in them, such as first-aid kits and fire extinguishers. Home care interviewees said that they have digital keys with which they can easily open their clients' apartment door.

Challenges. The interviewees mentioned the difficulties of using previous training because they had forgotten it, had not repeated it or would not dare to use it in real situations. The manager of facility services claimed:

"[...] it [the training] is fresh the first year; however, then you start to forget. [...] we have training in CPR and similar types every four years but, as I said, it's not sufficient if we are expected to help in this way."

Even though all the interviewees acknowledged that they had already received some training, this was not always true for the other employees working in their organisation. In particular, interviewees from home care and the fire services day personnel said that some employees had either received only partial training or none at all. Regarding equipment, interviewees from the security guards and facility services said that their cars did not have much space to carry additional emergency supplies. The manager interviewees said that some equipment (e.g. defibrillators) is expensive and additional training is needed to use it properly.

Needs. The interviewees and participants in the second Future Workshop stated the necessity of receiving and updating training in CPR and basic fire extinguishing at least once a year in order to be able to act as semi-professionals. They also wanted to engage in practical exercises with the professional responders; for example, every second year. They emphasised the need to gain sufficient knowledge (training) about being semi-professionals. With such knowledge, they may be able to overcome their fear and dare to act as first responders. The interviewee from the fire services day personnel mentioned additional training needs, including training on traffic rules so as to act appropriately in traffic accidents, training in managing other people (e.g. shocked persons and injured relatives) at emergency sites, and

familiarity with professional responders' routines in order not to conflict with their tasks. The fire services day personnel representatives in the second workshop mentioned concrete needs; for example, learning to use the alarm management systems and perform risk assessment. They also highlighted more advanced training; for example, managing suicide cases and traffic accidents.

The interviewees suggested a variety of equipment, such as a dedicated smartphone for receiving alarms, blankets, reflective vests and warning triangles. In the second workshop, the representatives from the fire services also identified other tools, such as pocket breathing masks, warning lights and car chargers for mobile phones. The manager interviewee suggested defibrillators and extinguishing grenades, which were confirmed as helpful by the participants in the second workshop.

The results of the study on semi-professionals are summarised in Table 5.3.

Table 5.3: The results of Study 3: Co-operative of resources as semi-professionals in the municipality of Norrköping

Study 3: Co-operative of resources as semi-professionals in the municipality of Norrköping			
Themes	Opportunities	Challenges	Needs
Information Technology (IT) and communication	<ul style="list-style-type: none"> -All have both work and private mobile phones -Huge interest in smartphone-based solutions -Semi-professional as a source of information for professional resources if they arrive sooner 	<ul style="list-style-type: none"> -Limited coverage of mobile phones -Lack of integration with the professional response organisation's system 	<ul style="list-style-type: none"> -Vital information: type of incident, its location, short description -Smart-phone-based alarm management system -Navigation function -Loud and entirely different alarm signal -Functions to send videos, photos, text -Semi-professionals' availability status -Acknowledgement function -Information about other dispatched resources -A function to call the alarm centre or professional response resources directly -To inform employers automatically when semi-professionals interrupt their daily tasks
Task, responsibility, availability and attitude	<ul style="list-style-type: none"> -Positive feeling about being semi-professionals -Able to perform various first response actions -Available patrol cars -Spread resources -Easy to interrupt the current task and go to an alarm 	<ul style="list-style-type: none"> -To define the new responsibilities and tasks -Fear of acting as a first responder - To prioritise and create a balance between new and established tasks 	<ul style="list-style-type: none"> -To clarify responsibilities, role and tasks -To gain sufficient knowledge (training) about being semi-professionals -Psychological and mental support when a semi-professional fails in a response operation
Organisational aspects	<ul style="list-style-type: none"> -No visible organisational or legal hindrances 	<ul style="list-style-type: none"> - Cultural hindrances -A lack of proper insurance -A lack of supportive laws - Ethical hindrances -Stress 	<ul style="list-style-type: none"> - To identify and clarify the legal and ethical aspects -To inform others about semi-professionals' responsibilities and limits -To inform employers (managers) when personnel interrupt their ordinary tasks

Training and emergency supplies	<ul style="list-style-type: none"> -Many already have relevant training -Many have cars with relevant equipment 	<ul style="list-style-type: none"> -Many forget previous training -Some emergency supplies are deemed expensive and need extra training 	<ul style="list-style-type: none"> -To receive training regularly -Joint practical exercises with professional responders - Equipment: mobile phones, blankets, reflective vests, warning triangles, pocket breathing masks, warning lights and car chargers for mobile phones. - Training: CPR, basic fire extinguishing, traffic rules, controlling other people at emergency sites, risk assessment and stress management.
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5.2.4 Cross-study comparison and analysis using network governance and the sociotechnical ensemble view

The analysis includes a comparison between emerging forms of cross-sector collaboration in the Swedish ERS; that is, the three studies in relation to the core principles and a number of key factors generally associated with network governance. The analysis also uses the sociotechnical ensemble view described in Chapter 2, including which network governance factors (Chapter 3) may influence IS development.

5.2.4.1 Core principles and implications for IS

The core principles of network governance usually include interactions between autonomous actors who have shared interests and goals in a horizontal pattern without any visible top-down governing mechanism (Jones et al., 1997). This principle is also relevant to the sociotechnical ensemble view, in which human intentions and their relations (e.g. collaboration) are among the aspects that need to be considered in technology (here IS) design and development (Kroes and Meijers, 2006). The results of the studies performed reveal the existence of core principles of networks in cross-sector collaboration and also that these principles affect actor needs for IS.

In Study 1, actors at Safety House, such as the fire service, the police and the Swedish Defence, had different tools for communication (e.g. email, telephone) and had their own alarm management system. Also, in the new setting, there was no top management mechanism to control them in their network and they collaborated in a network governance (horizontal) pattern at emergency sites. They had a shared interest in creating a shorter response time and a better response by facilitating communication between actors and gaining a shared understanding of the situation. However, actors were still independent and autonomous in the new setting and had their own organisational rules. Therefore, despite having shared rooms and different cross-sector meetings, their needs were to have IS that can help them to implement the new collaboration within existing organisational structures. Examples were: shared platforms for more interoperability, decision-making and information handling (e.g. shared map and resource management system) to facilitate reaching their shared interests, and implementing horizontal patterns of collaboration. Therefore, the core principles in the new setting formed one basis for actors' needs for IS.

In the co-operative use of resources in Nyköping (Study 2), the involved organisations were also still autonomous and independent in their new workplace (fire station) and had their

own IS for internal communication and alarm management. The fire services and the division of social care had started to centralise the municipal alarm management using shared operators and systems but it had not been completed at the time of the study. None of the organisations had priority over others and they collaborated in a network governance pattern when they needed to. For example, they assisted each other in particular situations (e.g. automatic building alarms) to generate a shorter response time. The efficient use of resources and reducing costs might be the most important shared goals of their new collaboration. Therefore, their needs for IS included support for sharing equipment and the creation of a joint municipal alarm management centre. Therefore, the actors requested shared alarm management systems and a shared platform for information management. Again, their needs for new IS were affected by the type of network (participant networks governance) in which they were working for more horizontal collaboration.

The Norrköping Study (Study 3) highlighted four groups of semi-professionals that were considered when creating a cross-sector collaboration with the fire service from scratch. Therefore, there were no IS or any infrastructure available to support this collaboration. Semi-professionals have their own organisations and associated rules. Their regular tasks do sometimes, but not always, have something in common with the emergency response. However, the fire services and potential semi-professionals share an interest in saving lives and helping others in emergencies. Semi-professionals receive alarms simultaneously with the fire services and they are free in some, but far from all, decision-making at an emergency site to mitigate the consequences of the emergency. They are also restricted to performing certain actions due to a lack of proper competencies (e.g. smoke diving, managing explosive material) or legal obstacles (e.g. giving medicines to victims). They also receive training and guideline from the fire services about their tasks, responsibilities and risk assessment during response operations. Therefore, their actions are implicitly influenced in a top-down manner by the fire services, and they may not be considered as independent and autonomous actors in their new collaboration or as substitute fire services. While the actors in Studies 1 and 2 had access to existing IS in their organisations, semi-professionals needed entirely new IS tools to enable the new collaboration. Their expressed needs included: a mobile-phone-based application to receive alarms, to receive vital information about incidents, navigation functions which help them to arrive at the incident scene quickly and special communication channels to communicate with the alarm centre (SOS). However, since their collaboration with the fire service is not completely horizontal, but top-down in several respects, their need for shared platforms for information management and a shared understanding of situations, which are consequences of horizontal collaboration (as in Studies 1 and 2), were not evident.

5.2.4.2 Collaboration and decision-making

Collaborative action involving heterogeneous resources, collective problem-solving, equal priority in the interaction between actors and democratic decision-making have frequently been highlighted as key factors in network governance (e.g. Klijn and Koppenjan, 2012; Rhodes, 1996). They can thus be seen as corresponding to social/organisational and human-related factors which are deemed important in IS developments according to the sociotechnical ensemble view.

Regarding democratic decision-making, in Study 1, actors at the Safety House held joint meetings for managing emergencies and made decisions based on their mutual discussions and understandings. However, they did not have any system specifically designed to enable shared decision-making. The actors also complained of ambiguities about whose decision has priority over another and who can command the others, indicating a need for more formalisation in the new setting. Addressing these ambiguities is therefore an important first step in future IS developments. Furthermore, actors collaborated horizontally in order to gain a shared understanding of emergencies for collective problem-solving specifically in complex situations which also reveals a crucial need for IS dedicated to supporting decision-making. In Study 2, actors at the new fire station did not interfere in each other's work but took decisions together in certain situations as needed; for example, about how to share resources or manage alarms. However, there were also conflicts in decision-making related to such issues as budget allocation and management processes. Actors in the new fire station in Study 2 also pooled their resources and competencies to help each other; for example, they shared cars or assisted each other during specific alarms and took certain collective actions. However, again, they did not have any shared platform to support the relevant information management. Relating this to the sociotechnical ensemble view and IS development, it seems that decision-making and collective actions or problem-solving in both settings are critical factors clearly affecting actors' needs for IS and that solving these organisational issues plays a dominant role in IS development for enabling the new cross-sector collaboration settings.

On the other hand, in Study 3, semi-professionals' collaboration with the fire services is an intended future service implementation and there are thus no related IS for this collaboration. However, establishing networks with these semi-professionals may create several opportunities related to the use of heterogeneous resources and competencies. For example, some respondents (e.g. security guards and fire services day personnel) had relevant competencies that were deemed helpful in emergency response. The number of potential semi-professionals is also much higher than that of professional responders. This implies that creating a network by involving semi-professionals would create a huge pool of capacity and resources that could be used in emergency response and might promote collective problem-solving during some emergencies. However, the study also shows that semi-professionals usually choose their main tasks and do not act as first responders if they come to a situation where they need to prioritise. Semi-professionals' decision-making is also restricted. They can take some actions at the incident site but they do not have the same scope for action as the fire services in emergencies (this is also highly regulated by Swedish law) and the collaboration is administered by the fire services, which has decided the range of semi-professional tasks and responsibilities. In most critical situations (e.g. developed fires), they need to wait for the professionals. In this sense, these cross-sector collaborations take place within a more vertical decision-making pattern than a pure network governance structure. Democratic decision-making is thus less visible in Study 3, which affects IS needs. The semi-professionals need accurate dispatching and their decision-making is mostly related to what actions they should take at the incident site. They therefore require accurate key information about the incident scene, the possibility to direct calls to professional resources and also

navigational help. They may also need extra information or support based on human-related factors; for example, their competence, skills and/or fear of making incorrect decisions. Relating this to the social-ensemble view, the human factors should be identified, including their influence on IS development, and actor needs should be studied. Furthermore, semi-professionals require IS that are integrated with those systems that currently exist at the fire services and SOS Alarm, which in turn will require much effort devoted to organisational integration and the handling of legal aspects; for example, with regards to GPS positioning, which is also in line with the sociotechnical ensemble view.

5.2.4.3 Trust

Trust is usually discussed as a key factor, a central coordination mechanism and a facilitator for collaboration within networks if actors have mutual goals and consider each other's interests (Klijn et al., 2010; Deakin and Wilkinson, 1998). Using the sociotechnical ensemble view, in these studies, trust can also be seen as a human-related and social/organisational factor which is intertwined with a set of other factors; for example, the actors' mutual interests, familiarity with each other, organisational knowledge and the ability to share information. Developing appropriate IS to enable information sharing may enhance the trust between actors. Conversely, a lack of trust may prevent information sharing and thus may cause failures in the collaboration. Therefore, trust should be considered as a factor influencing IS development.

According to the results from Studies 1 and 2, the co-location of actors in their new workplace may increase trust between them because they have better opportunities (e.g. informal meetings, adjacent offices) to get to know each other. In Study 3, the semi-professionals mentioned their trust both in each other (due to shared interests) and in relation to the professional organisations. Thus, actors in all three studies seem to trust and rely on each other, which is likely to enhance the prospects for collaboration. Therefore, they believe that they are ready to utilise IS enabling shared platforms for information handling and a shared understanding of information (because they trust each other at an organisational level). Conversely, the fact that an absence of trust may cause complexities in a network; for example, in information exchange, can be seen when actors in Studies 1 and 2 are reluctant or do not dare to share their information, thus inhibiting a shared understanding of situations or preventing resource sharing. However, it should be noted that, in both studies, actors were cautious about sharing information not because of a lack of trust in each other but due to secrecy or a lack of knowledge/training about the relevant institutional rules and information handling. Therefore, although trust itself was not mentioned as an explicit hindrance, the actors did not have IS functioning as a shared platform at the time of these studies, and associated factors relating to secrecy/confidentiality might have influenced the intended and future IS development.

In Study 3, home care and fire services day personnel doubted that all actors will accept being monitored by a dispatch system (e.g. their positions). Furthermore, some actors (e.g. the home care organisation and facility services) did not express full trust in taking part in the collaborations due to ambiguities in the goals of their cross-sector collaborations and in how to prioritise between first response tasks and their everyday tasks. Also, the home care

interviewees expressed a need to create *internal trust* within their own organisation/employer rather than among the network participants so as not to create suspicion, for example, if unintentional harm to victims is inflicted by semi-professionals, or when the prioritisation of tasks and interrupting current work tasks happens. Thus, although the role of trust in IS development is not visible in Study 3, it may cause difficulties in positioning actors (e.g. via a dispatch system) and ambiguities in using IS that share information with the employer on a performed response operation.

5.2.4.4 Conflicts and institutional rules

Some of the main identified *conflicts* in network governance include conflicts of interest and strategy, perceptions of information and problems with members and institutional rules, largely due to the lack of a formal governing mechanism (e.g. Klijn and Koppenjan, 2014; Weber and Khademanian, 2008). All of these factors can be categorised as organisational or institutional and are thus emphasised by the sociotechnical ensemble view to be studied and involved in IS development.

In Study 1, complexities in the interactions between members of the Safety House can become translated into difficulties in decision-making during emergencies, which were mostly reported as being due to ambiguities in responsibilities and conflicts of opinion and strategy. Actors also did not dare to share information. This may have contributed to the fact that they did not have any IS dedicated to the new setting. In Study 2, the budget allocation was difficult and there were conflicts about how it should be performed since it was based on old laws and rules. Questions also arose such as “who has the main responsibility for the shared environment, i.e. Nyköping new fire station?” This may contribute to difficulties in developing and implementing a shared alarm management system. In Study 3, conflicts and difficulties in prioritising between roles, the uncertainty of tasks, ambiguity about responsibilities and the semi-professionals’ perceived fear of acting during response operations are examples of issues that might affect or inhibit the cross-sector collaborations. Semi-professional candidates also cited ambiguities in supportive laws when semi-professionals harm themselves, the lack of insurance, and lack of culture in their organisation about being semi-professionals. Therefore, developing IS for professionals requires a definition of their tasks and responsibilities first and potentially the adjustment of existing laws or taking precautions (e.g. insurance) to support them.

5.2.4.5 Summary

Network governance is a political science perspective or theory that highlights the different institutional factors in networks which are believed to play a key role in the success or failure of networks. This is in line with the sociotechnical ensemble view, which includes all such social/organisational and human-related factors as entangled parts of IS development. The sociotechnical ensemble view has a broader scope and sees IS as a phenomenon that is an intertwined ensemble of policies, organisational rules, laws, actors and technology, which all are important factors in IS design. However, the studies performed here suggest that they can complement each other, in that the identified network factors directly influence the actors’ need for IS and thus have a substantial effect on the development and design of future

IS and digitalisation. At the same time, in these studies recurrent key factors were also identified that are not currently part of the network governance literature but that can be captured by the sociotechnical ensemble view, focusing for example on technology, IT artefacts and human factors. Most prominent was the central role of technology and IS support in communication, information sharing and alarm management. It was perceived that the lack of adequate IS can be a major obstacle to collaboration within the emerging networks in emergency response. Also, the central role of training, equipment, semi-professionals' fear of taking part in collaborations, stress factors, and internal trust are clearly visible elements in the data. The usefulness of applying network governance to these cross-sector collaborations, along with the implications and potential benefits of combining the network governance perspective with the sociotechnical ensemble view in the analysis of emerging ERS cross-sector collaborations will be discussed further in Chapter 6.

