

Assessing Inter-organizational Crisis Management Capability - Initial Results of a Systematic Literature Review

Magdalena Granåsen

Swedish Defence Research Agency
magdalena.granasen@foi.se

Mari Olsén

Swedish Defence Research Agency
mari.olsen@foi.se

Per-Anders Oskarsson

Swedish Defence Research Agency
per-anders.oskarsson@foi.se

ABSTRACT

The ability to learn from crises is vital in order to strengthen the capability of societies to manage severe events. This paper presents the initial analysis of a systematic literature review regarding capability assessment of inter-organizational crisis management systems. Inter-organizational crisis management capability is a diverse concept, touching on several related concepts such as resilience, situation awareness and operational performance. During a systematic review process 73 publications were identified. The different aspects of crisis management capability found in the publications were clustered, using an exploratory approach. Nine thematic clusters were identified: interaction, relationships, coordination/C2, system performance, preparedness, situation awareness, resilience, decision making and information infrastructure. A conclusion is that crisis management capability encompasses a multitude of aspects associated with a wide range of assessment methods. The identified publications to a large extent explored aspects of collaboration and coordination, while the actual outcome (system performance) was less explored.

Keywords

Inter-organizational crisis management, crisis response, capability, assessment.

INTRODUCTION

Disasters, emergencies and crises - three interrelated terms referring to events that are sudden, unexpected, extra-ordinary and unpredictable; and affect societal functions (Al-Dahash et al., 2016). These events typically demand immediate action, suspension of ordinary procedures, decision making under uncertainty, and coordinated action (Scholl and Carnes, 2016). Crisis management capability involves a multitude of factors, and identification of valid methods to assess crisis management capability is complex. The current study was conducted within a project funded by the Swedish Contingencies Agency. The project aims to develop models for systematic learning from inter-organizational crisis management exercises to improve crisis management capability.

The ability to learn from crises is critical to organizational performance (Wang, 2015). A valid assessment of the crisis management capability is the trigger in a systematic learning process. Lessons learned processes are typically described as gathering observations (issues for improvement or a potential best practice), transforming these into lessons identified and implementing the lessons identified to lessons learned (Nato, 2016; Andersson and Eriksson, 2015). Figure 1 illustrates how detected deficiencies in crisis management capability motivate changes in a crisis management system, and how this corresponds to a lessons learned process.

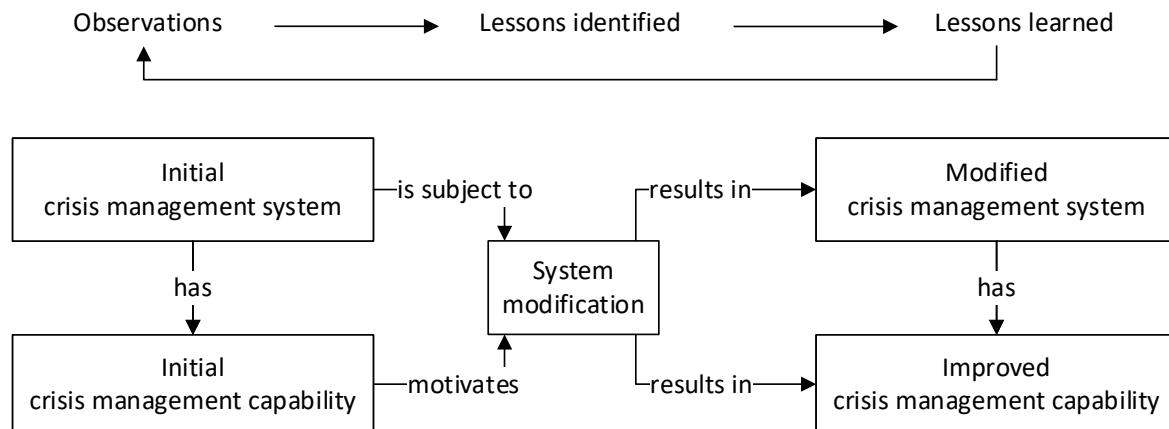


Figure 1. Illustration of how detected deficiencies in crisis management capability motivate changes in a crisis management system.

The objective of the study is to explore inter-organizational crisis management capability and identify capability assessment methods applicable within the Swedish crisis management system. For this means, a systematic literature review was performed.

What is meant by crisis management capability? In its broadest sense, capability is the ability to do something (Oxford dictionary). Lindbom et al. (2015) have identified 13 different definitions of capability used within the crisis management domain. They conclude that capability definitions are commonly related to the easily measured constructs resources and capacity, but generally lack to consider resilience, vulnerability and risk.