More specifically, in all three studies, the existence of the core principles of network governance, that is, the shared interest between actors and their horizontal pattern of communication in their network (e.g. in terms of the interoperability of systems) are visible and decisive factors in forming the actors' needs for IS. Since these forms of collaboration are new and still under development, it seems that much effort must be devoted to the identified institutional and/or ensemble social/organisational factors of network governance and to handling the related unclarity and challenges, before proceeding to the concrete design and implementation of IS support. The degree of the collaborations' resemblance to traditional network governance structures also determines the actors' needs for IS. The collaborations in Studies 1 and 2 seem to embrace many core principles of network governance; while Study 3 seems to display a hybrid form of network governance and traditional hierarchical government patterns. Consequently, in Studies 1 and 2, the need for a sophisticated shared platform for information exchange and alarm management was visible since they need to collaborate in a horizontal pattern, but in Study 3 these factors could not be seen.

As to democratic decision-making and collaborative problem-solving, the latter exists in all three studies. Democratic decision-making exists mostly in Studies 1 and 2 and organisational structure, the lack of formalisation of the new settings/collaborations and ambiguities in institutional rules and even human-related factors may inhibit effective decision-making.

Trust (in its all forms) seems important as a facilitator in emerging forms of cross-sector collaboration in all three studies, and this is also specifically emphasised by network governance. However, lack of trust mainly stems from a lack of knowledge or ambiguity in institutional rules concerning secrecy issues; issues that tend to be present in most IS development and are captured by the sociotechnical ensemble view. As to the internal trust identified in Study 3, it seems not to have been discussed previously in network governance.

Table 5.4 shows the main identified similarities and differences between network governance forms and cross-sector collaboration in the three studies.

Table 5.4: Cross-study analysis showing the similarities/differences between key network governance factors and cross-sector collaborations as displayed in the three studies and with links/comparison to the sociotechnical ensemble view.

Network governance	Study 1 (Safety House)	Study 2 (Nyköping)	Study 3 (Semi-professionals in Norrköping)
Core principles	Similarities: -Heterogeneous actors with shared interests. -Collaboration between independent organisations with their own rules.		
	-	-	Differences: -Existence of implicit hierarchical control of semi-professionals' actions
Collaboration and decision-making	Similarities: -Collaborative action and problem-solving. -Democratic decision-making	Similarities: -Democratic decision-making -Resource sharing and collaboration in certain alarms	Similarities: -Collaborative action and problem-solving.
	Differences: -Central role of IT for information sharing	Differences: -Major focus not on collective problem-solving but on cost reduction	Differences: -Limited decision-making by semi-professionals -Crucial role of IT in communication between actors
Trust	Similarities: -Facilitator of collaboration -Can reduce institutional complexities		
	Differences -Potential lack of trust stems mostly from ambiguity, conflicts or lack of training in institutional rules about secrecy, not from a lack of respect for each other's interests		Differences: -'Internal trust' not discussed in network governance
Conflicts and institutional rules	Similarities: -Ambiguities in responsibilities and conflicts of opinion and strategy -Institutional rules/laws as obstacles	Similarities: -Ambiguities in institutional rules revealed in budget allocation	Similarities: -Complexities/conflicts, e.g. ambiguities in responsibilities, and prioritising between tasks -Institutional rules/laws as obstacles
	Differences: -Lack of proper training/knowledge for information handling/sharing		Differences: -Ethical challenges Additional factors identified -Additional factors such as 'fear', 'stress' and 'motivation' may cause conflicts

5.3 A conceptual context-specific framework for emerging cross-sector collaborations in ERSs

This section presents the latest version of the conceptual context-specific framework and a brief description of its dimensions. Relating to the thesis objective, this framework is intended to be used in exploring emerging forms of cross-sector collaboration in ERSs to identify such aspects as the emerging challenges, possibilities and actor needs relating to IS/IT artefacts.

The framework is intended to reduce the risk of overlooking important aspects of the collaboration by presenting the various aspects of cross-sectoral forms of collaboration in ERSs that are deemed crucial in studies and development. This framework was used in the studies performed to aid in data collection and supporting user participation activities. There is no fixed relationship between dimensions, although the actors’ challenges, opportunities and needs within the collaborations are always the *point of departure* when the framework is used for analysis. For example, actors’ tasks should be analysed in order to identify and explore the related challenges, opportunities and needs when actors perform their tasks within the new collaborations.

The framework was developed in several steps. The development of the initial version is described in Paper 1. The entire development process is presented in detail in Paper 3 and is not repeated here. Paper 3 also describes the current version of the framework and its dimensions in more detail. The use of the framework as an instrument of inquiry to explore forms of collaboration is also described in detail in Paper 3. How it can support user participation activities is described in Paper 4 and section 5.5. The latest version of the framework is shown in Figure 5.1

Figure 5.1: The framework with added theoretical grounding used in Study 3.

The final list of important framework aspects/dimensions identified includes:

1. Actors’ identity – type and role. Types of actors, and particularly potential new actors, in ERSs, such as *semi-professionals*, *volunteers* and *bystanders (laymen)*. Their roles can be categorised as *first responders*, *assistants* and *supportive actors*.

2. Actors' attitudes within new forms of collaboration. Actors' feelings and attitudes to and within the collaborations are considered an important factor. A perceived fear of acting in an emergency, trust or mistrust between actors, and ambiguities about goals and visions in response operations are some examples.

3. Training. The extent and type of training (e.g., in firefighting, first aid, or cardiopulmonary resuscitation) that actors receive have a great impact on their ability to participate in response operations.

4. Actors' background. Qualifications, experience, age, and physical and cognitive abilities are examples of factors that have a decisive role in what actors can do and what types of tasks they can be given.

5. Actors' tasks and responsibilities. Actors in response operations may perform many different actions, such as basic life support, putting out fires, logistic help, etc. However, the clarity of their responsibilities and tasks in response operations of different types should be identified, defined, explained and discussed.

6. Actors' availability and accessibility. The extent to which actors are available and how they can be accessed are important factors. Ways to involve and organisationally integrate actors in emerging forms of cross-sector collaboration, including involvement procedures, agreements, contracts and financing, should be identified, studied, discussed and implemented.

7. Incident type. In some incidents (e.g., fires, health issues and traffic accidents), actors may function as first responders to provide first aid or as supportive agents to provide transportation services, vehicles and/or appropriate tools. Therefore, incident type along with actor type has an important impact on actors' tasks, roles and responsibilities.

8. Communication method. Effective communication is the foundation for effective collaboration and can support coordination between actors. The RAKEL system, SMS services, and mobile phones are current examples of common methods of communication between actors in the contemporary Swedish ERS.

9. Information Technology (IT). IT from the actors' perspective is a set of tools that can facilitate information exchange between actors during response operations, either to acquire information about incidents or to provide information to others. A shared platform for information exchange and portable devices for viewing information are examples of IT tools that can facilitate communication and collaboration.

10. Emergency supplies. Inappropriate equipment causes problems during response operations. For example, using non-portable radio systems at an emergency site can hinder communication between actors. High-quality equipment that is designed according to actors' tasks and needs can have a significant positive impact on establishing new forms of collaboration.

11. Organisational structure. Actors are categorised under *organised structures* of varying sizes (e.g., semi-professionals, Red Cross volunteers, local sports clubs) or *unorganised structures* (e.g., civil volunteers) and accordingly may have different tasks and needs in response operations.

12. Leadership. Decision-making and leadership have an important role in emergency response and in controlling the response operation. In some cases, for example, in a network governance structure, the leadership role may not be as clear as in hierarchical models, and thus should be carefully studied and considered.

13. Costs/benefits. Associated benefits and costs, such as resources, IS, and equipment, should be analysed and calculated, especially at a strategic and political level, to enable the motivation, discussion, decision-making and implementation of new forms of collaboration.

14. Work environment. Actors may have different work environments, work in new organisational contexts, or may not even reside within an organisational work environment (e.g., civil volunteers). This can cause problems because regulations, information confidentiality and job contracts may not be clear to actors in the new work environment. These problems may be especially great in cross-sector collaborations due to multiple organisational belonging and conflicts between rules, loyalties and the prioritisation of tasks.

15. Regulations and legal issues. Since the collaborations under study are relatively new, a number of problems may appear because it is not yet clear what Swedish law states about responsibilities, limitations, job contracts, financing, job safety and the tasks of new actors in response operations. Therefore, what actors are legally and ethically allowed and not allowed to do must be investigated.

This framework is based upon empirical data from the baseline study, and feedback from Studies 1 and 2. It also takes sociotechnical systems theory as its theoretical foundation (see Chapters 3 and 4). In retrospect, the framework may miss or does not highlight some factors if it is compared to the performed network governance/sociotechnical ensemble view analysis. For example, collaboration forms, collective problem solving and shared interests between actors are not part of the framework. Trust is under 'attitude' dimension in the framework but may not be sufficiently visible. Accordingly, such factors may need to be incorporated into IS development and thus into the framework. Furthermore, the technical factors emphasised are in the framework, having their own parent dimension. In this sense, the framework reflects both sociotechnical systems theory and the sociotechnical ensemble view to a greater extent than network governance, which does not usually deal with technical matters since it stems from other research disciplines (e.g. political science, public administration). How the theories and the framework may complement each other will be discussed further in Chapters 6 and 7.

5.4 Challenges of applying user participation to IS development in cross-sector collaborations in the Swedish ERS

In this section, the four main challenges to user participation activities that have been identified in IS development in ERS cross-sector collaboration are presented. In relation to this, the experiences from user participation activities (mostly Future Workshops) in the first two studies (Safety House/Nyköping municipality) are first summarised as a brief background. Then, the identified challenges and actions from observing user participation in Study 3 are presented in detail. Finally, the use of the framework in user participation activities and its potential to support these activities are described.

Studies 1 and 2 were rather short and limited to only two of the IS development phases; that is, organisational and needs analysis. However, the challenges experienced in holding Future Workshops (e.g. difficulties with stakeholder involvement and unknown stakeholders) during these studies were the reason for performing the systematic observation of user participation in Study 3 (semi-professionals) in order to identify the associated challenges and suggest actions. The results are published in Paper 4 but are partly replicated in this thesis to maintain readability (however, see Paper 4 for details of the challenges faced in each IS development phase). Some of the results from applying user participation in Study 1 (Safety House) are also present in Paper 3; however, the focus of that paper was mostly on framework use and not on user participation in a broader sense. The experience of user participation employed in Study 2 (Nyköping) is new to this thesis.

5.4.1 User participant challenges and suggested actions

As described in Chapter 2 of this thesis, all activities which involve stakeholders in IS development are viewed as efforts to achieve participation and catch stakeholders' voices. Therefore, they are considered to be user participation activities even though some of them are not part of more 'traditional' user participation toolboxes. For example, focus groups might be seen as a qualitative research method rather than an explicit user participation activity, but they have been used in this thesis (and in other PD studies, see Chapters 2 and 6) as a way to involve stakeholders when it was not possible to hold joint meetings with them in a resource-strained environment. They may also be common in general systems development processes, but here they were conducted specifically to facilitate stakeholder involvement and produce user participation outcomes.

The main user participation challenges identified in this thesis are:

- Unknown end-users and stakeholder groups
- Lack of shared understanding between stakeholders
- Lack of sufficient competencies
- Developing a collaboration, which does not yet exist, within a resource-strained environment.

5.4.1.1 Challenge #1. Unknown end-users and stakeholder groups

Experience from Safety House and Nyköping municipality: During the organisational and needs analysis at Safety House, the fire services, the police, the alarm centre and supportive actors were clearly recognised as stakeholders in the first meeting with the project manager. Some of them had already been selected and invited by the project manager, including the fire services, the police and the Swedish Defence. Therefore, not all of the relevant stakeholders were present during the interviews and the Future Workshop. Furthermore, following the interviews with representatives from the involved stakeholder groups, it transpired that some dimensions of the collaboration, such as 'Leadership' and 'Organisational Structure', could not be explored without stakeholders from, for example, the municipalities, the police and fire service management. It also became clear that there are important existing collaborations between the police and volunteers; for example, those who are sufficiently familiar with the region and landscape to search for missing persons. These would probably be affected by the new organisational setting and should be involved in the development process. The interviews with the fire services and the police also revealed that the municipality affects many decisions and is an important part of the new setting and that the role of the county administrative board is vital during large-scale emergencies. Therefore, to overlook a more comprehensive stakeholder identification was, in retrospect, perceived as an inappropriate decision in the Safety House Study. During the Nyköping municipality organisational and needs analysis, the set of primary stakeholders was limited and known beforehand; that is, they took part or were about to take part in an existing collaboration. Thus, stakeholders from the fire service, the division of social care and the technical division were involved in interviews and a Future Workshop. After the interviews, the need to also involve stakeholders from ambulance services and healthcare was evident since they had close collaborations with the fire services and the division of social care.

Results from Norrköping Study (semi-professionals): In retrospect, Studies 1 and 2 were deemed to illustrate the need for a thorough stakeholder identification in the emerging collaborations. In addition, in the studied case, the use of semi-professionals as first responders in Norrköping municipality, a major difference complicating the issue of stakeholder involvement, was that the intended cross-sector collaboration was new to all the parties involved. Not only stakeholders in a more general sense, but also the potential primary end-users – semi-professionals – were not known at the outset of the project and study, and their tasks were thus not defined. It was initially unclear even to the project manager who or what organisation(s) would be involved. This challenge showed itself at the project's initiation, while creating plans and launching the development of the cross-sector collaboration. For example, during the initial project meeting, one of the researchers said:

"...What are the tasks that they [semi-professionals] should do? Who are they? From what perspective should we discuss them? It's too broad."

Given the above situation, it was perceived as difficult to initiate the user participation activities.

Action. Formation of the core design group. The project manager and the researchers decided to form a *core design group* by involving the known and available stakeholders. For

example, the fire services were clearly part of the intended cross-sector collaborations and thus were involved. The project had been initiated by the municipality and therefore the security manager of the municipality was contacted and involved. The overall need for an IT system to facilitate semi-professional dispatching, navigation and communication was also clear from the beginning and thus an IT company had already been involved. The core design group members were thus: the project manager, the group of researchers, a representative from the fire services, the municipality's security manager and a representative of the IT company. However, at this stage, it was not possible to involve any end-users since they had not been identified and it was not clear who or what occupational groups can work as semi-professionals. The core design group had the role of making decisions related to the entire development process, data collection and analysis and user participation activities and their structure.

5.4.1.2 Challenge #2. Lack of sufficient competencies to perform stakeholder identification

Results for Norrköping Study (semi-professionals): This challenge had not been discerned in Studies 1 and 2, since they did not include stakeholder identification. However, it was clearly observed in the stakeholder identification in the Norrköping municipality study. As mentioned above, it was not clear to the core design group what organisations would be affected by or affect the intended collaborations and thus should be involved as stakeholders, or even as primary end-users. To facilitate the analysis, the context-specific framework was introduced to the core design group by the researchers as a support tool (See section 5.5). This highlighted the different dimensions of collaboration in ERSs that it was deemed necessary to explore. However, the core design group did not have sufficient competencies to cover all of the framework dimensions. For example, task, responsibilities and required training were difficult to explore because of the lack of end-users in the core design group.

Action. Formation of the extended design group. An *extended design group* was formed, including additional participants. Core design group members knew stakeholders who had close collaborations with the fire services (e.g. the police) or had related experiences in cross-sector collaboration with the fire services (e.g. security guards and home care); for example, in other municipalities or projects. They selected stakeholders who could help to explore the framework dimensions. The extended design group included the police, municipal home care, fire services day personnel (e.g. inspectors and technicians), and a security guard company, in addition to the core design group members. Some of the stakeholders could be potential end-users (e.g. home care) but during this step it was not clear who these might be.

5.4.1.3 Challenge #3. Lack of shared understanding about the new cross-sector collaboration among stakeholders.

Safety House and Nyköping studies experience: In the organisational and needs analysis phases, stakeholders at the Safety House and the new fire station in Nyköping had complained numerous times about ambiguities in their respective project goals, vision and plans, and, in the case of Nyköping, some end-users perceived it as difficult to balance between their everyday work tasks and the new ones. These ambiguities sometimes caused resistance to accepting the collaboration between the involved organisations. Relating this to

IS development and user participation challenges, there was a perceived lack of shared understanding about the project/collaborations between stakeholders. This challenge was very much present, even though the collaboration had been in progress for a while. It seemed that no one had paid attention to addressing it more systematically.

Norrköping Study (semi-professionals) results: The dilemma described above also manifested itself clearly in the Norrköping municipality study. In both the core and extended design groups, stakeholders were heterogeneous and had different backgrounds, interests, knowledge and experience about cross-sector collaboration. Therefore, their interpretations and understandings of the project and related concepts and core values were different. One example was various interpretations of the term ‘emergency situation’ between the fire service and home care in the extended design group, since both groups had worked with emergency situations but in different contexts.

Action. Brainstorming, discussions and literature review. To achieve some shared understanding, the core design group held a meeting in which *brainstorming* and *open discussion* were used to understand the key values, the concepts of ‘cross-sector collaboration’ and ‘semi-professional’ and the relevant organisations. Participants could freely ask and give their opinion. At the end of the meeting, all participants had a reasonably clear view of the project. Furthermore, the researcher group was assigned a literature review task to seek examples of cross-sector collaborations in emergency management, both in Sweden and internationally. The results of this literature review were shared with all other members of the core design group. The shared understanding was presented later to other stakeholders in the subsequent user participation activities; for example, via presenting the project values and concepts and creating scenarios.

5.4.1.4 Challenge 4: Developing a collaboration, which does not yet exist, in a resource-strained environment

Nyköping study experience: This challenge was not noted in the study of Safety House but it was present in the Nyköping municipality study, where the collaboration between the fire services and social care in the new fire station existed, but was new to the technical division. The latter did not know what their role and responsibilities were and their new tasks were not yet defined. Therefore, it was perceived as difficult to involve them in the organisational analysis and needs analysis or to ask them about their collaboration needs and associated challenges and opportunities. Furthermore, they already had tight schedules and did not have dedicated time to participate in the user participation activities. For example, they left the Future Workshop to attend their daily tasks.

Norrköping Study (semi-professionals) results: Bringing the above experience to the Norrköping municipality, where the collaboration was new not only to one, but to all the project partners, the challenge manifested itself during all project phases and in different forms. Firstly, the stakeholders and also, during later phases, the end-users, were from different organisations and had different working timetables. They had no formal responsibilities or dedicated time to take part in the user participation activities aimed at developing the cross-sector collaboration. Therefore, it was very difficult to arrange joint meetings or create user participation activities to involve them actively in the design process.

Secondly, since the intended collaborations were new to stakeholders/end-users, they found it difficult to reflect upon and discuss a situation of which they had no experience. They did not have any frame of reference for discussion in user participation activities during any of the phases. This challenge manifested itself most explicitly in the needs analysis when the core design group decided to involve end-users in a second Future Workshop. Thirdly, the number of participants had to be limited since there was only one group (fire service day personnel – see Papers 4 and 5) to invite and not all of the participants showed up. Thus, again it was perceived as difficult to hold the workshop in the planned format. Fourthly, during the design phase, many traditional user participation methods, such as prototypes, mock-ups, roleplaying and wireframes, could not be used for user involvement/design purposes because they mainly apply to technology and artefact design/evaluation, assume the existence of end-users who are familiar with the context to be designed for, and do not embrace the design of a comprehensive surrounding infrastructure/organisational setting. Here, cross-sector collaboration did not yet exist and end-users had no experience of it at all. Although the mobile app is an IT artefact, its design and evaluation not only embraced technical matters but also had to involve many other aspects and elements; for example, legal issues, training and other stakeholders (organisations responsible for dispatching semi-professionals).

Actions. Stakeholder involvement using scenario-based Future Workshops, focus groups and an exercise/AAR. Several actions were taken to mitigate the challenge of finding joint time-slots for user participation activities. For organisational analysis, the core design group decided, rather than having a larger workshop, to involve the end-user groups at operational and management level in six focus group interviews, which require smaller groups than Future Workshops.

Furthermore, the extended design group was involved in two one-day concentrated Future Workshops relating to the stakeholder and needs analysis phases, instead of several user participation activities stretching over a longer time period. The point of departure is usually the current work situation, as it had been in the Future Workshops at Safety House and Nyköping. However, here, the lack of context and the work situation made it impossible to carry out the Future Workshop in the same way. The core design group thus developed three short and easy-to-understand scenarios for the involved stakeholders to trigger discussion and keep the focus of the activities on the subject/emerging collaboration context. These scenarios were designed in a way that covered the most frequent emergencies (in this case a traffic accident, fire in a building, cardiac arrest). Participants were also free to think of other scenarios. Furthermore, the framework was presented to them and they were asked to use it as a point of departure in their discussions and to cover or explore the dimensions as much as they could.

In the second Future Workshop as well, the core design group decided to change the format to compensate for the low number of participants. Therefore, participants thought about their needs individually and then discussed them with the core design group. To assist them, the focus of this workshop was narrowed and participants were asked to focus on three types

of need: the needs for training, emergency supplies and IS support, which were deemed necessary for the design and test phases.

During the design/evaluation phase, the user participation design toolkit, the core design group decided to capture the end-users' perspective and enable participation by creating a part of the intended infrastructure; that is, the future cross-sector collaboration for end-users using exercises/simulations. Therefore, a simulated traffic accident was conducted with two victims, and the identified needs and the use of the smartphone app were tested and observed. The smartphone app has been developed by the IT company in parallel with the needs analysis and was based on the primary needs for IS support identified from organisational analysis. Two semi-professionals and other stakeholders representing the ambulance services and fire services took part in this exercise. An after action review (AAR) was held afterwards to capture the end-users' and other participants' voices as related to the exercise.

5.4.2 User participation outcomes

In the **Safety House and Nyköping studies**, Future Workshops in combination with the results of interviews and the participant observation had led to a list of opportunities and challenges associated with the collaborations and a list of stakeholders needs, including general needs and the needs for IS support, training and equipment. The results from Nyköping were handed to the relevant organisations and stakeholders (e.g. the fire services) in the form of a Swedish-language report written specifically for practitioners. The results from Safety House were published as a scientific text (licentiate thesis) and as Paper 2 and were also sent to the project manager at Safety House.

In the **Norrköping study (semi-professionals)**, the performed user activities in combination with suggested actions led to:

- A list of four selected semi-professional candidates, including the fire services day personnel, home care personnel, facility services personnel, and security guards. Factors such as availability of resources with relevant training in the municipality, their ability to interrupt their current work when receiving alarms and the geographical spread of resources were used for this selection (see Paper 5 for details)
- Selection of the fire services day personnel as the main candidate for semi-professional first responders because other end-user groups and their organisations had tight daily schedules or did not currently have the ability to support collaborations; for example, because of substantial ongoing organisational changes
- A list of general challenges, opportunities and different types of general needs (e.g. the need for organisational changes, law changes, insurance)
- A detailed list of user needs for training, emergency supplies and IS support
- A smartphone-based app prototype
- Compiled packages/checklists for training, emergency supply, and IS support when introducing semi-professionals as first responders in a municipality
- All of this produced as a Swedish-language report written for practitioners.

The needs lists and packages were sent to experts in the emergency response organisations for further review and possible implementation. Subsequently, some user participation outcomes were sent exclusively to responsible stakeholders (e.g. fire services and the municipality) in the current project (e.g. the lists of needs, opportunities and challenges). Other outcomes, e.g. the report and the packages/checklists, have been made publicly available to be used by any municipality in Sweden. The smart-phone app prototype has been further developed and applied in a similar project involving civil volunteers as first responders.

5.5 Using the framework in user participation activities

As mentioned several times, the framework presented in section 5.3 was also used specifically as a support tool in IS development and related user participation activities to facilitate stakeholder identification and participation and to create a frame of reference for discussions and data inquiry. The framework as user participation support tool is discussed as part of Paper 3 and as a short reflection in Paper 2. Below, the most important aspects are described in more detail.

When using the framework as a support tool in user participation activities, first, all framework dimensions should be overviewed and the relevant dimensions should be selected for the project. For example, in the Safety House (Study 1), the ‘availability’, ‘role’ and ‘incident type’ dimensions were not considered relevant since the actors were professional actors in emergency response and were well-known, thus there was no need to explore these dimensions further. In the Norrköping Study (Study 3), on the other hand, it was decided to include all the dimensions in the development processes since both the actors and the context were new and unknown. In the next step, all relevant stakeholder groups should be identified and involved in user participation activities. Relevant stakeholders can be defined as those who are connected to the collaborations; that is, they have related experience or knowledge, can affect the collaboration or are affected by it. These connections can be identified with the help of the framework to actively identify those who have any type of relation to the selected framework dimensions. In ERSs, this may include main response actors (e.g., the fire services, the police, ambulance services, alarm centres) and semi-professionals as primary end users, and also, for example, managers, administrators, economists and jurists as stakeholders. Stakeholders may also act as external experts if other stakeholder groups cannot provide sufficient information to cover the selected dimensions. For example, the framework demands the involvement of persons with knowledge about the law or leadership if these are counted as relevant dimensions in a project. For example, the need to involve stakeholders from the municipalities was evident in Studies 1 and 3 to cover dimensions related to organisational structure, legal issues and leadership.

The framework may also be used as an instrument of inquiry in user participation activities; for example, by developers for designing templates, questions, interviews, scenarios, surveys, participant observations, etc., by taking the selected dimensions as points of departure. The framework has also been specifically designed to be used by participants themselves (see

Papers 3 and 4). Therefore, identified stakeholder groups may use the framework dimensions in user participation activities as a frame of reference to create shared understanding (e.g. as in Study 3), to discuss forms of collaboration and to try to explore the selected dimensions. For example, the interview questions can be bound to the selected dimensions and are intended to cover them sufficiently. The Future Workshops in these studies were also designed in such a way that participants could discuss the relevant dimensions of the framework in order to identify the opportunities, challenges and actors' needs in the new setting. Using the framework for the analyses (e.g. organisational and needs analysis) can be achieved by categorising the data in the parent dimension and identifying the opportunities, challenges and needs in each parent dimension. For example, data related to task/responsibilities aspects of collaboration can be divided into three categories: 1) the opportunities to perform the new tasks, 2) the related challenges in performing the task and 3) the required training, emergency supplies and IS support. This process is repeated for all four parent dimensions. For example, the 'regulation and legal issues' dimension can be studied and analysed in order to understand how laws and policies may affect or inhibit user needs for IS; for example, in relation to information exchange.

6 DISCUSSIONS

This chapter first discusses the results of this thesis in terms of IS development for ERS cross-sector collaborations. The specific contribution of the results and their potential implications for the field of IS are highlighted. The theoretical approaches of the sociotechnical ensemble view, along with network governance and sociotechnical systems, are then discussed, with a focus on their usability in this context and their potential to complement each other. Subsequently, the challenges and needs identified in the thesis when applying user participation in IS development for cross-sector collaborations and their implications for emerging public sector initiatives are discussed. Finally, the benefits and drawbacks of applying the contextual framework as part of user participation activities are reflected upon and related to the analytical framework used in the thesis.

6.1 IS development for ERS cross-sector collaborations

IS seem to be ubiquitous in modern societies, and the digitisation of different societal contexts includes ERSs (Martin, 2008; Walle and Turoff, 2008; Chen et al., 2007). An understanding of the context, the potential challenges and the actors' needs is in turn a prerequisite for IS development (Mumford, 2006; Laudon and Laudon, 1999). In relation to this, the sociotechnical ensemble view emphasises the importance of involving a broad range of social, institutional and technical aspects and elements during IS development (Bijker, 2010). When it comes to ERS cross-sector collaboration, IS are vital to support collaborations between actors, in which the needs for better communication and information sharing, decision-making and information analysis are apparent. ERS cross-sector collaboration is a rather recent phenomenon (Pilemalm et al., 2016a; Weinholt and Andersson Granberg, 2015; Sun and Wallis, 2012) and the related research and available knowledge were deemed somewhat scarce and fragmented when the thesis work started in 2012. The main identified research gap was thus the lack of knowledge about cross-sector collaborations in ERSs, which is required for the early phases of IS development and provides a baseline for further design and digitalisation. In line with the thesis objective, that is: *to explore IS-related opportunities, challenges and needs aimed at supporting heterogeneous actors in emerging cross-sector collaborations in the context of ERSs using the sociotechnical ensemble view*, the main contribution of this thesis to the IS research field is thus IS-related knowledge about cross-sector collaborations in ERSs in terms of the potential *opportunities, challenges and actors' needs* that may affect, support or inhibit IS development and, consequently, the entire cross-sector collaborations. At a more practical level, this knowledge can be used by practitioners (e.g. project managers, systems developers, authorities and response organisations); for example, to create lists of actors' needs for IS, training and equipment, and checklists for establishing collaborations.

First, IS development and support may work as an enabler of the most important potential *opportunities* associated with the collaborations: collective action, collaborative problem-solving and increasing emergency response capacity through the joint pooling of existing and

new resources and the sharing of equipment and alarm centres to improve response time and reduce costs. Similar recent perceived benefits and potential have been the focus of cross-sector collaborations discussed under the term ‘collaborative emergency management’ (Kapucu and Ustun, 2017). However, the ability of intergovernmental and inter-organisational relations and the involvement of non-governmental actors to increase the capacity of communities have been discussed mainly in relation to disasters and large-scale incidents (Nohrstedt et al., 2018; Kapucu and Demiroz, 2017; Nguyen et al., 2017). It has recently been pointed out that such collaborations are a necessity and might be the only way to manage the response to such developments as the increasing number of severe storms and huge wildfires (e.g. 2018 in Sweden, the USA, and Greece) (Henkey, 2017). Henkey argues that it is beyond the capacity of an individual organisation or sector to handle these challenges, and that they need cross-sector collaborations. At the same time, the trend towards involving cross-sector collaboration and new occupations in daily emergency response is increasing in many countries, not least in Swedish municipalities, thus motivating the work of this thesis. A recent additional example (to the thesis), are car-park guards (as semi-professionals) equipped with emergency supplies.

In the public sector in general, the benefits of cross-sector collaborations have also been emphasised (e.g. Johnston and Finegood, 2015; Jones et al., 2015; Grudinschi et al., 2013; Alford and O’Flynn, 2012; Agranoff and McGuire, 2010; O’Leary and Bingham, 2009; Bryson et al., 2009). For example, they highlight the significant role of networks, information sharing and resources, private-sector partnering, and the involvement of citizens. From an even broader perspective, public sector cross-sector collaborations have been discussed under different terms, such as: network governance, new public management, public-private partnerships, e-government and e-health, as a potential solution to many public challenges (Agranoff, 2007; Waugh and Streib, 2006). Given this development, and relating it to an IS perspective, IS can be seen as a central enabler of these cross-sector collaboration opportunities by facilitating communication, information sharing, decision-making and alarm management. For instance, in the context of this thesis, the dispatching of extra resources to add capacity to a response would not be possible without alarm and dispatch systems and decision-support systems for dynamic resource allocation. In turn, proper IS support to realise the identified potential and opportunities needs to address the associated challenges and needs.

The *challenges* associated with the cross-sector collaborations explored in this thesis were often legal, organisational and ethical. In retrospect, those most crucial to all three studies, to varying extents, were: ambiguities in actors’ tasks and responsibilities, the need for formal steering mechanisms to prevent institutional conflicts and to regulate such aspects as the prioritisation of tasks, and the need for supportive laws and legal frameworks; for example, in term of insurance. In addition, the actors did not have sufficient IS cross-sector platforms to share information, and it was thus challenging to manage information (e.g. to gain situational awareness), including when the collaboration was in progress. These circumstances are probably related in part to the legal and organisational challenges that need to be addressed in any IS design. Other studies on the Swedish ERS have highlighted related challenges and difficulties in building trust and legitimacy, gaining a shared understanding of incidents, insufficient categorisation of responsibilities, ambiguities in

actors' needs, uncertainty in communications and the lack of incentives as potential challenges when involving other resources and creating networks in ERSs (e.g., Ramsell et al., 2017; Pilemalm et al., 2013; Berlin and Carlström, 2011; Palm and Törnqvist, 2008). From a wider perspective, similar challenges and the inherent complexities of interactions between institutions have been investigated in both the network governance and the cross-sector collaboration literature (Klijn and Koppenjan, 2014; Babiak and Thibault, 2009). For instance, institutional conflicts have been identified as one of the central challenges in networks and cross-sector collaborations (Klijn and Koppenjan, 2014; Christensen and Lægreid, 2010). However, the challenges identified in the literature (ERS and/or cross-sector more generally) are mostly seen from a single perspective (e.g. technical) or focus on a specific topic; for example, trust, lack of incentives or institutional complexities.

Relating to the above, the thesis adds to previous knowledge, making a contribution by providing a sociotechnical ensemble view which provides a multi-angle perspective on the common challenges identified and also considering their relations to future actor needs and IS development. The results show that future IS development needs to address these challenges; for example, the social, organisational/institutional and human elements in IS collaborations. Probably the most important aspects are to resolve the ambiguities in tasks and responsibilities and tackle the legal issues, which are a prerequisite for cross-sector collaborations; otherwise, no collaboration can be established.