During risk and vulnerability analyses, the potential capability to manage future crises is assessed (Lindbom et al. (2015). However, capability can also be assessed in retrospect, that is, how capable organization(s) were to manage an actual (or simulated) crisis, similar to the concept of organizational performance (Wang, 2015; Comfort, 2007). A multi-organizational perspective means that the ability to solve a situation depends on organizations' individual capabilities, as well as their ability to collaborate and coordinate their efforts. The *4C framework* includes essential aspects of inter-organizational performance: cognition, communication, coordination and control (Comfort, 2007). Cognition encompasses the ability to detect risks or malfunctions in a system, which is what triggers action. Communication is essential to convey detected risks and coordinate actions. Through coordination, actors align their actions in order to achieve a common goal. Control encompasses the capacity to keep actions focused on the shared goal of protecting lives, property, and maintaining continuity of operations.

Resilience is a concept closely related to capability that has been widely studied (Woltjer et al., 2015). Woods (2015) structures the meanings of resilience into four approaches: (1) rebounding from a trauma and returning to equilibrium, (2) robustness, (3) graceful extensibility, and (4) sustained adaptability. Woods argues for a definition which is in line with the last two approaches, suggesting that a resilient system is one that is able to adapt and change rather than a system that stands firm in times of changes. In this sense, resilience is closely related to *agility*, a concept mainly used within the military command and control domain (NATO STO-TR-SAS-085, 2014). Béné (2013) concludes that resilience is a multi-component concept. A resilient system is able to balance the cost of the response, the type of response required and the intensity of as well as the cost of the "shock". Thus, resilience is the ability to persist, adapt or transform in the face of a shock or changing environment (Bènè, 2013).

Situation awareness (SA) is a frequently used theoretical concept of the individual's understanding of a situation or a system. SA is commonly described as comprising three levels of understanding: (1) perception of critical factors in the environment, (2) understanding of the meaning of these factors, and (3) understanding, or predictability, of what will happen in the near future (Endsley, 1997). The concept has been developed for applicability to teamwork, where SA, for example, is essential for emergency management organizations that strive to consolidate towards a common goal. Two basic types of definitions are considered for teamwork: team SA and shared SA. Team SA concerns the degree to which every team member possesses the SA required for his or her responsibilities, whereas shared SA concerns the degree to which team members possess the similar SA on shared requirements (Endsley and Jones, 1997). Generally, shared SA provides a richer and more meaningful picture of a teams' ability to work towards a common goal.

This paper presents an initial analysis of a systematic literature review regarding capability assessment of inter-organizational crisis management systems. The inter-organizational scope means that capability in terms of

single-organization capacity and personal skills are not considered. Further analyses will investigate how inter-organizational crisis management systems are modelled and the relations between capability assessment and the inter-organizational crisis management system.

METHOD

The systematic literature review was conducted according to standard procedures for systematic reviews (e.g. Kitchenham, 2004; Okoli and Shabram 2010). The selected methodological approach was to identify a single dataset that was useful for investigating assessment of inter-organizational capability as well as providing descriptions of inter-organizational crisis management systems. The actual literature search was preceded by a pilot study, as described in the following sections.

Pilot study

The pilot study aimed at identifying existing systematic literature reviews assessing crisis management capability or modelling emergency management systems, provide input regarding appropriate search terms, development of a review protocol, and get hands-on experience of the Scopus database. Scopus is a multi-disciplinary database widely used for literature reviews, provides functionality for obtaining an overview of the result and has been proven to result in a sufficient dataset (Yang and Lokman, 2006). The pilot search was based on a limited selection of search terms (table 1), and limited to publications between 2012-2017. A Boolean type of search was used with OR between the rows in a column and AND between the columns. The search was conducted on title, abstract and keywords of the publications in the Scopus database.

Table 1. Search terms for pilot study

Crisis	Management	Assessment/ model	Literature review
Emergency	Preparedness	Assess*	Literature review
Crisis	Management	Analys*	Scoping study
Disaster	Response	Performance Measure Model	Scoping review

The pilot study resulted in the identification of six literature reviews providing inspiration in the continuous planning and execution of the main study. A review of similarities and differences between the terms crisis, disaster and emergency provided insight about the interconnectedness, interdependencies and interchangeable use of these terms in the literature (Al-Dahash et al. (2016). As a consequence, all combinations of emergency/crisis/disaster with preparedness/management/response were included as search terms in the main study.

Two literature reviews found provided particular inspiration, describing literature reviews that methodologically and topic-wise were related to the research questions of the current study (Skryabina et al. 2017; Beerens and Tehler, 2016). Terms describing capability assessment provided a challenge as different terms are used for similar phenomena, and terms such as “assess” may occur in common language without indicating specific assessment methods. The pilot search guided in the formulation of inclusion and exclusion criteria (table 3).

Database search

The search was conducted in the Scopus database. Three categories of search terms were identified (table 2). The time limit was set to publications between the years 2012-2017. Only publications written in English were included. Publications in the following subject areas were excluded; mathematics, biochemistry, material studies, immunology, neurology, pharmacy and veterinary studies.