As to *actors' needs*, in addition to addressing the identified challenges, the thesis points to substantial, basic and concrete needs for IS (e.g. a shared platform for information sharing and alarm management), training and emergency supplies. Many of the identified needs are also in line with previous ERS literature. For example, proper training in trauma care can improve patient safety at an accident scene in a study of bystanders who perform first response (Pelinka et al., 2004). As to IS, the need for the proper and optimised positioning of professional resources for faster response have been shown in several studies (e.g. Leknes et al. 2017; Andersson Granberg and Värbrand, 2007). Turoff et al. (2004) identify the needs for system training and exercises, accessing vital, up-to-date and correct information and the free exchange of information. Schraagen and Ven (2011) have also highlighted skills in communication, critical thinking, situational awareness and adaptability as the human-related needs affecting decision-making in emergency response. Several studies also reveal the need for documentation of the collaboration concept, clear leadership, collaborative exercises, shared responsibility and appreciation for better trust and motivation in emergency response teams (e.g. Berlin and Carlström, 2014, 2011). However, these needs are not usually connected to cross-sector collaborations but to emergency response in general. Furthermore, they are also mostly about large-scale emergencies and have a specific theme (e.g. technique, human, teamwork, exercises). The needs for specific training, emergency supplies and IS in cross-sector collaboration (e.g. in relation to semi-professionals) have not been explored in previous literature.

Thus, this thesis also contributes in relation to needs, by providing a comprehensive picture and a sociotechnical view of what actors may need in their cross-sector collaborations and from the related IS support. The identified needs seem more context-specific than the

identified opportunities and challenges. For example, semi-professionals need fire extinguishers, related training and specific dispatch IS functions to be involved in cross-sector collaborations with the fire services. The creation of cross-sector collaborations in other contexts (e.g. healthcare) is likely to need different equipment and training. Many needs identified in this thesis can therefore probably be used or adapted for other ERS cross-sector collaborations; for example, in the form of checklists or as inspiration. The transferability of the thesis results will be discussed in Chapter 7.

6.1.1 Implications for practical IS development

This thesis' focus on identifying opportunities, challenges and actors' needs in cross-sector collaborations has thus several implications that can be related directly to practical IS development. It has repeatedly been argued that many challenges in IS development are organisational and institutional, and numerous studies emphasise the importance of contextual factors as potential hindrances to IS development (e.g. Mumford, 2006; Laudon and Laudon, 1999; Christel and Kang, 1992). This is also in line with the sociotechnical ensemble view, in which technological development is defined within its context, embracing all those organisational, human-related and technological aspects and elements (Bijker, 2010). However, despite their perceived importance for developing IS, in practice, not all development processes carry all of the analyses, sometimes due to the potential expense and resource needs. In particular, stakeholder analyses often receive insufficient attention (Lindgren, 2013).

The findings of this thesis do not only confirm the need for a sociotechnical ensemble view, but it may also be argued that the need to place primary emphasis on early IS development becomes even more intensified in the environment of ERS cross-sector collaboration, where collaborations are frequently built from scratch and where heterogeneous resources have to collaborate, sometimes with no previous experience of joint working or without knowing each other. To a certain extent, the three studies had different forms and purposes. However, in all of them, heterogeneous actors came from different sectors and were expected to collaborate in order to achieve shared goals. Organisational, institutional and legal aspects, and ambiguities related to stakeholders (who are the users?), roles, tasks, responsibilities and prioritisation became more substantial the more undefined the new joint setting was (e.g. in Study 3). This implies that, in an ideal world, in order to develop IS for a cross-sector collaboration, first, the collaboration should be established, the infrastructure should exist or be created, the stakeholders should be identified and involved, and all the important related challenges should be addressed. Concrete examples from this thesis' results include: ethical and legal considerations about actors' geographical positioning, which need to be addressed in advance before developing the mobile app for semi-professionals; organisational secrecy rules and laws hindering actors from having a shared platform for information management; creating new insurance; legislating supportive laws for semi-professionals; and formalising the roles, tasks, responsibilities and prioritisation in the new setting. The importance of building internal organisational trust was also identified as an organisational/human-related factor, a lack of which could halt the entire collaboration, and thus any IS development-related processes. However, at the same time, the thesis shows, unsurprisingly, that these ideal IS development prerequisites seldom exist in reality. On the contrary, in these three

studies, at least one collaboration was not yet established, all the relevant stakeholders had not been involved when creating the collaborations and many challenges remained unsolved. How IS development might address this more practically is discussed in more detail in section 6.4, on user participation.

At the same time, the need for organisational and needs analysis, that is, a focus on the early phases of IS development, becomes something of a paradox, since the involved resource-strained public sector organisations need to invest their resources (e.g. first responders) in time-intensive development at the same time as they experience difficulties or cannot spare them. In other words, they have to weigh short-term investments/costs against long-term benefits. On the other hand, the rapid development and transformation of IT, accessible to most people in our society, might somewhat compensate for the effort that needs to be expended on the early development phases. Research claims that IS development over the past decade has become more about adapting, re-configuring and integrating existing commercial off-the-shelf (COTS) technology or legacy systems (i.e. existing and old systems) rather than developing IS from scratch (Robertson and Simonsen, 2012). This trend is also visible in the studies in this thesis, which ‘only’ span the time period from 2012 to 2016. For instance, while actors at the Safety House (2012) requested portable IT solutions (e.g. for navigation systems and alarm management), semi-professionals in 2016 already possessed smartphone applications that could be used for alarm management; for example, the design solution was already in place but needed to be adapted to user needs, adding cross-sector functionality. The identified needs for IS in the thesis are mostly technically feasible. For example, information-sharing features can be added to the organisations’ existing IS or there are already COTS alarm management systems available that can be reconfigured with cross-sector collaboration features. The results of this thesis thus suggest that developing IT artefacts from scratch may not always be necessary for emerging cross-sector collaborations. The focus might rather be on customising existing solutions and integrating them into professional response organisations’ and authorities’ own systems, and/or adding the cross-sector collaboration features that are needed by actors. This may imply that efforts can be devoted to developing the surrounding infrastructure, handling stakeholders, laws, policies, organisational matters etc.; for example, focusing on the social/organisational elements in the sociotechnical ensemble view. Still, the dilemma of developing IS in resource-strained organisations remains.

6.2 The use of sociotechnical systems theory, the sociotechnical ensemble view and network governance

In the analytical framework of this thesis, sociotechnical systems theory was primarily used for the development of the framework during the initial work. The socialtechnical ensemble view was used during later phases to relax the system view and allow the incorporation of more entangled approaches, elements and aspects. Network governance was used as an analytical lens in the cross-case comparisons, together with the sociotechnical ensemble view. Here, the thesis provides some specific *theoretical contributions*, for example, in applying

the sociotechnical ensemble view to IS development for ERS cross-sector collaboration, characterising the collaborations as hybrid forms of network governance and suggesting that network governance may actually need to introduce IS as a key factor, when analysing not only cross-sector collaborations but networks in general. The use of network governance, the sociotechnical ensemble view, sociotechnical systems theory and their combination in the thesis is discussed in the following.

6.2.1 Perceived limitations of sociotechnical systems theory and the use of the sociotechnical ensemble view

Sociotechnical systems theory was used as a theoretical paradigm for developing the framework. Viewing ERSs as sociotechnical systems during the initial phases of the thesis work was due to the aim of incorporating both the technical and non-technical aspects of collaborations. Thus, above all it was used as a tool in IS development processes, mostly through the development of the thesis' conceptual framework. The theory was deemed helpful in understanding existing ERSs and the emerging cross-sector collaborations using a systems approach in which different components work together to achieve the system goal. Therefore, the framework systematised different aspects, factors and components of the collaborations and presented them as framework dimensions. Similar efforts have been made in other domains; for example, in clinical systems, military systems and workplace safety (Carayon et al., 2015; Walker et al., 2008; Reddy et al., 2003), in order to facilitate an understanding of the domains; however, to use the theory in cross-sector collaborations might be a new application. The results of this thesis indicate that the complicated aspects of current cross-sector collaborations mostly have non-technical characteristics; however, these are entangled with and connected to the design of IS and IT artefacts. Those most prominent were actually legal and institutional. Similarly, 'Regulatory body' is one of the layers in the sociotechnical systems model developed by Rasmussen and Svedung (2000) that needs to be explored in relation to other layers. Even the centrality of actors, their tasks and their responsibilities, which are emphasised by many sociotechnical system models (e.g. Davis et al., 2014; Mumford, 2006; Bostrom and Heinen, 1977), were identified and discernible in all three studies. For instance, without a clear and documented division of tasks and responsibilities between the various actors and sectors, the collaborations will be likely to have less chance of success. The technical aspects of collaboration were found to be vital but mostly basic and feasible, given contemporary technological development.

As the thesis work progressed, the sociotechnical systems view was experienced as somewhat limited because of its underlying assumptions. First, this theory assumes that social and technical systems are separated and have clear borders (Mumford, 2006). Although the theory emphasises that these two are strongly connected to each other, they are still considered as separate and distinct components. This kind of separation can be seen in existing models over recent decades (e.g. by Davis et al., 2014; Rasmussen and Svedung, 2000; Bostrom and Heinen, 1977). This assumption affected the data collection and complicated the data analysis process when using the framework (see section 6.4). There were obvious overlaps between dimensions. Hence, they could not be used separately since the inquiries about one dimension in most cases exceeded its boundaries and also covered other dimensions. One example was

the actors' tasks and roles in emergency response (social systems), which strongly influenced the type of emergency supplies and IT support (technical systems) they needed. Therefore, it was not deemed possible to discuss the actors' task dimension without discussing the technical dimensions. Thus, following the framework sometimes caused a repetition of questions and an overlap in the analyses. Furthermore, the theory assumes that a sociotechnical system (here cross-sector collaboration) already exists and that its social and technical components are known. However, in Study 3 this was not the case and the same situation could occur in any future service implementation if the context is emerging, stakeholders are new and partly unknown and user needs are not identified (Obata et al., 2012).

As the work progressed, and when tying the papers together, there was thus a perceived need to expand the definition of IS. The sociotechnical ensemble view was here deemed helpful during the later phases of the work and is mostly visible in this text when defining and conceptualising IS and viewing cross-sector collaboration ERSs as an application domain or an instance of IS as an overall phenomenon (see Chapter 2). Furthermore, using the sociotechnical ensemble view, there was no need to emphasise the separation between social and technical components since they are seen as entangled. Therefore, for example, the framework dimensions could be combined and presented together when presenting the study results in Chapter 5. However, one of the perceived difficulties in using the sociotechnical ensemble view is its breadth. For example, Bijker's (2010) definition of the view: "The word 'ensemble' is conceptually less restrictive and allows for a broader, more open – some would say more messy – range of conceptual approaches" indicates the possibility of involving all social and technical aspects in the same concept. Therefore, it was not clear how the sociotechnical ensemble view can be used and which sociotechnical aspects, approaches and elements can be included in IS development for the specific cross-sector collaboration context. The use of network governance alongside the sociotechnical ensemble view was perceived as helpful in this regard, above all when focusing on certain aspects of the collaborations.

6.2.2 ERS cross-sector collaborations and the application of network governance

In this thesis, it was assumed that emerging forms of cross-sector collaboration may be seen as an instance of network governance. This assumption was shown to be appropriate to a certain extent; however, from the results it was shown that the two also differ in some respects. The network governance analysis indicated that cross-sector forms of collaboration in the Swedish ERS have similarities with overall network governance structures, including for example, mutual interests between autonomous and heterogeneous actors in collective problem-solving and the inherent complexities of networks, such as conflicts over institutional rules and ambiguity in control mechanisms (Klijn and Koppenjan, 2014; Christensen et al., 2007). Thus, ERS cross-sector collaborations seem to fit comparatively well into the network governance perspective as regards institutional perspectives. Although not part of the current study, it is interesting to note that other forms of ERS collaboration, for example, involving volunteers, display many of the same key network governance factors as observed in these studies. For example, in a study in the north of Sweden involving civil volunteers, the volunteers have a certain degree of responsibility and can act during response

operations while waiting for the professional organisations to arrive. Similar associated problems include: ambiguity of the responsibilities of actors at the incident scene, insurance and laws concerning the life-threatening risks for actors and victims, and the confidentiality of alarm information (Ramsell et al., 2017).

On the other hand, there were also visible differences in the forms and degrees of network governance. Some of the collaborations studied in this thesis were deemed closer to traditional networks, and some can be described as a hybrid form of horizontal relations and top-down control mechanisms demanding more formalisations. In general, the need for formalisation of the collaboration through contracts, insurance and training was much more visible in these results than in traditional forms of network governance. Therefore, it seems more adequate to view the ERS collaborations as a whole as hybrid forms of network governance and more traditional, hierarchical forms of government, most notably in the case of semi-professionals, and where formalisation is tightly coupled with the respective organisations' own context. The collaborations are influenced, inhibited or even managed to different degrees by existing institutional rules and actors' tasks in each given situation, and the need for steering mechanisms is more discernible, again most notably when different occupations/sectors are supposed to collaborate. Therefore, a lower degree of dynamism might also be seen in these collaborations. On the other hand, the outcome of collaborations between members may be more predictable than in pure network governance, in which governance mechanisms do not exist or are vague.

Lack of formalisation may have serious consequences in which, for example, semi-professionals may risk their own or victims' lives. Therefore, steering mechanisms for the collaborations in terms of responsibilities, regulations, insurance etc. seem to be a necessity for the implementation of the collaborations and the subsequent IS support and digitalisation. There are also additional factors that can be identified as crucial to the emerging collaborations that are not included as key factors in network governance theory. These include: fear and stress factors, internal trust, and the fundamental role of training, emergency supplies and IS support. Many of these factors are likely either to be specific to the ERS context/first response (e.g. the role of joint training and emergency supplies) and/or at an individual level (e.g. stress, fear). Network governance takes a political science perspective, mostly focusing on key factors at the institutional level and on horizontal and dynamic networks. That such aspects as fear, joint training and supplies are not included in the theory is thus not overly surprising. However, neglecting these factors in developing ERS cross-sector collaborations may risk actors' lives and/or lead to emotional and physical damage to the actors involved. Therefore, these factors should be addressed when analysing, developing and implementing cross-sector collaboration in ERSs. The same goes for the role of 'internal trust', which cannot be found in the contemporary network governance literature but seemed sometimes to play a decisive role in preventing people from taking part in cross-sector collaborations in the study on semi-professionals.

In conclusion, the results of this thesis show that use of network governance can be helpful when it comes to studying the institutional and horizontal pattern aspects of ERS cross-

sector collaborations. Thus, this perspective may be used in a similar way in related future studies and developments; for example, to make sure that the key factors are enabled or facilitated. However, it is not deemed sufficient. Apart from the factors identified above, IS and technological aspects also need to be addressed and included. The sociotechnical ensemble view and network governance are different theories/perspectives, have partly different focuses and were used in various situations. However, they also have similarities and overlaps and may complement and cross-fertilise each other, which will be discussed in the following.

6.2.3 Applying the combination of sociotechnical ensemble view and network governance

The sociotechnical ensemble view is mostly an approach or school of thought to conceptualise technology and IS design. It does not contain explicit key factors or elements to incorporate into technological development but remains at a more abstract level. Network governance stems from different disciplines; for example, political science and public administration, and can be used either as a perspective or a theory (Davis et al., 2014; Klijn and Koppenjan, 2012; Ropohl, 1999). It contains explicitly different key factors and principles which can be applied to analyse networks and possibly sociotechnical systems (see Chapter 3). In this sense, and also because they differ in their applications, it is not possible to compare these perspectives directly. However, it is possible to discuss how they may be used and how they complement each other in the analysis of emerging ERS cross-sector collaborations, and what the perceived benefits and drawbacks are.

The network governance analysis identified shared interests, governance mechanisms (horizontal vs. top-down), collective problem-solving, democratic decision-making and institutional conflicts as the principles and key factors of cross-sector collaborations that can have a substantial role in the success or failure of networks. From a sociotechnical ensemble perspective, they can all be seen as social and institutional factors/challenges of the collaborations and will thus be likely to affect IS development and the success or failure of IS. For example, trust and lack of trust can be seen as human-related or organisational factors according to the sociotechnical ensemble view. Similarly, sociotechnical systems highlight similar institutional aspects as network governance but using different names, such as 'regulatory bodies' and 'structure/infrastructure', and emphasise humans (or people, employees) and human-related factors as an important element of the systems (Davis et al., 2014; Mumford, 2006; Rasmussen and Svedung, 1997). However, conversely, it is notable that technology and/or IS are not included as key factors in network governance. Also, some other key aspects have been captured using the sociotechnical ensemble view and sociotechnical systems theory. Examples are the fear and stress experienced by actors, which was identified when exploring the 'Attitude' dimension of the framework.

The above might imply that the sociotechnical ensemble view, or even sociotechnical systems theory, might have a broader scope and could have been used as the sole theoretical perspective in the analytical framework of this thesis. This might have simplified the analysis and made it clearer, leaning on a sole IS perspective. On the other hand, network governance

was deemed useful as it helped to focus on the key institutional aspects that were so central to, but mainly unsolved in the emerging collaborations; specifically, to create the prerequisites for the collaborations themselves, and their subsequent digitalisation. Network governance was thus one way to concretise the use of the sociotechnical ensemble view; that is, it facilitated identifying the most network-related key factors and elements (which are also part of the sociotechnical ensemble view at an abstract level, but it is not clear what they are in practice). In short, the sociotechnical ensemble view was perceived to benefit from a related and context-specific theoretical analysis to concretise the perspective during IS development for the specific context of cross-sector collaborations. Conversely, relying solely on network governance would have missed out IS and some other factors. The sociotechnical ensemble view and network governance perspectives were thus deemed to complement and cross-fertilise each other during the analysis.