Table 2. Search terms for main study

Crisis management	Capability assessment	Multi-actor
Emergency preparedness	Assess*	Multi-agency
Crisis preparedness	Analys*	Multi-actor
Disaster preparedness	Performance	Inter-organization*
Emergency management	Indicator*	Coordination
Crisis management	Examin*	Joint
Disaster management	Validat*	Collaboration
Emergency response	Capability	
Crisis response	Eval*	
Disaster response	Concept	
Emergency relief		

Abstract review

The title and abstracts of the 1197 publications resulting from the database search were reviewed according to inclusion and exclusion criteria (table 3). The publications were divided between three researchers so that all abstracts were reviewed by two researchers. Hence, each researcher reviewed approximately 2/3 of the publication abstracts.

Table 3. Criteria for inclusion and exclusion of publications during abstract review

Inclusion criteria	Exclusion criteria
Description of assessment of crisis management capability and/or description of modelling of crisis management system/s	Not relevant for the research questions
Primary focus on governmental organizations	Focus on personal skills
Involving more than one crisis management organization	Focus on single crisis management organization
	Primarily technical focus
	Focus mainly on preparedness plans

For publications complying with the inclusion and exclusion criteria, each reviewer rated its relevance on a three-point scale: 1) Questionable relevance, 2) Moderate relevance, and 3) High relevance

Initially, two of the reviewers both reviewed the first 50 publications in the dataset. A check of their agreement showed agreement of inclusion/exclusion for 76 percent (38) of the 50 publications. The reviewers solved the 12 disagreements by a common discussion, resulting in that six of the non-agreed publications were included. This discussion contributed to a common understanding of the questions at issue as well as interpretation of the relevance rating and exclusion and inclusion criteria.

The abstract review resulted in 250 publications where both reviewers agreed on inclusion, 682 publications where both reviewers agreed on exclusion (or identified duplications) and 265 disagreements. For the disagreements, if one reviewer had decided on inclusion with relevance rating 1 (Questionable relevance) and the other had decided on exclusion, the publication was excluded. This was the case for 168 of the 265 conflicts. For the remaining 97 publications, the third reviewer performed a supplementary abstract review, resulting in that 44 of these publications were included (45%). This left a total of 294 included publications. Due to time constraints, the dataset for full-text review needed to be further reduced. The sum of the reviewers' relevance ratings was used for this reduction. Since two reviewers reviewed each abstract, the sum of the ratings for included publications ranged between two and six. Publications rated four or higher were included in the full text review (table 4).

Table 4. Sum of relevance rating for included abstracts. Relevance below 4 is shaded since these publications were not included in the full text review

Rated relevance	6	5	4	3	2
Number of publications	8	36	106	106	38
Accumulated sum of publications	8	44	150	256	294

Publications with a sum relevance of two and three may be reviewed again if the study is extended with a supplementary review.

Full-text review

Full-text review was performed on the 150 remaining publications. Initially, three publications were reviewed individually in parallel by all three reviewers. This was followed by a group discussion to consolidate on agreement of interpretation and understanding of the inclusion and exclusion criteria. The remaining 147 publications were then divided between the three reviewers, thus each publication was reviewed by one reviewer.

The procedure of the full text review was formalized by a review template implemented in an MS Excel sheet. The overall template structure was inspired by a review template developed for a literature review in DARWIN, a European research project aiming to develop generic resilience guidelines for emergency and crisis management organizations (Woltjer et al., 2015). The DARWIN template served as inspiration for the general questions to the material. For questions related to the research questions, two of the reference reviews from the pilot study provided inspiration (Skryabina, et. al, 2014; Beerens and Tehler, 2016). The review template encompassed 34 review questions assessing general information of the described studies, capability assessment, modelling or describing emergency management systems, and information on relevant reference literature (snowballing).

Through snowballing, 37 publications were identified as potentially interesting to include in the dataset. The abstracts of these publications were reviewed according to the same procedure as the other reviewed abstracts. 16 (43%) of the snowballing abstracts were included in full-text review.

This means that in all, 166 publications were included in the full text review. Of these, 106 (64%) were assessed as relevant while 60 were excluded. The selection process from database search to full-text review is summarized in figure 2.

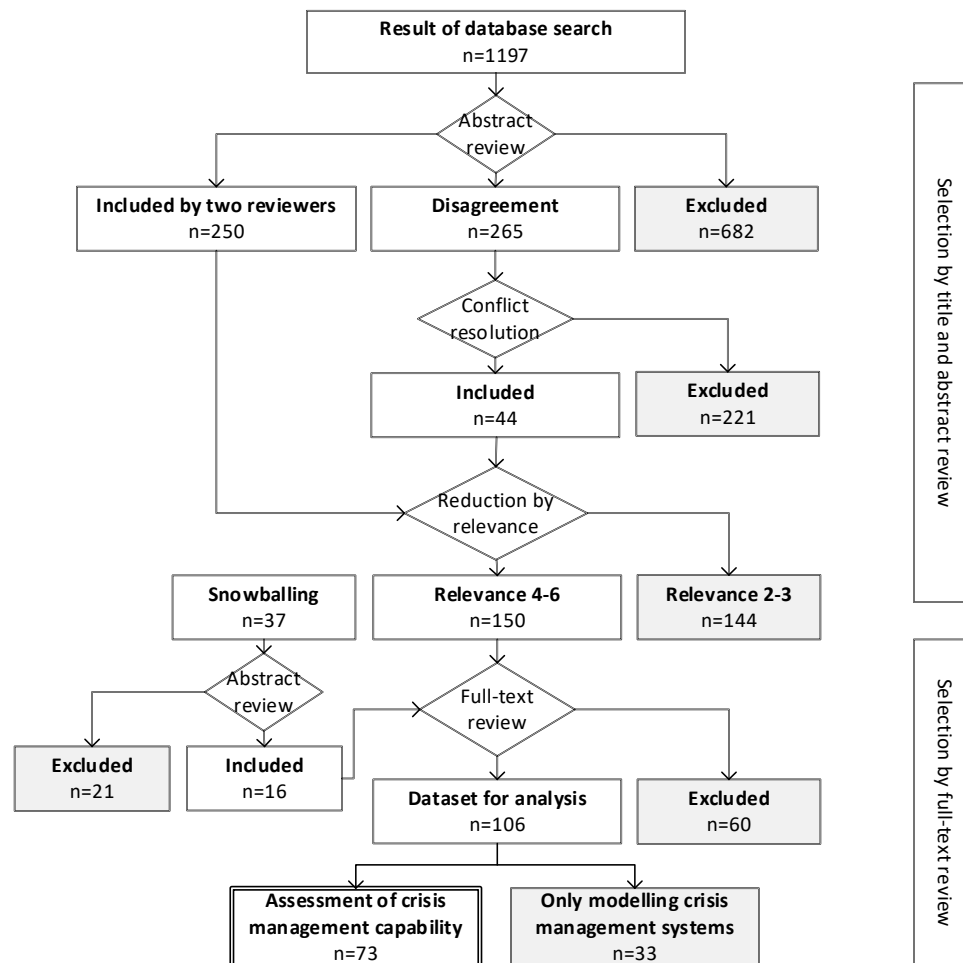


Figure 2. Overview of the publication selection process

Analysis

Using the information in the full-text protocol on the question “which aspect of crisis management capability is assessed,” the identified capabilities were clustered. One of the publications in the dataset used a modified version of the 4C framework by Comfort (2007) to structure the results of a review on case studies of multi-agency disaster response (Steigenberg, 2015). However, we found it difficult to match the identified capabilities according to 4C. Instead an explorative approach was chosen, where the clusters were formed based on content. The clustering process was iterative, resulting in that the categories changed along with the capabilities identified. Some publications needed to be reviewed again, to identify the meaning behind the formulations, as the information in the full-text protocol was unsatisfactory. For instance, collaboration was used frequently throughout the publications, however with different meanings. The clustering provided an overview of the different themes in the material.

The analysis further included an investigation of which types of measures that were used for assessing the capabilities. The methods were clustered to investigate if some methods or types of methods were used more frequently. Furthermore, a comparison between assessment methods and the thematic clusters were conducted to investigate whether some methods are more commonly used for certain types of capabilities.

RESULTS

73 of the 106 publications in the dataset included methods to evaluate inter-organizational crisis management capability. The analyses in the current paper are conducted on those 73 publications.

General overview of publications

The distribution of which types of studies that were described in the publications is presented in table 5.

Table 5. Distribution of the types of studies in the publications

Study type	Number	Percent
Empirical study	42	58%
Mixed	22	30%
Literature review	5	7%
Theoretical study	4	5%

Regarding type of data or measures, the distribution was 29 (40%) qualitative studies, 20 (27%) quantitative studies, 21 (29%) including a mix between qualitative and quantitative measures, and 3 (4%) specifying no measures.

A majority of the publications were based on actual incidents, of which a majority referred to natural disasters. The distribution of types of empirical interventions in the studies described in the publications is presented in Table 6. 17 of the publications did not fit into any of the categories, either because empirical intervention was unclear, the type of intervention did not fit any of the available categories, or that the publication was a theoretical study with no empirical intervention.