6.2.3.1 The absence of IS in network governance

As previously mentioned, the thesis analysis highlighted that network governance does not cover technical considerations in the interactions between members; that is, the crucial role of IS support in response operations in networks would not have been captured by only using a network governance analysis. IS are, in all the studied cases, a prerequisite for and an enabler of collaborations. Actors' needs for IS are often basic and based on a geographical positioning system (GPS) and smartphone applications (e.g. for semi-professionals), but they are still vital for communication and information sharing. At a practical level, SOS Alarm is currently working on a national GPS-based solution for dispatching semi-professionals (and volunteers) that is integrated with their own system for dynamic resource allocation. As long as this solution does not exist, the large-scale application of these forms of collaboration is likely to be hindered.

In contemporary societies, IS seem to be an essential part of any collaboration, and networks are no exception. The fact that the fundamental role of IS in the interactions between the members of networks seems almost absent in the network governance literature is therefore more surprising than the absence of more context-specific factors discussed earlier, even though network governance does not stem from the field of IS research. The lack of IS aspects in the literature on network governance has been pointed out recently by Loukis et al (2016) who claim that the relationship between network governance and technology is actually bi-directional where "evolutions in ICT enable the development of new types of network collaborations and governance, whereas governance of collaboration networks is critical for the development of complex ICT infrastructures". Similar claims have been made in related domains such as network policies, for example in other studies involving civil volunteers' emergency response (Ramsell et al., 2017). Pilemalm (2018) and Pilemalm et al. (2016b) point out how IS development, not least user participation approaches, need to involve policy analysts in the inter-disciplinary design teams when developing emerging public sector collaborations. Conversely, network governance can contribute to IS research by providing an understanding of the complex interactions between stakeholders/users in cross-sector or inter-organisational collaborations, or in other IS research on horizontal collaboration; for example, in e-government and civic engagement (Pilemalm, 2018; Linders, 2011). Recently, a

more general macro-level discussion has also emerged on how the research fields of informatics/IS and political science can benefit from and complement each other when applied to public governance, digital government and public administration (Melin and Wihlborg, 2018; Gil-Garcia et al., 2017). The results of this thesis, in line with these studies, indicate that future applications of network governance might benefit from considering the IS-related factors affecting networks, i.e. including IS as key factor, and that it might be of interest to scholars in both disciplines/research fields to investigate how they can contribute to each other.

6.3 User participation in emerging public sector initiatives: intensified challenges in new collaborations in resource-strained organisations?

In order to address the identified research needs and achieve the thesis objective, stakeholders and users who may know the context of ERSs and cross-sector collaborations in ERSs were involved in all three studies. The involvement of stakeholders is also in line with using the sociotechnical ensemble view in IS development, since this view stresses the importance of including social contexts (here, e.g., stakeholders) in the development of technology (here IS). Therefore, in this thesis, user participation activities were applied in Studies 1 and 2, mainly in the form of Future Workshops, using the experiences from these as input for the more systematic study of user participation and stakeholder involvement in Study 3. From the beginning, user participation was thus seen as a means to achieve the thesis objective. However, as the work progressed, user participation in Study 3 was studied within its own context and reported in Paper 4. The thesis' more *practical contributions* in this respect were thus to identify challenges in user participation relevant to the context of ERS cross-sector collaboration and provide suggestions for handling them or mitigating their consequences. Several user participation studies have described the difficulties in identifying stakeholders and ensuring their involvement in relation to large-scale projects with multiple stakeholders in the public sector (Mok et al., 2017; Dalpiaz et al., 2017; Obata et al., 2012; Dalsgaard, 2010; Simonsen and Hertzum, 2008; Oostveen and van den Besselaar, 2004). Hence, this thesis also contributes to the user participation research field, especially in PD, and relating the challenges to smaller-scale projects. The identified challenges discussed below are also central social elements in IS development from the perspective of the sociotechnical ensemble view. Therefore, it is perceived as important to take these challenges into account during IS development processes.

The first challenge, i.e., *unknown stakeholders and end-users*, occurred because the collaboration involving semi-professionals was entirely new to the stakeholders and did not yet exist; it was therefore not clear who could be considered as a stakeholder. Similar challenges have been pointed out in similar public sector innovation studies; for example, by Obata et al. (2012), who worked on a future service implementation project in welfare to mitigate the consequences of the ageing society in Japan. They argued that they had not envisioned IT systems, products or services from the start and therefore stakeholders such as the owners of the new IT system and its potential users could not be identified during the initial phases. It seems reasonable to assume that unknown stakeholders and end-users will

continue to be a challenge in new public sector projects and future service implementations, including emerging cross-sector collaborations.

The difficulties in identifying stakeholders were partly related to the second challenge, *the lack of sufficient competence and knowledge* in the project's core group. Knowledge about potential semi-professionals did not exist among stakeholders and it was not clear how it could be achieved. Some user participation toolkits suggest personas, or 'fictive user presentation', as a way to understand stakeholders' characteristics (Matthews et al., 2012). It has been claimed also that personas can support IS development by providing more detailed description of the context and making the daily work of users visible (Borglund and Nulden, 2012). However, it has also been argued that personas may limit and distract the design group from the real participation of real stakeholders, so they may not support user participation as intended (Bødker et al., 2012). Furthermore, when using personas, the stakeholders must be known in order to investigate their characteristics.

In this thesis, the third challenge, *the lack of shared understanding among stakeholders*, occurred in the Nyköping study, but specifically in the study of Norrköping and semi-professionals. This was probably because the context was cross-sector and new to stakeholders, involving new occupations in emergency response. This is also in line with previous research, where it has been claimed that one of the user participation concerns is stakeholders' understanding of a project and working with them. This is often taken for granted but may be difficult to achieve in practice (Iversen et al., 2010). Divergent inter-operations may lead to conflict during user participation activities (Simonsen and Hertzum, 2008).

However, the fourth challenge, *to develop a collaboration that did not yet exist in a markedly resource-strained environment*, was perceived as the most visible and difficult to handle. This challenge manifested itself during different phases and took various forms (e.g., difficulties in identifying and gathering appropriate stakeholders together, making inquiries, and testing the results achieved), many relating to the stakeholders lacking time to take part in the activities since their ordinary employers/work would not spare them. Another consequence of the fourth challenge was the lack of a frame of reference for discussion, because it was difficult to ask stakeholders to reflect upon a work situation they had never experienced. Along the same lines, Holgersson and Karlsson (2014) also argue that sometimes stakeholders (citizens in their study) have the willingness to participate in activities, but their ability is limited and they lack specific skills. For example, they do not possess sufficient organisational, IT-related or system development knowledge. The user participation literature also argues that similar challenges often stem from the different stakeholders' backgrounds, needs and opinions, a lack of organisational belonging for participation in design groups (e.g. civil citizens) and a lack of concrete methods for achieving participation (Pilemalm et al., 2016b; Dalsgaard, 2010; Simonsen and Hertzum, 2008; Jansen, 2006; Oostveen and van den Besselaar, 2004). This challenge seems highly relevant to cross-sector collaboration and new public sector initiatives in which there are heterogeneous stakeholders and the collaboration is often still under development.

It should be pointed out that none of the identified challenges are new to user participation. However, the results of this thesis suggest that many of those that have been discussed in relation to large-scale projects might also apply to projects of smaller scale, and may become intensified when developing projects for contexts that do not yet exist and/or in current (cross-sector) public sector initiatives which are much driven by the fact that the public sector is experiencing resource constraints. Thus, it becomes important to adapt tools and apply toolboxes that are suited to the contexts of emerging cross-sector collaborations, public sector initiatives and related future service implementation.

6.3.1 Toolboxes to enable cross-sector user participation

The prerequisite for many user participation techniques; for example, prototypes, mock-ups, roleplaying, Future Workshops, organisational games, contextual inquiry and wireframes (Sanders et al., 2010; Spinuzzi, 2005; Iacucci et al., 2000; Beyer and Holtzblatt, 1997; Kensing and Madsen, 1992), is an existing organisational context and processes that stakeholders are somewhat familiar with or have worked with before. Furthermore, it seems that many earlier methods based on user participation (e.g. MUST) (Kensing et al., 1996) have assumed an existing project context with available and known stakeholders. On the other hand, over the past few decades, the need for new instruments has been emphasised in complex contexts (Hillgren et al., 2011; Dalsgaard, 2010). The lack of formalisation or specific methods for user participation has been discussed and is seen as a hindrance that may lead to no product or outcome emerging (Simonsen and Hertzum, 2008; Pekkola et al. 2006; Følstad et al., 2004; Besselaar, 1998). The results of this thesis support this argument, suggesting that new and existing methods and/or techniques can be combined with user-friendly toolboxes suited to a particular emerging cross-sector collaboration and/or public sector initiative in contexts where the development of future services and infrastructures are often distinguishable elements. In the work for thesis, various forms of user participation methods were successively adapted and applied, in combination with qualitative research methods and an exercise/AAR, using the context-specific framework as support for the inquiry and formalisation, all aimed at capturing the stakeholders' voices during the IS development.

First, creating *multiple design groups* and allowing them to interact with each other and with other stakeholders was achieved to enable the capturing of stakeholders' voices in practical terms. A similar approach was used in the public sector project on social welfare (Obata et al., 2012), in which different stakeholder groups were assigned the project objectives relevant to them. Also, iteration between different design groups has been utilised in large-scale projects (Pilemalm et al., 2007), but here it was applied to a project of smaller scale.

The difficulties in finding joint time-slots and holding numerous user participation activities with stakeholders from different sectors were managed by focusing on stakeholder involvement when it was most needed; for example, in the form of Future Workshops. The use of *future scenarios* in these workshops was deemed helpful in triggering discussions and activating the stakeholders. Scenarios have previously been employed in user participation (e.g. Bødker, 1999), even though they are not a necessary part of the original Future Workshop concept (Kensing and Madsen, 1991). Scenarios have also been used in the ERS context as a support tool for the communication between, for example, IS designers and

representative from the police, to analyse the current police work and identify challenges in existing or future IS (Borglund and Nulden, 2012). Scenarios have also been used as part of collaboration exercises for professional emergency response organisations (Andersson et al., 2014; Borglund and Öberg, 2014). However, it has also been argued that to design rich scenarios is a design challenge since it is difficult to include, for example, different actors (e.g. age, gender, nationalities) and their needs and tasks in different incidents, therefore methods are required to design them (Borglund and Öberg, 2014). In relation to the latter, the use of the context-specific framework, was deemed useful as support when designing the scenarios in the thesis, since the dimensions helped to point out certain actors/stakeholders, needs etc.

As for qualitative research methods, *focus groups* were perceived as useful since they did not demand simultaneous access to stakeholders from different sectors/occupations; instead, they could be involved separately and at both operative and management level. Thus, the risk of domination by a specific stakeholder group (e.g. managers), as sometimes happens in traditional design groups (Schuler and Namioka, 1993), was perceived as low. Focus groups have also sometimes been used in other user participation contexts (e.g. Bohøj et al., 2011). However, there are some associated risks. For example, in interviews, the interviewees may dominate the activities and influence the stakeholders. Furthermore, interviews and focus groups do not support stakeholders in actually experiencing and experimenting with the context. Furthermore, the size of the focus groups may not be fully representative of the intended stakeholder group. On the other hand, in some cases/context, this might be a necessary compromise when ideal full participation is not possible. In Study 3, it was perceived that stakeholders were able to freely discuss the collaborations in the focus groups and also complement and help each other to understand and explore the context. It might be argued that, in the focus groups, the dynamic of gathering perspectives from different sectors at the same time was lost. On the other hand, they were not used in their own right but as a basis for or complement to other user participation activities based on the joint participation of stakeholders from various sectors and organisations; for example, Future Workshops.

The *context-specific framework* was introduced to create a shared understanding and a frame of reference for stakeholders (see section 6.4). Also, *the exercise and AAR* was deemed helpful to create a part of the intended collaboration in Study 3. Exercises have been conducted in user participation; for example, to test outcomes in terms of prototypes (Simonsen and Hertzum, 2008). However, here there was a perceived need to actually enable stakeholders to act in the new setting, not only by using an IT artefact but also as first responders. Stakeholders identified new challenges and needs during the AAR. In retrospect, the exercise was actually perceived as one of the most useful user participation activities. By taking part in the exercise, it became possible for stakeholders to experience the new context and tasks and to generate needs that would not have been visible otherwise. Also, a few new stakeholder representatives (from the ambulance services, victims, and fire services) took part in the exercise and AAR, identifying new needs and requirements. On the other hand, despite its many experienced benefits, holding an exercise is also time-consuming and sometimes expensive. Therefore, other techniques can also be seen as alternatives, and their pros and cons in relation to exercises and an AAR should be considered in any given context.

6.3.2 User participation in emerging public sector initiatives: implications for IS development

The use of sociotechnical systems theory, and later the sociotechnical ensemble view, stresses the involvement of both organisational and technological aspects of emerging cross-sector collaborations in IS development. Humans and their role in technological development are also central to both of them; for example, in terms of people, employees, workers, stakeholders and end-users. Many scholars have emphasised that user participation can lead to a better fit between the technology and the way in which people use it (Kensing and Blomberg, 1998; Ehn, 1993; Norman and Draper, 1986). In line with the sociotechnical ensemble view, and its close relation to user participation in IS development, the practical involvement of stakeholders in this thesis does not only bring benefits; it seems to be necessary when developing a new setting for cross-sector collaboration and infrastructure from scratch, including the joint definition of tasks and roles etc. The results of this thesis are in line here with several recent studies arguing that user participation in IS development is no longer explicitly about technology or product design but in many cases has extended to embrace or even focus on ‘infrastructuring’, including long-term changes in infrastructure, organisational structures, stakeholder relations and mind-sets, and laws (Bratteteig and Wagner, 2016; Hillgren et al., 2011). Despite the design of an alarm management system, including the positioning system in Study 3, the user participation outcomes were equally about cross-sector collaborations related to organisational and legal challenges, actors’ need lists, training packages and emergency supplies, all identified and designed with the help of stakeholders. Without building this infrastructure, the alarm system/IT artefact will not work.

In relation to this, IS development during the collaborations was frequently about the reconfiguration of existing IT artefacts; for example, commercial-off-the-shelf (COTS) products or legacy systems (i.e. existing and old systems). These reconfigurations include adding cross-sector collaboration features to existing IS and the integration of existing IS between different organisations/authorities. For example, in Safety House and Nyköping, actors emphasised the need for a shared platform to integrate the involved actors’ existing systems to enable better communication. In the more comprehensive study on semi-professionals, the most comprehensive challenge from an IT artefact point of view will be to integrate the alarm management system (based on existing technology and used on semi-professionals’ own mobile phones) with the existing SOS Alarm systems for dispatching first responders. This issue can also be connected to PD studies of the past few decades claiming that it focuses primarily on the change, improvement and re-configuration of existing systems and legacy systems rather than developing new IS (Robertson and Simonsen, 2012; Anthopolous et al., 2007)

The collaborations studied in this thesis and the likely emerging public sector initiatives, in general, are frequently driven by a desire to create redundancy, increased cost efficiency and effectiveness within a resource-strained environment. This, somewhat paradoxically, may clash with short-term organisational investments in user participation, which is resource and time intensive. In the work for this thesis, these circumstances manifested themselves as challenges whereby stakeholders could not attend planned activities at all, or where it was

difficult to find joint time slots. This suggests that the ideal of full user participation, originally mostly stemming from PD, does not seem feasible within resource-strained environments. Rather, it implies that stakeholders should contribute to those parts that are deemed most complex and related to the new context and infrastructure. From a wider user participation perspective, it has been claimed that the notion of 'user' has transformed into the notion of people/stakeholders, particularly in civic engagement projects or project with broad user groups (e.g. volunteers, occupational groups) (Halskov and Hansen, 2015), and that an increasing number of PD projects no longer adhere to the ideal of full user participation. In relation to this, Bratteteig and Wagner (2016) argue that, instead of insisting on full user participation, it is important to focus on the outcomes and carry out activities in a way that captures stakeholders' voices and opinions. They provide an example from a project aimed at designing a smartphone-based app for children with cancer, in which the primary stakeholder group, the children, were ill and did not experience the conditions for full participation. It may be argued that the approach presented in this thesis may restrict original user-participation (especially PD) values such as democracy in design and the active involvement of all user representatives in all design activities. On the other hand, user participation outcomes from Study 3 in particular, which was a development project, actually included concrete and tangible outcomes; for example, lists of challenges, actors' needs, training packages and checklists for semi-professionals that could be used by municipalities and which actually resulted in the training of fire-services day personnel as first responders.