Table 6. Distribution of empirical interventions in the publications

Empirical intervention	Number	Percent
Real incident/case	41	56%
Tabletop exercise	5	7%
Command Post Exercise	4	5%
Functional exercise	3	4%
Field Exercise	2	3%
Experiment	1	1%

The publications described incidents, exercises or experiments conducted in 24 different countries. Distribution of countries that occurred in three or more publications is presented in table 7. As seen, Sweden is highly represented, considering its small population and low occurrence of natural disasters. This can be explained by three factors. First, since the main focus was on governmental organizations, publications focusing on the work of voluntary organizations in major natural disasters were to a large extent excluded, while studies of disasters or exercises focusing on nation's own capacity to manage the incidents remained in the material. Thus, studies investigating crises in countries where there was a huge need for international aid were to a large extent excluded. Further, in the time scope of the literature review there was a major forest fire in Sweden 2014, resulting in research specifically targeting multi-agency collaboration (Bergström et al., 2016; Bodin and Nohrstedt, 2016). Third, as the result of the systematic literature review is mainly to be applicable in the Swedish context, the acceptance of Swedish publications was somewhat more generous. Still, all publications in the dataset were in line with the inclusion criteria, regardless of location of intervention.

Table 7. Distribution of countries that occurred in three or more of the publications

Location of events (countries)	Number	Percent
USA	15	21%
Sweden	11	15%
Australia	7	10%
China	6	8%
Germany	3	4%
Indonesia	3	4%

The publications included studies from local to international administrative level (table 8). 42 publications (58%) described studies on more than one administrative management level, on average 2 in each study. International organizations were represented to a higher extent in the Scopus search result, however as publications about international organizations mainly focused on volunteer work, most were excluded during the abstract review.

Table 8. Distribution of publications on administrative management scale

Administrative management scale	Number	Percent
Local (communal)	50	68%
Regional (county)	50	68%
National	31	42%
International	6	8%
Unspecified	6	8%

Assessment of crisis management capability

Concerning capability assessment, nine thematic clusters were identified. The clusters identified are presented in table 9, with their related capabilities as described in the publications, and the number of publications represented in each cluster. Each publication included on average 2.2 capabilities. Since publications included terms represented in more than one cluster, the number of publications in table 9 sums to 157.

Table 9. Clustered capabilities

Cluster	Capabilities	Number of publications
<i>Interaction</i>	Communication (responder, crisis, outreach, inter-organizational, rapid), Collaboration (Formal/informal), Relation between collaborative networks and task interdependency, Team disconnects, Information sharing, Collaboration practices, Task interdependency, Inter-organizational crisis management, Participators interaction, Information flow, Intersectional interactions/collaboration, (Intergovernmental) interactions, Managing collaborative activities, Information flow, Cooperation, Social behaviors, Social network, Informal networks	38
<i>Relationships</i>	Formal and trust based relationships, Resource allocation, (Shared) Awareness of knowledge, tasks, roles, material and personal resources, Formal and informal networks, Trust, Shared priorities and goals, Collective accountability, Interoperability (barriers and approaches), Predictability, Common understanding and vision, Multiplexity, Embeddedness, Transitivity, Homiphily, Brokerage, Collaborative initiatives, Creating collaborative culture, Building collaborative institution, Synergies, Partnership development and maintenance, Cooperative attitude, Misalignment between agencies, Organizational structure and practices	24
<i>Coordination/C2</i>	Hierarchies between actors, Shift from information management to interaction management, C2, Coordination, Coordination centers/command posts, Leadership, Identifying formal and emergent coordinators, Clear superordinate goals, Hierarchical multi-agency organizational structure, Inter-organizational coordination, Formal disaster response system, Control mechanisms in coordination, Resource mobilization, Favor monodisciplinary, Strategy	23
<i>System performance</i>	Analysing the situation, Actor and process pre- and post-disaster, Team performance (Requisite variety, Delegation of decisions, Fallacy of centrality, Thematic lock-up, Thematic vagabonding), Network- level outcomes, Client level effectiveness, Network (sensitivity, function), Endogenous and exogenous stressors, Collaboration awareness, System/organizational capacity, Capability and function, (General, organizational) performance, System-wide humanitarian response operations performance, Actions implemented, Operational efficiency, Organizational capacity building, Framework (conceptual, structural, operational, scientific), Self-awareness, Network level competencies	22
<i>Preparedness</i>	Training and evaluating disaster preparedness plans, Contingency planning (effectiveness), Preparedness (Institutional, Individual, collective, local emergency), Network according to prior plans, Framework applicability, Operational experience, Emergency plan,	12

	Learning related work activity	
<i>Situation awareness</i>	Risk awareness, Risk assessment, Situation assessment, Assessment of resource needs, Sensemaking, (Shared) Situation awareness, Disaster assessment, Perceptions of risk and risk management procedures, Situation understanding, Situational picture	11
<i>Resilience</i>	Robustness, Rapidity, Resourcefulness, Redundancy, Innovation and change, Adaptive capacity, Resilience themes in preparedness, Emergent network, (Social) Network evolution, Evolution of social behaviours in a network, Capacity, Integrated disaster resilience, Relationships between resilience and adaptive governance	11
<i>Decision making</i>	Decision making (decentralized), Planning processes and procedures, Plan formulation, Central planning, Evaluation of implementation of emergency plans, Analyse crisis situations, Simulating the effects of different possible actions	9
<i>Information infrastructure</i>	Information and communication technology (ICT), Development and validation of ICT prototypes, Communication technology, Use of coordination technology, Equipment, IT-support, Inter-organizational IT use	7

Interaction was the largest cluster, which was included in 38 publications. Most frequent capabilities mentioned in this cluster were communication and collaboration. The publications used several related terms, inconsistently used between publications. Interaction activities may have both active and passive forms but still be referred to as collaboration (Robinson and Gaddis, 2012). The cluster thus included some publications about information sharing activities from a quantitative perspective, that is, number and patterns of interaction (Ley et al., 2014), while other publications qualitatively addressed how different actors actively engage in collaborative activities (Bergström et al., 2016).

Relationships referred to capabilities relating to knowledge of each other's roles, responsibilities, equipment and tasks, trustbuilding and collaborative institutions. The concept of trust was explored in several publications (House et al., 2016; Gero et al., 2015), while other terms were mentioned only in one publication, such as multiplexity and embeddedness, (Lai et al., 2017).

Coordination/C2 included concepts related to mandates and commanding structures (hierarchical or horizontally organized) as well as leadership issues. Coordination is about aligning different actors' actions towards common goals (Comfort, 2007). The cluster further included capabilities related to activities for structuring the leadership (Bergström et al., 2016).

System performance included capabilities related to the actual outcome of the crisis management response. These were primarily capabilities aiming to give an overall assessment of the total performance of a crisis management system; however, some publications primarily focused on the outcome on client level (Bang and Kim, 2016).

Preparedness included terms related to the evaluation of preparedness plans based on the outcome of a crisis or an exercise. For example if the collaborative network that emerged during crisis response was in line with the preparedness plan (Robinson et al., 2013). The publications that only had focus on the development of preparedness without relating it to a crisis were excluded according to the exclusion criteria.

The *Situation awareness (SA)* cluster was formed based on Endsley (1997). All publications in this cluster did not use the term situation awareness, however they studied capabilities in line with this theme, such as sensemaking or risk perception (Baroutsi, 2016; Holgersson, 2016). The awareness of other actors' tasks and responsibilities is related to the situation awareness, however it was decided to instead include these capabilities as a part of the relationships cluster. This is mainly due to that the awareness of other crisis response actors is highly related to trust and the forming of relationships.

The *Resilience* cluster was formed mainly based on the definitions of Woods (2015) as well as Bené (2013). This means that publications could focus on robustness aspects or on adaptation aspects. One example is Jung (2017), viewing resilience as a function of the capabilities robustness, rapidity, resourcefulness and redundancy. Similar to the situation awareness cluster, not all publications specifically mentioned resilience. For instance, the cluster included a publication assessing adaptive capacity (Gero et al., 2015).

Decision making included capabilities relating to the decision making process such as analysing the situation,

creating plans and simulating the plans to investigate the possible outcome (Bañuls et al., 2013).

Information infrastructure gathered terms dealing with technical equipment, mainly communication equipment. As publications focusing purely on technology were excluded, the publications in this cluster addressed for instance how communication technology is used in the emergency management situation and the effects of insufficient technology on crisis management (Hall et al., 2012).

Figure 3 illustrates types of measures (quantitative, qualitative, or mixed) used for assessing the capabilities in each cluster. Three of the publications did not specify any measures. In total, 72 capabilities were assessed using qualitative measures, 40 capabilities were assessed using quantitative measures and 39 contained a mix. The bars in figure 3 illustrates that the number of publications with qualitative measures is larger for most categories, except for the clusters preparedness and resilience. This indicates a general preference for qualitative measures for assessment of emergency management capability. Qualitative capability assessment was based on e.g. analysis of reports, interviews, questionnaires, observation and workshops. For quantitative or mixed measures, Social network analysis (SNA) was most influential, representing 38% of the quantitatively measured capabilities and 28% of the mixed measures. SNA is commonly used to investigate which participants/functions that were most influential in an organization or organizational cluster (Bisri, 2017). SNA analysis is conducted mainly through quantitative measures, however in order to extract the data needed for the analysis, qualitative measures may be used. SNA was highly represented in the coordination/C2 cluster, where SNA represented 100% of the quantitative measures and 50% of the mixed measures, followed by the interactions cluster (44% of quantitative measures and 15% of mixed) and relationships (17% of quantitative measures, 40% of mixed).