As to practical user participation, the identified user participation challenges described above are not new and have been discussed previously in the literature (e.g. Obata et al., 2012; Dalsgaard 2010; Simonsen and Hertzum 2008; Følstad et al., 2004; Oostveen and van den Besselaar, 2004; Edwards et al., 2003). However, they have mostly been discussed in relation to large-scale projects. Some of them seem to become extra intensive and thus important to address in new public sector cross-sector initiatives, including when the projects or systems are of smaller scale. In the context of this thesis, a combination of user participation activities was used. Traditional user participation methods were sometimes revised (e.g. Future Workshops). Inquiry methods from qualitative research (e.g. focus groups) and exercises were used as complements, and tools from other domains were added (e.g. AAR). Some of the activities, specifically the exercise and AAR, seem to be particularly effective and to match the context of ERS because they provide opportunities for stakeholders to be involved in a simulated 'real' situation, which can be quite challenging to create in ERSs. Other applied methods are more general and may have the potential be used in a wider context of new public sector initiatives. The combination used in this thesis has been used with minor adaptations in similar ERS projects on the civic engagement of volunteers, and has led to somewhat similar results and outcomes (Pilemalm et al., 2016b). At the same time, there are numerous combinations of activities and methods available and it is important to identify and apply the most appropriate combination of methods and tools for any given context or project, based on stakeholders' availability and complexity, the novelty of the context and the related challenges. The transferability of the user participation results is further reflected upon in Chapter 7 and related future work is suggested in Chapter 8.

6.4 Exploring cross-sector collaborations with the support of contextual frameworks

The development of the context-specific framework is seen as a part of the work to achieve the thesis objective. It helped to include different social and technical aspects of collaboration in the thesis work and is thus also in line with the sociotechnical ensemble view. This framework was used in the work of the thesis in order to facilitate the analysis and understanding of cross-sector collaborations in ERSs, and it was also used by stakeholders as a tool in user participation activities. Several studies have pointed to the need to use frameworks in new or complex domains to facilitate context analysis and improve understanding of the context and the related stakeholders (Lindgren and Jansson, 2013; Thomson and Perry, 2006; Bryson et al., 2006; Ki Kim and Sharman, 2006; Rasmussen and Svedung, 2000). There is also often a perceived lack of corresponding methodologies and structured sub-processes for identifying stakeholders and involving them in IS development, not least in user participation (Lindgren, 2013; Tollmar, 2001; Besselaar, 1998). The context-specific framework can thus be seen as *a practical contribution* both to IS research/user participation and specifically to the application domain of cross-sector collaboration in ERSs since it systematises and presents the important dimensions that have been identified. Similar ERS/cross-sector collaboration frameworks have not been found in previous research literature. The framework was applied and has contributed in several senses, which are discussed in the following.

First, the framework was used during data collection and analysis in order to identify the stakeholders who have knowledge about the collaborations, to gather data to cover the framework dimensions and to categorise the data based on those dimensions. More specifically, the framework was used as a starting point to design the data collection processes for involving stakeholders, capturing users' needs (questions, templates, interviews, Future Workshops) and helping to formulate inquiries. It is suggested that, without the framework, important stakeholders might have been overlooked or ignored, especially those at higher organisational levels. This might in turn have negatively affected the subsequent IS development processes and have possibly led to the creation of systems that are not organisationally implementable. It might also have been more difficult to design coherent data collection methods and more time-consuming to identify appropriate inquiries if they needed to be investigated from scratch. By using the framework, the data could be categorised further and it was possible to perform cross-case analyses because the data stemmed from the same template (the framework). At the same time, the framework revealed some limitations; for example, in the overlap between dimensions, and may result in more bias in data collection and analysis (see Chapter 7 for further reflection).

Secondly, the framework was used as a support tool and inquiry instrument in user participation activities and also by stakeholders to help them focus and discuss different aspects of cross-sector collaborations. The need for new instruments of inquiry and frameworks for stakeholder identification has already been emphasised (Lindgren, 2013;

Dalsgaard, 2010). Previously developed frameworks have usually been developed for designers or at an abstract level (e.g. Gajda, 2004; Rasmussen and Svedung, 2000) and it might be difficult for them to be used directly in user participation activities or by participants. In other words, frameworks that the stakeholders themselves can use and suggestions on how to use them have not been found in previous studies. To use the context-specific framework in user participation activities was perceived as useful in the studies performed for this thesis when the participants did not have any joint frame of reference or sufficient experience with the different aspects of cross-sector collaboration. From the beginning, it was not clear what should be the focal point or direction of user participation activities. The use of the context-specific framework was perceived to provide some structure to activities, and to keep the participants' focus on the related subjects, since the actors could focus on and discuss the framework dimensions one by one. Several stakeholders mentioned that the framework had helped them to focus on the relevant subject instead of engaging in unfocused discussions. On the other hand, there were also some difficulties associated with using the framework (see Chapter 7 for further reflection).

Overall, it was thus perceived that the application of the framework saved some time and resources during the data collection and analysis process, since it could be re-used in the three studies. It was also deemed to support focus and encourage a similar design for each study, thus facilitating comparison. It is also deemed to have the potential to involve relevant stakeholders and to incorporate important aspects of cross-sector collaboration during IS development. Therefore, more developed and standardised versions of the framework may have the potential to provide a structured method to explore cross-sector collaboration in ERSs. However, the perceived benefits of the framework are only claimed by researchers and stakeholders. No systematic evaluation of the framework has been performed during the work for this thesis. The framework limitations and related future work is further reflected upon in Chapters 7 and 8.

6.4.1 Empirical and theoretical grounding of the framework

The framework is based on a limited set of empirical data from the Swedish ERS. The data at the strategic level from the MSB, the co-operative use of security guards and the co-location of actors at the Safety House provide the empirical foundations. It has also been used for the development of civic engagement initiatives and related IS in ERSs with similar experience (Pilemalm, 2018; Ramsell et al., 2017). It is also possible to generate some initial theoretical foundations for the framework using the sociotechnical ensemble view and network governance, as shown in the following.

The main theoretical foundation of the framework is sociotechnical systems theory, which was applied during the early phases of the work for this thesis. The theory did not necessarily help to understand the mechanism of the current collaboration but it did help to highlight critical aspects of it by placing the initial framework within the IS domain and relating it to sociotechnical systems. The theory supported the categorisation of the important aspects of ERSs. People and the social components of ERSs were categorised as 'Actors'. Emergency supplies and IT tools were seen as 'Technology'. Response operations were categorised as 'Task and processes'. Management, organisational structure, culture and the goals of ERSs

were grouped as 'Structure/organisation'. Legal, political and environmental aspects of ERSs were considered as 'Environment/context' (see Chapter 3 and Paper 3).

Moreover, sociotechnical systems theory served to relate the framework to user participation approaches, e.g. PD, since in several respects the approach embraces sociotechnical systems perspectives (Mumford, 2006, 1981). Furthermore, the theory can be used to argue that the failures in understanding of the interactions between components of a sociotechnical system (here ERSs) in the studies performed may lead to failure in the resulting IS (e.g. Laudon and Laudon, 1999; Bostrom and Heinen, 1977). It is thus suggested that a framework based on sociotechnical systems theory can help to highlight the key aspects of cross-sector collaborations and facilitate an understanding of them in the ERS context. However, as the thesis work progressed, it was found that some categories overlap to different extents, or may cause repetition in the analysis and results, and thus needed to be changed.

The overlaps can also be seen as illustrations of the entanglement of the sociotechnical aspects of cross-sector collaboration, as the sociotechnical ensemble view emphasises. The framework presents a simplified version of reality; that is, of cross-sector collaboration in ERSs, and systematises the initial exploration and understanding of the context. Also, there might be more aspects and key factors that the framework does not include because of its limited theoretical and empirical foundations. As the work with the thesis progressed, it was perceived as difficult to distinguish between sociotechnical components in the way in which they are presented in the framework; that is, in the form of different, separated dimensions, leading to the overlaps mentioned. Therefore, a more open and flexible approach, here the sociotechnical ensemble view, was needed in order to involve the entangled aspects in the further analysis and the IS development process.

A further analysis of the results using network governance also revealed some overlaps with the framework analysis. For example, institutional conflicts in network governance are called 'regulation and legal issues' in the framework. However, some aspects may have been overlooked or not made sufficiently clear in the framework or visible in sociotechnical system theory. Examples are 'shared interest', 'collaboration forms', 'trust', and 'collective problem solving', which are crucial in network governance and also identified as significant in the cross-sector collaborations and related IS development. For instance, 'trust' is part of the 'attitude' dimension of the framework and is thus present but may not be sufficiently visible. Therefore, it is possible that 'trust' should be considered as a separate dimension in the framework, or explained in more detail under 'Attitude' (see Chapter 5). Other important aspects of networks might also be highlighted in the framework in a similar way.

In summary, the framework can thus be seen as an instance of a practical application of sociotechnical systems and it also has overlaps with both the sociotechnical ensemble view and network governance. The potential transferability of the framework to similar empirical settings and how its theoretical grounding may be improved will be discussed further in Chapter 7.

7 METHODOLOGICAL REFLECTIONS AND LIMITATIONS

This chapter presents methodological reflections upon the thesis work, the transferability of the study results and the limitations of the thesis.

7.1 Methodological reflections

There are continuing debates about standards and measures for assessing qualitative research (Corbin and Strauss, 2007; Lincoln and Guba, 1985). The assessment criteria used in quantitative research is unsuitable for qualitative research, since these involve different approaches, specifically, ‘positivism’ versus ‘interpretivism’. There is no real agreement about how qualitative research should be assessed. Credibility (validity), transferability, dependability and conformability are the criteria used in this thesis to assess the quality of the case study research described in Chapter 4. These are frequently cited in the literature by researchers (e.g., Bryman, 2012; Lincoln and Guba, 1985) and are also suggested by Creswell as common criteria to be used in qualitative research (Creswell, 2013, p. 243).

7.1.1 Credibility

To satisfy the *credibility* of the research, it was attempted to apply a clear research methodology by discussing and illustrating the different parts of the research process and the research design regarding both thesis objectives. In order to gain a clear and comprehensive view of cross-sector forms of collaboration in ERSs, three different instances of collaboration embracing the concepts of co-operative use of resources and co-location of actors were used for data collection. However, the total amount of data gathered was different for each. In Studies 1 and 2, only an organisational analysis combined with a needs analysis was performed. In Study 3 (semi-professionals), the researcher was involved in an entire project and more work could be performed to gain an in-depth understanding of the study object and to capture its complexity. To enhance credibility, data triangulation was used in all three studies, whereby data was gathered from different sources; for example, interviews, participant observation, focus groups and Future Workshops. In retrospect, the results of the three studies shared many similarities; for example, the need for joint training, information-sharing platforms and mobile-based solutions. Participants also repeatedly mentioned ambiguity in tasks and responsibilities in all three studies. When different sources point to the same findings, it can increase the credibility of the results. On the other hand, almost the same approach and similar methods, including the context-specific framework, interview guides and questions, were used with only slight adaptations to perform the three studies. Therefore, the credibility might be affected adversely since, for example, participants may answer in similar ways when they were guided to answer specific questions by interview guides using similar overall themes.

When it came to applying user participation approaches, a literature review was performed to gain a good overview of user participation challenges in general and in the public sector

specifically. The results were then connected to the literature and their implications were discussed. In this way, the identified challenges and suggested actions were somewhat verified using the literature, and then expanded and discussed in the context of the current ERS cross-sector collaboration. The data used to build the framework stems from empirical studies, the researcher's experiences of using it in Study 1, feedback from other involved researchers in the studies, and sociotechnical systems theory. Furthermore, to test and increase the credibility of the framework, its dimensions was compared with the international literature and it was shown that this framework is reasonably in line with much of this literature. In retrospect, it was perceived that the framework facilitated stakeholder identification and involvement and the inquiry processes during the studies. There were also no major complaints from stakeholders' side, showing a fair acceptance of the framework on their part. However, it is also admitted that the framework revealed difficulties (e.g. overlaps between dimensions, potentially increased bias in data collection), lacked systematic evaluation and had limited empirical and theoretical foundations.

7.1.2 Dependability

To satisfy *dependability*, an 'auditing approach' was applied throughout the entire research process, by which the research findings (cross-sector collaboration challenges and opportunities, actor needs, user participation challenges and the framework) were made accessible to peers and other researchers for critical review. Peer review, project meetings (in Study 3), thesis seminars, workshops and joint project work were the methods used for auditing. In Studies 1 and 2 (shorter studies), the auditing was limited to successive review of the reports and published papers, but in Study 3 the gathered data was also reviewed. While there was mostly consensus on the research results during the auditing process, there were also different critiques. For example, whether there was actually a need for the context-specific framework was questioned several times, since there already exist similar frameworks. Although frameworks that facilitate the understanding of cross-sector collaboration or can be used to apply sociotechnical systems theory already exist, their focus is different and not on cross-sector collaboration in ERSs. Furthermore, they are set at an abstract level and perceived as challenging to be used in practice, especially in user participation activities. Additionally, the categorisation of cross-sector collaboration results was criticised because of the overlaps and ambiguities in presenting the results, leading to an effort by the researcher to re-categorise all the results at the end of Study 3. The identified user participation challenges were also discussed, refined and re-categorised several times, and finally presented in four categories, compared to the initial presentation, which contained more categories that had overlaps.

7.1.3 Confirmability

As to *confirmability*, the results were limited to the three studies performed. In all of these studies, and especially in Study 3, the researcher played the dual role of researcher and developer. This may be considered as likely to introduce bias into the research process as the researcher may have controlled or influenced the development process. On the other hand, the active involvement and role of stakeholders in the studies performed (e.g. in Future Workshops, focus groups, the exercise) has had a large influence on the data gathered and outcome of the studies performed and thus might mitigate the potential bias caused by the

researcher. The auditing approach described above also helped to incorporate the opinions of other researchers, scholars and stakeholders during the entire research process, and thus the data was exposed to multiple reviews. Also, taking a similar approach in the various studies, above all using the same framework to generate data will, of course, have caused a certain amount of bias, both in the data itself, and in the analysis. However, to avoid too much bias, interviewees were also allowed to discuss other related topics freely and ask open questions.

7.1.4 Transferability

In terms of *transferability*, the results of this thesis are, of course, not applicable to all instances of cross-sector collaboration. However, there is a fair chance that the results could be used as a point of departure to understand similar collaborations within the public sector, and specifically in ERSs both within and outside Sweden. The user participation challenges are also discussed in relation to public sector innovation projects and future service implementation in new contexts and with heterogeneous unknown stakeholders. The transferability of the results is discussed in more detail in the following.

7.1.4.1 Implications of the study for other ERS cross-sector collaborations

The collaborations studied here are limited to three cases in Swedish emergency response and may thus seem specific to the studied actors. However, it is plausible that parts of the results are transferable beyond the studied cases. From a societal perspective, the temporary co-location of actors is not a new phenomenon and occurs internationally, specifically in the event of large-scale incidents and disasters, by mobilising different response and support actors near the incident scene. Creating permanent co-location seems to be a somewhat more recent phenomenon, but can be established in relation to frequent everyday emergencies by following similar principles (e.g. in information sharing and collective action in response operations). The new fire station in Nyköping is also an example of sharing resources between different public sector organisations in line with recent new public management (NPM) reforms (Gruening, 2001). These results may thus be of interest to other organisations in ERSs (in Sweden and internationally) which opt to share their resources and capacities in order to reduce costs or improve their response operations. It is also possible to assume that the studied groups of semi-professionals are not limited to Norrköping municipality. In Sweden, the use of various occupational groups (security guards, car-park guards and shopping centre personnel) already exists or is being planning in different municipalities. Some parts of the results are likely to be more transferable to other ERSs internationally. Examples are: training and equipment packages, alarm management systems including the smartphone application, and the criteria used in this thesis to choose the occupational groups (i.e. groups that patrol in an area, have or can receive basic training and emergency supplies). However, there are also different parts of the results that are context specific. The identified legal issues, requirements for organisational change and ethical issues probably need to be re-explored since legal and (sometimes) ethical frameworks differ in various countries. Furthermore, the occupational groups selected as semi-professionals in Study 3 depended strongly on the studied organisations' context and the municipality of Norrköping. For example, home care could not take part in cross-sector collaborations because of the ongoing substantial changes in their organisation. However, home care might have good potential to work as semi-

professionals in other municipalities. Therefore, these parts of the results should be adapted to the current context.

There are also other types of collaboration in ERSs which are not categorised as cross-sector but may resemble such collaboration. In many cases, involving volunteers and bystanders relates to compensating for the shortage of professional resources and creating redundancy (e.g., Ramsell et al., 2017; Venema et al., 2010). Civil volunteers are also involved in a new setting and are assigned new tasks and (at least in Sweden) deal with similar emergencies, such as fires, traffic accidents, drownings and heart attacks. For example, Venema et al. (2010) showed that the rescue and resuscitation of drowning victims by bystanders seems to contribute to a positive outcome. At the same time, they may be risking their own lives. Also, in the results of this thesis, on certain occasion actors expressed concerns about the emergency operation and the associated risks. A related example is the 'Enhanced Neighbours project in Medelpad in which civilians in rural area are alerted at the same time as the fire services and ambulance in case of certain emergencies (Ramsell et al., 2017). Defining civilian assignments, expectations, tasks and responsibilities and providing them with sufficient legal (insurance) protection were among the identified challenges. These examples indicate that some of the results of this thesis may be extended to other, related examples of emerging ERS collaborations.