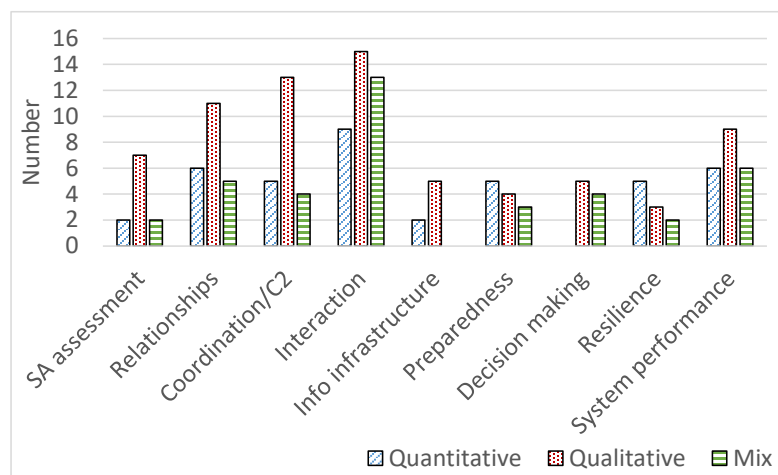


Figure 3. Types of measures used for assessing capabilities within the different clusters.

DISCUSSION

This paper presents an initial analysis of a systematic literature review aiming to investigate assessment of crisis management capability in inter-organizational crisis management systems. The dataset was diverse, including a multitude of perspectives relating to the topic. The broad scope on capability fulfilled its purpose to open up for different perspectives, however demanded an iterative and exploratory analysis and a thorough investigation of the meaning behind the terminology used by the authors of the publications. The clusters resilience and situation awareness were formed based on reference literature, which was particularly useful regarding publications that did not specifically use the terms situation awareness or resilience, (e.g. adaptive capacity, Gero et al., 2015). The interaction cluster was a “giving up” on trying distinguishing between interrelated terms concerning collaboration, cooperation, communication, interaction etc., as the authors of the publications used these terms very differently. By creating a broad cluster for interactive activities, this problem was reduced. It is hardly surprising that the most common capabilities clustered in the analysis were related to interactions, relationships and coordination/C2 considering that the multi-agency perspective was included both in the literature search terms and in the review criteria. Publications were mainly focused on the interaction between actors, while the actual outcome (System performance cluster) was less explored. It is assumed that improved collaboration will result in improved performance, however few studies have investigated whether the actual response and actions taken were appropriate.

As different terms and concepts overlap, and some terms encompass broad phenomena there are not absolute boundaries between the clusters, and capabilities are clearly related to each other. One identified example is knowledge of other actors’ responsibilities and tasks, which was assigned to the relationships cluster, although it

can be argued that this knowledge is part of SA. Still, the nine clusters are, to us, quite intuitive, and useful for the further analysis, when trying to identify applicable methods and measures as well as understanding which different themes are included in the concept of inter-organizational crisis management capability. The 4C Framework (Comfort, 2007) initially seemed applicable, however when assigning capabilities, we found it difficult to distinguish between the C's, especially between coordination and control. The resulting set of clusters is not definite, and if it is found that the boundaries between capabilities is blurred, clusters may be merged. Further research on the dataset will include deeper investigations of the specific concepts and methods.

The systematic review approach was found useful, although time consuming. The pilot study indicated that terminology in this subject is diverse, which was further confirmed by the results of the main study. In retrospect, the search terms seem sufficient. We have not identified how we could have adjusted search terms or used Scopus features to more efficiently sort out irrelevant results, while keeping the relevant results. The relevance rating facilitated prioritization of which publications should be read in full-text for this initial analysis, although we have already identified several publications with low rating that are relevant to read for a more comprehensive result in the further analysis. The fact that 60 publications were excluded during the full-text review shows that the assessed relevance of the abstracts did not always correlate with the relevance of the full-text publications. The diversity in researcher background was fruitful for the understanding of the different perspectives of the publications. Synchronizing the review assessments by co-reading abstracts as well as publications, and discussing the review criteria as well as the protocol was a criteria for success.

CONCLUSION AND FUTURE WORK

The systematic literature review have definitely resulted in an understanding of the concept of inter-organizational crisis management capability. The nine different themes, or clusters, summarizes the recent research and shows that the capability concept is broad with a diverse, sometimes confusing, terminology. The analysis shows that research is mainly focused on the interaction between actors, while the actual outcome (System performance cluster) is less explored

Hopefully, the terms identified within the different clusters can guide researchers to identify related research within their topics of interest. The next step will be to conduct a more thorough analysis of the methods and measures used for capability assessment within each cluster. As figure 1 in the introductory section illustrates, crisis management capability is connected to a crisis management system. Thus, the links between the types of capabilities assessed and the types of crisis management systems will be investigated. Exploring capability assessment in relation to crisis management systems will hopefully give valuable insight into how crisis management systems can learn from crises. The dataset will further be used to explore how inter-organizational crisis management systems are described and modelled. Since a significant amount (35%) of the so far included publications contain both the capability assessment dimension and the system modelling dimension, the dataset gives a good foundation for these analyses.

ACKNOWLEDGMENTS

This paper presents a study carried out within the research project KOMET, sponsored by the Swedish Contingencies Agency.