7.1.4.2 Implications of the study for emerging cross-sector initiatives in the public sector

From a wider public sector perspective, cross-sector collaborations are global trends (Agranoff and McGuire, 2010; Bryson et al., 2006). Governments have become increasingly dependent on cross-sector collaboration to address certain public challenges that require the involvement of many autonomous actors from different sectors. Examples are cross-sector collaborations to resolve public health issues, obesity and traffic congestion (Johnston and Finegood, 2015; Kickbusch, 2013; Bryson et al., 2009). The phenomenon may also be discussed using different terms, such as cross-sector collaboration, e-health, e-government, network governance or NPM reforms.

Although these various collaborations have different aims than those in ERSs, there are also similarities since the actors are from different sectors and have to collaborate within the framework of their respective organisations. For example, Bryson et al. (2006) argue for the complexity of the interaction between actors and the need for continuous trust-building between them. They highlight the role of sponsors, project managers and other support actors as very important stakeholders in the cross-sector collaboration. Similarly, the role of such groups as MSB and SOS Alarm are fundamental in the Swedish ERS. Of course, some sectors are more similar to ERSs, whereas others are very different. One potential example of the former might be healthcare, in which dealing with patient care (compared to victim care) might include similar tasks and where the same laws and regulations (in Sweden) sometimes apply. From an international perspective, in a cross-sector healthcare collaboration involving the public and private sectors in healthcare, trust was found to be a key factor for success (Johnston and Finegood, 2015). Creating cross-sector collaborations in similar contexts would thus perhaps pose some needs and challenges similar to those identified in this thesis. Similarly, clarification of the roles, practices, interests and duties of the involved partners is

also needed. Therefore, other parts of the public sector can likely benefit from some of these results; for example, when analysing the collaborations by using the sociotechnical ensemble view of technology and the network governance perspective, or by adapting and applying the user participation suggestions and analytical frameworks to their specific context.

7.1.4.3 Transferability of results to large-scale crises

ERS collaborations reflect a recent trend in public sector initiatives towards cross-sector collaboration, including elements of future service implementation in which the context is partially or entirely new to the stakeholders. Examples can be seen in healthcare, social care and social integration, among others (Johnston and Finegood, 2015; Jones et al., 2015; Obata et al., 2012; Hillgren et al., 2011). Furthermore, e-government, civic engagement, community involvement and do-it-yourself government are similar trends in which stakeholder groups are broad and may not be familiar with the context or their new tasks (Pilemalm, 2018; Linders, 2011). This thesis is about cross-sector collaboration during frequent emergencies of a smaller scale. However, a brief reflection on how the thesis results might apply to large-scale crisis management is also of interest. Quarantelli (2000) argues that, despite both quantitative and qualitative differences between everyday emergencies and large-scale disasters, research and development work in different types of emergencies can learn from each other. ERSs worldwide have many similarities regarding small and large-scale incidents (e.g. traffic accidents, fires in buildings, wildfires), challenges (e.g. quick response), emergency supplies (e.g. fire extinguishers, healthcare kits), IS support (e.g. decision support systems, alarm management), basic training (CPR, firefighting) and procedures (lifesaving, fire extinguishing). In addition, the same organisations/actors (e.g. fire services, ambulance services) are often responsible for managing emergencies at different scales. Some of the results of this thesis may thus also be applicable to crises and large-scale incidents. For example, the communication system RAKEL is used by Swedish professional response organisations during both small and large-scale emergencies. Therefore, actors who work with such techniques, routines, emergency supplies, rules and IS in everyday emergencies may use them again in larger-scale incidents that occur suddenly without the need to learn them again. At the same time, there are, of course, also a number of differences between routine small-scale accidents and large-scale catastrophes. The most visible difference is the greater number of actors in the crisis management cross-sector networks, which leads to larger and more complex ‘megacommunities’ (Kleiner and Delurey, 2007) demonstrating increased complexity. Large-scale crises also have less predictable outcomes than routine incidents and need to rely more on ad-hoc mobilisation. This complexity is likely to pose additional challenges beyond those identified in this study.

7.1.4.4 Transferability of user participation challenges and actions

The user participation approach used in this thesis and the suggested combination of actions have been tested in other emergency response projects (e.g. involving civil volunteers in emergency response in rural areas with largely similar outcomes in terms of user participation challenges (Pilemalm, 2018). The approach/combination of activities used here may also be applied in similar projects involving heterogeneous stakeholder in the new public sector with elements of innovation. However, it is of course important to consider the

suggested combination of actions as a tentative toolbox that can be used, adapted or combined with other user participation activities. Also, additional challenges may occur when the context is partly different. For example, using the approach in cross-sector collaborations during large-scale incidents would probably require the involvement of more stakeholders, which would affect the related user participation activities.

7.1.4.5 Applicability of the framework beyond the performed studies

In many respects, ERSs in different countries share roles, training, resources, equipment and, ultimately, the same basic goals to save lives and mitigate environmental damage. This framework has been re-used with slight revisions, in several studies in the Swedish ERS, and also in studies involving civil volunteers (Pilemalm, 2018; Ramsell et al., 2017). It may also be relevant and have the potential to be applied in ERSs internationally. When making an international comparison, it was found that several ERS studies discuss similar dimensions to those displayed in this framework. For example, the roles of new actors have been highlighted and categorised as volunteers, bystanders and semi-professionals (Venema et al., 2010; Waugh and Streib, 2006). The type of training for bystanders as new actors has been analysed and shown to be a key factor in the success of response operations when trauma care is performed (Pelinka et al., 2004). These findings correspond to the *Actors* dimension in the framework. There are also studies that describe and highlight the tasks of first responders in response operations and categorise them as: first aid, supplying food and equipment, providing emotional assistance and providing transport (Weinholt and Andersson Granberg, 2013; Barsky et al., 2007; Tierney et al., 2001; Valenzuela et al., 2000; Quarantelli, 1994). Other studies have discussed the role of new actors within a specific incident type (e.g., cardiac arrest vs. drownings) (Venema et al., 2010; Valenzuela et al., 2000), which demonstrates that incident type is also considered an important factor in the success of response operations. These examples are represented under the *Task/Response Operation* dimension in this framework. In relation to the *Technology* dimension, there are studies that draw attention to the importance of designing and providing appropriate equipment for first responders to use at the incident scene (Schraagen and Ven, 2011; Jack, 2005). Other studies discuss differences in policies when heterogeneous actors collaborate and issues of legitimacy and trust arise (Christensen and Lægheid, 2010; Palm and Törnqvist, 2008). In this framework, these are categorised under the *Structure/Organisation* dimension. Conflicts regarding policies and legal issues, and problems in the categorisation of tasks and responsibilities, have also been cited as challenges in cross-sector collaboration (Pilemalm et al., 2013; Christensen and Lægheid, 2010; Ödlund, 2010; Burt and Taylor, 2004). These are represented in this framework by the *Environment/Context* dimension. Since numerous studies in emergency response overlap with the dimensions of this framework, it may be adapted to ERSs in other countries or used as a point of departure from which to develop more standardised frameworks in the future.

It is also possible that the framework is relevant to the public sector in a more general sense, for analysing emerging forms of collaboration (e.g., cross-sector collaboration, e-government, and involving volunteers) and/or for developing corresponding IS. However, for such purposes, the framework must be adapted to the current context. Certain dimensions of this

framework are clearly context-specific and bound to ERSs, such as ‘incident type’ and ‘emergency supplies’. Other dimensions are rather general (e.g., ‘regulations’ and ‘legal issues’, or ‘task’) and probably do not need to be reviewed. When applying the framework to other public sector contexts, irrelevant dimensions should be omitted or renamed and other, context-specific dimensions added. A brief initial organisational analysis should be performed in order to review the definition of each dimension and align it with the current project. Systems developers, project managers and experienced actors are examples of stakeholders who can help in this work.

7.2 Reflection: Research process and thesis limitations

Some of the limitations in the evaluation and application of the results of this thesis have been touched upon in the methodological reflections. In the following, the overall research process (e.g. data collection), applying user participation and the framework are reflected upon in more detail and the perceived major limitations are discussed.

7.2.1 Overall research process

This is a paper compilation thesis, including five papers. It includes both *domain-specific and IS-specific paper publications*. It was initially perceived as challenging to relate the two domains (IS and ERS) within the thesis since, at the outset of the research process, cross-sector collaboration in ERSs was a relatively new domain. The few studies that did exist specifically covered actor needs for IS and the role of IS. One of the challenges for the research process was thus how to structure the thesis and its relations to the five papers. At least two of these papers include work about developing the conceptual framework, which is not part of the thesis objective (but was in the licentiate thesis). This is because the framework development took a lot of time and effort. On the other hand, the thesis provides different new sections that do not exist in the papers; for example, the cross-study analyses, and the Nyköping municipality results. Additionally, the sociotechnical ensemble view was added in retrospect and is not included in the papers. This is due to the perceived limitations of sociotechnical systems theory when moving towards the thesis objectives, but also since the domain-specific publication forums did not focus on theoretical elaborations of IS perspectives. This is, of course, a limitation of the thesis; however, the hope is that the thesis and papers can complement each other sufficiently. The author also decided to repeat some specific parts of the papers in the thesis in order to make it readable as an independent text. However, one drawback is that the thesis thus became longer than expected.

The role of the framework within the work of this thesis might also be somewhat confusing, since it was used as part of the method of data collection and analysis to achieve the thesis objective, but is also presented as a result. Attempts have been made to make the role of the framework in the data collection processes and analysis visible when writing the thesis. The framework was developed when there was an initial need to systematise the important factors in ERS cross-sector collaboration. In retrospect, it was perceived as difficult to explain the use of the framework in relation to user participation activities since the framework uses the term ‘actor’ while user participation approaches usually speak about ‘stakeholders’ and

'end-users'. Therefore, the author had to use and exchange multiple terms referring to almost the same concept; specifically, people in this context. One reason was that user participation was not an explicit focus when the framework development was started in order to understand the collaboration. Therefore, the term 'actor' was used to refer to those who are part of the context, including whole organisations; for example, fire services. However, the term 'stakeholder' might be broader and more user-friendly for user participation activities and may also refer to those organisations/authorities which are not part of the collaborations but may be affected by or influence them; for example, IT contractors, unions and municipalities.

Another potential limitation is the *different lengths of the thesis studies*. The author performed a baseline study to gain an overall view of the new collaborations and two shorter studies (Safety House and Nyköping). Because each study took only a few months, actors in Safety House and Nyköping did not have the time or opportunity to accept the author into long-term, in-depth studies, providing a basis for the entire thesis. The third study was initiated in late 2014 and it was the first study to embrace an entire research project. This took about two years. Only the third study may be considered an in-depth study. One consequence of the circumstances is that this is a broad thesis work rather than being an in-depth exploration of one study/case. It may be argued that this is a limitation of the thesis and, in certain respects, it might have been better to conduct one long study of one case, yielding rich and detailed information. On the other hand, the three studies covered different ERS cross-sector collaborations and thus provide a broad understanding of the concept. They also enabled the cross-case network analysis, which made it possible to distinguish the new forms of collaboration emerging from traditional networks, and to identify common challenges and needs.

Another consequence of Studies 1 and 2 being rather short was the limitation in running different participation activities with a sufficient number of stakeholders. Therefore, the experience and knowledge of employing user participation activities gained from the first two studies were somewhat narrow and therefore used in the thesis only as input/background/experience for Study 3. The third study created the opportunity to run several user participation activities with different groups of stakeholders, leading to richer results about user participation approaches. Still, instead of achieving full user participation and running numerous activities, the focus was on stakeholder involvement and user participation outcomes. Even though similar approaches are supported in the literature (Bratteteig and Wagner, 2016), they are also criticised (mostly in PD) because the democratic foundation of user participation approaches is overlooked (Greenbaum, 1996). Furthermore, PD was applied as the main approach to user participation at the beginning of the work in this thesis and in the licentiate thesis. However, during the later phases of the research process, it became clear that challenges may occur while using various user participation approaches, whether it be PD, UCD or UI, since the difficulties in stakeholder involvement were mostly related to the lack of necessary time, shared timeslots, shared understanding and competence, and the complexity of the context. One consequence of this was that the literature review was mostly limited to PD literature, and other approaches (e.g. UCD) were only included while writing the thesis. However, the PD literature remained dominant in the

work and, in retrospect, it would probably have been better to apply the overall notion of user participation from the beginning.

7.2.2 Bias in data collection

As to the limitations of *the thesis data collection processes*, as mentioned before, some interviews were performed only by one researcher/the thesis author. This was the case in Studies 1 and 2, in which it was not possible to assign more researchers to the studies in their real settings given the specific time and place. It is, of course, preferable to assign at least two interviewers, of whom one can manage the interview and one can take notes. To mitigate the consequence of only having one interviewer, the researcher audiotaped all interviews and carefully transcribed them later and read them. Also, one of the first Future Workshops (Safety House) was conducted only by the thesis author and this can be seen as a drawback or limitation. To mitigate the consequences, participants were asked to write down their ideas carefully on the post-it notes and a shared whiteboard and these were gathered by the researcher. The discussions were also audiotaped and transcribed.

To manage the interviews as input for the Future Workshops, questions were based on the context-specific framework, and it was easy for the researcher to select which subjects should be covered by interviewees. On the other hand, using the framework for performing organisational analysis and needs analysis may cause additional bias in the analysis if the analysts/developers are too closely bound to the framework and ignore data that is not explicitly connected to any dimension. It is important to maintain a balance, and stakeholder ideas, answers and observations that do not fit into any particular dimension should also be assessed (if relevant) in order to avoid neglecting emergent and possibly new dimensions or information. It was attempted to incorporate other aspects of collaboration into the data collection by motivating stakeholders to discuss the collaboration beyond the given dimensions, while using the framework as a point of departure for discussion. However, it is not possible to remove bias entirely because the results of the thesis would be somewhat different if another framework or other dimensions had been used.

7.2.3 Framework limitations

The most prominent limitation of the framework is probably the lack of framework evaluation during the research process. The drawbacks, advantages, principal uses and contributions of the framework are all based on the researchers' and (sometimes) users' perceptions and the experience gained while using it in the studies performed. However, it has not been evaluated systematically either by the researcher or the users. The framework has some theoretical grounding but lacks a more systematised theoretical evaluation. Also, developing context-specific frameworks from scratch is time-consuming and resource-intensive and thus they serve their aims best if they can be developed gradually and be re-used in different projects.

Another framework limitation is that it may be difficult at the beginning to choose the relevant dimensions for a project due to insufficient knowledge about the project and its objectives. This may be solved by gaining initial knowledge about the context before using the framework. There are also certain redundancies between dimensions that are inevitable. For example, the 'task' and 'type/role' dimensions may overlap and become confusing for

systems developers. To address this, it is important to follow the definition of each dimension closely and attempt to cover them with relevant information. Improvements, such as adding new dimensions, should be considered if this makes the framework more complete.

7.2.4 Theoretical limitations

The work in this thesis uses three theoretical perspectives: sociotechnical systems theory, network governance and the sociotechnical ensemble view. Other theories relevant to cross-sector collaboration, new public sector initiative and IS research could be used. Examples are: perspectives from NPM, public administration, actor network theory (ANT) and socio-materiality. However, it was deemed that the thesis would become more complicated if additional theoretical perspectives were involved; therefore, their use should be motivated and connected to IS development. For example, theories from network policies could have been used to explore the political foundations of collaborations (e.g. government and governance mechanisms), or NPM might have helped to explore the costs and benefits of the collaboration in terms of their efficiency or effectiveness. However, this was not part of the thesis objective. In addition, in this thesis, instead of 'stakeholder analysis', the term 'stakeholder identification' was used because no thorough analysis exclusively focusing on stakeholders, their characteristics, limitation or benefits has been conducted. Nonetheless, in retrospect it was felt that the use of stakeholder theory could have contributed to the thesis because of the importance of stakeholders in IS development and the emphasis placed on them in user participation approaches. This might also have contributed to a more consistent terminology in the thesis (e.g. addressing the dilemma of using 'actors', 'stakeholders' and 'users' to refer to similar persons/organisations).

8 CONCLUSION AND FUTURE WORK

This chapter summarises the key contributions of the thesis and its major implications for IS development for cross-sector collaboration, user participation in ERS and public sector initiatives. Some suggestions for future research are then provided.

8.1 Summary of key contributions

Information systems (IS) are vital parts of cross-sector collaborations in ERSs; however, a prerequisite for developing IS for involved actors is to understand the context, actors' tasks and their needs for IS. At the outset of the work for this thesis, the available research literature was not deemed to provide sufficient understanding, and related knowledge was perceived as somewhat scarce and fragmented. It was also not clear how to characterise the collaborations and study them. Therefore, the thesis explored three recent cross-sector collaborations in the Swedish ERS. The main scientific contribution can be summarised as:

- The thesis identified common *challenges*, *opportunities* and *actor needs* in ERS cross-sector collaboration based on a *sociotechnical ensemble view*. The knowledge can be used in the future enhancement or IS development of similar collaborations.

The thesis also provides some scientific contributions related to the use of theoretical perspectives. They can be summarised as:

- use of the *sociotechnical ensemble view* for analysing ERS cross-sector collaborations and relating them to IS development
- a characterisation of the ERS cross-collaborations as *hybrid forms of network governance and traditional government forms* and an assessment of the theory's usefulness for analysing and developing future collaborations,
- identifying an *absence of IS in network governance*, thus suggesting that network governance should introduce IS aspects, not only when analysing cross-sector collaborations but also when analysing networks in general.

As part of achieving the thesis objective, user participation was applied and a context-specific framework was developed and used. The more practically oriented contributions of the thesis are thus summarised as:

- identifying relevant *user participation challenges* when developing IS cross-sector collaborations and related IS support, and suggesting *combinations of actions* to handle challenges or mitigate consequences
- development of a *context-specific framework* systematising and presenting crucial aspects of cross-sector collaborations which can actually be applied by end-users and other stakeholders to support user participation activities.

As to the target groups, IS research may use/adapt the knowledge gained about cross-sector collaborations in ERSs, the framework and the described user participation application as inspiration for IS development in similar new public sector initiatives in which heterogeneous and partly unknown stakeholders/end-users from different sectors create new forms of collaboration. Researchers in the ERS domain can use the results to understand similar forms of cross-sector collaborations in ERSs and the related actor needs. Project managers, systems developers, the authorities and response organisations are some examples of practitioners who may benefit from the results of this thesis, using them or being inspired by them when developing and implementing related projects.

8.2 IS development for ERS cross-sector collaboration

The research process for this thesis was initiated in 2012. Since then, large-scale disasters such as storms (e.g. Typhoon Haiyan in the Philippines in 2013, killing 6,300 people) and forest fires (e.g. the recent wildfires in California in 2018) have continued to occur, both globally and in Sweden (e.g. the wildfires in Sweden's forests in 2014 and 2018). Epidemics and pandemics are difficult to control due to increasing flows of travellers between countries. Recent examples include the Ebola outbreak in Africa in 2014. Wars and terrorism in the Middle East have led to increased migration to the EU. Climate change, the ongoing financial crisis since 2008 and the corresponding steady reduction in public sector resources, the emergence of extremist groups and terrorism (e.g. the Stockholm Drottninggatan attack in 2017, London attacks in 2017, Paris attacks in 2015) all increase societal and ERS challenges. Recent world events have thus placed a huge strain on emergency response organisations in modern societies. At the same time, these organisations are the main actors responsible for delivering essential services in cases of frequently occurring, smaller-scale emergencies such as traffic accidents, drownings and fires, accidents that are not likely to decrease. Consequently, while emergency response actors are under extreme pressure, they need to be increasingly effective. Therefore, it seems that cross-sector collaboration could be one (of many) solutions designed to increase the capacity of emergency response actors.

In Sweden, budget cuts, lack of professional resources, urbanisation accompanied by increasing socio-economic gaps and physical distances between response actors in rural areas are also problems typically affecting society. These challenges are being addressed by reorganising the Swedish ERS, equipping professional response organisations with the right equipment, IS support and methods, and involving extra resources such as semi-professionals, citizens and volunteers. The co-location of actors at the Safety House in Jämtland, the co-operative use of resources in Nyköping, and the use of semi-professionals in Norrköping are the examples studied in this thesis. The SMS life-saving project (<http://www.smslivraddare.se/>) in Stockholm and a project involving volunteers as first responders in the county of Medelpad, which began in 2013, are other examples. Co-operative use of resources has been implemented in other parts of Sweden; for example, in the Öckerö, and Varberg municipalities. Volunteer organisations and individual volunteers have also started their own initiatives and, after the extremely hot summer of 2018, which resulted in

numerous wildfires and drownings, an increased number of volunteers came forward to engage with the fires services. Recently, the organisation 'Missing People' has been very active on social media encouraging the ad-hoc mobilisation of volunteers (<http://missingpeople.se>). New occupations are continuously being assigned emergency response tasks in addition to their main work in a growing number of municipalities (e.g. security guards and, recently, car-park guards). This trend of cross-sector collaboration within the public sector is thus growing rapidly in the Swedish ERS and, similarly, in different parts of the public sector in many countries. Different initiatives have been set up and established in practice.

Relating to the above, this thesis is timely. Corresponding research to explore the different aspects and to understand emerging cross-sector collaborations seems to be urgently needed and will play a central role in the successful development of these collaborations and related IS support. This thesis explored several cases of collaboration at different organisational levels using the sociotechnical ensemble view and thus contributed by identifying opportunities, challenges and actor needs which can be used in the development of similar collaborations and in related IS development/digitalisation. The results, in line with previous research on public sector cross-sector collaborations, imply that there is much potential and many opportunities associated with ERS cross-sector collaborations which can be realised with the aid of proper IS support. However, it also illustrates different organisational, institutional and legal challenges (e.g. ambiguities in actors' responsibilities, lack of formalisation and secrecy issues) which will affect IS development; for example, for systems for communication, decision-making and alarm management, and must be addressed before proceeding to the stages of design, implementation and extensive digitalisation. The work of this thesis also highlights various actor needs, ranging from organisational to training and basic equipment, to IT artefacts which it is vital to meet in these cross-sector collaborations. The actors' needs for IS seem to be technically feasible (e.g. shared platforms, navigational help) and in some cases rather basic (e.g. semi-professionals need to receive alarms on a mobile app). Moreover, digitalisation in this context does not necessarily mean that new IT artefacts should be designed from scratch. The thesis results rather point towards the idea that needs might be integrated and adapted into the existing IS/IT artefacts/infrastructure by adding cross-sector collaboration functionality. For example, cross-sector communication or information sharing will probably need to be added to the existing alarm and incident management systems of the response organisations and authorities, in order to facilitate the dispatching of new resources. This thesis has also systematised existing knowledge in the form of a framework which presents different crucial aspects of such collaborations.

From an IS research and development perspective, comprehensive stakeholder identification, organisational analysis and needs analysis of the collaborations seems to be a necessity in order to identify the sociotechnical aspects and elements affecting IS. The findings suggest that such an analysis becomes even more important when the joint context does not yet exist, either partly or in its entirety, the infrastructure is going to be built from scratch and/or many challenges and heterogeneous stakeholders are not yet known. In the work for this thesis, sociotechnical systems theory was deemed useful for gaining an initial understanding of the

context by identifying the different technical and non-technical factors that may affect the collaboration. However, as the work progressed, cross-sector collaborations were deemed more complex than the sociotechnical systems since their components, elements, aspects and stakeholders were not distinct and known but entangled and sometimes unidentified. Therefore, using the sociotechnical ensemble approach seemed appropriate as it reflects the complexity of the cross-sector collaboration setting.

Network governance stems from disciplines other than the field of IS research, but it was deemed useful to focus on network and institutionally related aspects of the collaborations that are crucial for developing and implementing them; for example, shared interests, trust and collaboration mechanisms that will affect IS. The importance of incorporating these aspects into technology development is emphasised by the sociotechnical ensemble view at a general level in terms of such issues as the social and institutional aspects, but these are not specified or concretised and thus need to be identified. Network governance here complemented the sociotechnical ensemble view and revealed itself as useful in understanding the complex interactions between stakeholders in cross-sector collaborations. Therefore, it may be used when developing similar collaborations, to ensure that relevant key factors are enabled and hindrances reduced. However, the role of IS seems to be absent in the current network governance literature. At the same time, IS can be seen as a core enabler of networks since it can facilitate interactions between stakeholders/users through enabling such aspects as communication, decision-making and information sharing. Therefore, this thesis suggests that the IS research field and political/social science can benefit and complement each other in analysing and developing new public sector initiatives involving, for example, cross-sector collaboration or civic engagement.

8.3 Challenges and actions in user participation in emerging public sector initiatives

Cross-sector collaboration in emerging public sector initiatives tends to create situations in which it is not clear who the stakeholders, and/or sometimes even the primary end-users, are or should be. Also, an increasingly broad set of heterogeneous stakeholders often become involved. The employing of user participation in the cross-sector collaborations in this thesis strongly confirms the existing challenges related to user participation appearing in the literature in relation to stakeholder identification and involvement (e.g. Pilemalm, 2018; Obata et al., 2012; Dalsgaard, 2010; Simonsen and Hertzum, 2008). However, the previous literature mostly discusses these challenges in relation to large-scale projects or systems with multiple stakeholders. The results of this thesis, however, imply that the same challenges are likely to occur in ERS cross-sector collaboration initiatives on a smaller scale. Also, the challenges seem to become intensified in cases of public sector future service implementation in which the context is new and with partly unknown aspects and stakeholders (most visible in this thesis in Study 3 about semi-professionals). In line with Björgvinsson et al. (2012), these results thus imply that it is important for user participation in these contexts to focus on targeting its overall design agenda in order to enable participation in the development of future services. Currently, related research does exist but is perceived as somewhat

fragmented and lacking a more comprehensive focus on user participation applications in the emerging contexts. Therefore, there might be a need to systematise the potential challenges, as well as to suggest and create new toolboxes. The practical contribution of this thesis here is a suggested combination of user participation activities that might inspire or be applied to similar cases of cross-sector collaboration, specifically in ERS, and/or public sector future service implementations involving new contexts, partly unknown stakeholders and undefined tasks.

Some recent user participation literature, specifically in PD, also pays attention to 'infrastructuring'. This thesis confirms the importance of 'infrastructuring' in emerging cross-sector collaborations since aspects beyond IT artefact designs (e.g. organisational and legal) seem crucial to incorporate in user participation activities and to discuss and explore with various stakeholder groups. At the same time, the results display a paradox in that it seems especially difficult to engage stakeholders within a resource-strained environment such as public sector/ERSs in which the workload of actors is high and organisations often cannot spare them. In other words, there is a trade-off between investment and engagement in short-term user participation activities in order to see the long-term results of efficiency, which is actually the ultimate goal of the collaborations. In line with this, some literature also emphasises the use of new tools and inquiry instruments (e.g. Hillgren et al., 2011; Dalsgaard, 2010). Some activities suggested in this thesis may have the potential to also address the general challenge of user participation sometimes being perceived as time-consuming and resource-intensive to employ in practice. In particular, the notion of context-specific, user-friendly frameworks is a practical contribution in this respect in that such frameworks may help to make user participation activities more effective by addressing challenges such as lack of formalisation and difficulties in identifying and involving stakeholder groups in new and complex public sector contexts. The framework contains a set of the important dimensions of cross-sector collaboration and can be used as a practical tool to: identify related stakeholders who can explore the dimensions, create inquiries for activities, keep the focus of stakeholders on important aspects of collaborations, and be used as the point of departure in discussions. However, a pre-requisite for framework effectivity of use is that it can be re-used in different cases since developing a framework from scratch is a resource-intensive task.

The chosen approach and combination of user participation activities may be criticised since it does not adhere to the traditional ideal of democracy put forward by, above all, earlier versions of PD. On the other hand, it was found that full user participation was not possible in the context of this thesis. Other studies also argue for an increasing number of projects in which full user participation may not be possible (e.g. Bratteteig and Wagner, 2016; Halskov and Hansen, 2015). Focusing on outcomes instead has been discussed as an alternative to compensate for the lack of full user participation (Bratteteig and Wagner, 2016). Therefore, in order to proceed with user participation activities, concrete outcomes were delivered in all the studies, above all, in Study 3, in the form of, for example, training packages, lists of challenges and user needs, and an alarm management app, all based on the stakeholders'/users' input. The outcomes were communicated to the involved organisations

and, in the case of semi-professionals, to the municipality and the fire services for training and further development and potential implementation. Therefore, user participation activities should not insist on the democratic ideal but should be flexible and adapted to stakeholders' availabilities and abilities and should focus on 'good enough' outcomes that can enable future development and implementation.

8.4 Future work

The context of ERS and cross-sector collaboration has been widely discussed during recent years and practical examples have been implemented, not least in Sweden. Thus, the domain is no longer as unexplored as it was in 2012 and there exists related recent research under different terms, such as 'collaborative emergency management', 'public-private partnerships', 'new public sector', etc. (Nohrstedt et al., 2018; Nguyen et al., 2017; Kapucu and Ustun, 2017). However, when it comes to ERS, large-scale incidents still seem to be the main context studied, and it also seems that IS development and the related challenges are still not the main focus. Sweden seems rather progressive in its involvement of complementary resources as first responders, including for frequent emergencies. However, since this is also a growing trend in many other countries, the domain needs further study. Some suggestions for future work are set out below:

In general, performing additional case studies about other cross-sector collaborations in ERSs is likely to increase the transferability of the results of this thesis if they can be compared and reveal similar outcomes. As to IS development for cross-sector collaborations in the Swedish ERS, some stakeholders could not be involved in the studies within the current timeframe. There are other important stakeholders that should be involved in the future in order to gain a more comprehensive picture of the collaborations. Important examples include: the alarm centres that would handle the dispatch of, among others, semi-professionals and ambulance services; county administrative boards (Länsstyrelsen); county councils (Landsting); municipalities; and possibly also the unions, IT contractors and other parties, ensuring that all important stakeholders are actively involved in the design of related infrastructure.

Additionally, some aspects of cross-sector collaboration should be further investigated once they have been implemented. Examples visible in the results of this thesis include an evaluation of the collaborations in terms of their effectiveness and efficiency; for example, in the form of cost/benefit analyses of monetary values. Knowledge about economic aspects is important since it enables decision-makers and politicians to make better large-scale decisions about collaborations within municipalities. In relation to efficiency, it would also be of interest, and a next step, to perform research to 'calibrate' cross-sector collaborations; for example, matching the needs of response organisations with semi-professionals' competences and equipment, so that they can perform the right tasks in the right situation.

The use of the sociotechnical ensemble view, sociotechnical systems theory and network governance in this thesis suggests that they might have the potential to complement each

other and yield a richer understanding of cross-sector collaborations. It should be of interest for future research to explore the relations between IS and the fields of political/social science research in the study of cross-sector collaborations and related IS developments, from both a practical perspective (e.g. interdisciplinary design teams) and a theoretical one (e.g. additional key factors in network governance) at the macro, political, and societal levels. Also, other related theories from political/social science, for example, public administration, new public management and network policies, may be used as complementary theoretical foundations for the framework or as an analytical lens through which to examine ERS/public sector collaborations. Furthermore, IS, ERSs and the cross-sector collaborations studied here are all viewed as sociotechnical systems in this thesis. Other theoretical perspectives, such as Actor-Network theory (Kaghan and Bowker, 2001) and socio-materiality (Leonardi, 2013), may help to develop an understanding of the internal mechanism of cross-sector collaborations in ERSs, and thus may be used as theoretical foundations upon which to develop the results further.

Only Study 3 embraced a systematic study of user participation challenges and actions in the emerging public sector initiatives. Longer and more detailed studies might be performed, in which user participation challenges should be identified and different solutions, for example, toolboxes, methods, activity combinations, could be designed, documented and evaluated. Here as well, evaluations in terms of their effectiveness, efficiency and associated costs can motivate their use. It would also be interesting to explore the future of user participation in new public sector initiatives in terms of preserving or renewing user empowerment and democracy in design, since the current initiatives are increasingly driven by concerns about effectivity and efficiency in stakeholder involvement; for example, in PD.

As to the framework, in the future, more formalised efficiency criteria for the framework as a support tool in user participation (e.g. ease of use, reliability, completeness and relation to designed artefacts) can be developed for more systematic evaluations. The framework can also serve as a starting point for developing similar frameworks to be applied in other contexts in which cross-sector forms of collaboration and network governance are the focus; for example, in e-government and e-health. From a long-term perspective, it may be possible to compare the results of different analyses of various cross-sector forms of collaboration in which the point of departure has been the framework. This could allow researchers to identify similarities and differences between the collaborations in ERSs and, consequently, to build theories about them and their related challenges.

It would also be of great interest (and useful, considering recent societal developments in terms of disasters) to further study the relation between everyday and large-scale emergencies in order to identify what aspects of everyday emergencies, such as techniques or methods, may be re-used during large-scale incidents, or how they could be designed to be flexible enough to be used in both types of emergencies.

Finally, from a practical perspective, the cumulative knowledge on cross-sector collaboration in ERSs may be used to increase the standardisation and transparency when involving other

actors such as volunteers, citizens and semi-professionals, and to provide checklists in order to 'certify' different groups to partake in a response operation (something which has been done, for example, in US CERT teams to involve volunteers; <https://www.ready.gov/community-emergency-response-team>, official website of the Department of Homeland Security, 2018). In the long term, such work could contribute to the more effective establishment of new forms of collaboration in the Swedish ERS and ERSs internationally.

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