REFERENCES

- Al-Dahash, H., Thayaparan, M. and Kulatunga, U. (2016) Understanding the terminologies: disaster, crisis and emergency, *Management*, 2, 1191-1200.
- Andersson, D. and Eriksson, P. (2015) Inter-organisational lessons learned: perspectives and challenges, *Proceedings of the International Emergency Management Society 2015 Annual Conference*, Rome, Italy.
- Bang, M. S. and Kim, Y. (2016) Collaborative governance difficulty and policy implication: Case study of the Sewol disaster in South Korea, *Disaster Prevention and Management*, 25, 2, 212-226.
- Bañuls, V. A., Turoff, M. and Hiltz, S. R. (2013) Collaborative scenario modeling in emergency management through cross-impact. *Technological Forecasting and Social Change*, 80, 9, 1756-1774.
- Baroutsi, N. (2016) Observing Sensemaking in C2: Performance Assessment in Multi-Organizational Crisis Response, *Proceedings of the 13th International Conference on Information Systems for Crisis Response and Management (ISCRAM)*, Rio de Janeiro, Brazil.
- Béné, C. (2013) Towards a Quantifiable Measure of Resilience, *IDS Working paper*, 2013, 434.
- Beerens, R. J. J. and Tehler, H. (2016) Scoping the field of disaster exercise evaluation-A literature overview

- and analysis, *International Journal of Disaster Risk Reduction*, 19, 413-446.
- Bergström, J., Uhr, C. and Frykmer, T. (2016) A complexity framework for studying disaster response management. *Journal of Contingencies and Crisis Management*, 24, 3, 124-135.
- Bisri, M. B. F. (2017) Inter-organizational network in Indonesia during disasters: Examples and research agenda on disaster management, *IOP Conference Series: Earth and Environmental Science*, 56, 1, p. 012023. IOP Publishing.
- Bodin, Ö. and Nohrstedt, D. (2016) Formation and performance of collaborative disaster management networks: Evidence from a Swedish wildfire response, *Global Environmental Change*, 41, 183-194.
- Comfort, L. K. (2007) Crisis management in hindsight: Cognition, communication, coordination, and control, *Public Administration Review*, 67, 189-197.
- Endsley, M. R. (1997) The role of situation awareness in naturalistic decision making, 269-283, In C. E. Zsombok and G. Klein (eds.), *Naturalistic decision making*, Lawrence Erlbaum Associates, New Jersey.
- Endsley M. R. and Jones, W. M. (1997) *Situation awareness information dominance & information warfare* (Technical Report), Armstrong Laboratories, Belmont, MA.
- Gero, A., Fletcher, S., Rumsey, M., Thiessen, J., Kuruppu, N., Buchan, J. and Willetts, J. (2015) Disasters and climate change in the Pacific: adaptive capacity of humanitarian response organizations, *Climate and Development*, 7, 1, 35-46.
- Hall, D. J., Skipper, J. B., Hazen, B. T. and Hanna, J. B. (2012) Inter-organizational IT use, cooperative attitude, and inter-organizational collaboration as antecedents to contingency planning effectiveness, *The International Journal of Logistics Management*, 23, 1, 50-76.
- Holgersson, A. (2016) Review of On-Scene Management of Mass-Casualty Attacks, *Journal of Human Security*, 12, 1, 91.
- House, A., Power, N. and Alison, L. (2014) A systematic review of the potential hurdles of interoperability to the emergency services in major incidents: recommendations for solutions and alternatives, *Cognition, technology & work*, 16, 3, 319-335.
- Jung, K. (2017) Sources of Organizational Resilience for Sustainable Communities: An Institutional Collective Action Perspective, *Sustainability*, 9, 7, 1141.
- Kitchenham, B. (2004) *Procedures for performing systematic reviews*, NICTA Technical report 0400011T.1. July, 2004.
- Lai, C. H., She, B. and Tao, C. C. (2017) Connecting the dots: A longitudinal observation of relief organizations' representational networks on social media, *Computers in Human Behavior*, 74, 224-234.
- Ley, B., Ludwig, T., Pipek, V., Randall, D., Reuter, C. and Wiedenhoefer, T. (2014) Information and expertise sharing in inter-organizational crisis management, *Computer Supported Cooperative Work (CSCW)*, 23, 4-6, 347-387.
- Lindbom, H., Tehler, H., Eriksson, K. and Aven, T. (2015) The capability concept – On how to define and describe capability in relation to risk, vulnerability and resilience, *Reliability Engineering and System Safety*, 135, 45-54.
- NATO STO-TR-SAS-085 (2014) *C2 Agility: Task Group SAS-085 Final Report*, Neuilly-sur-Seine Cedex, France: NATO Science and Technology Organisation, STO-TR-SAS-085.
- NATO (2016) *The NATO Lessons Learned Handbook* (3rd edition), Joint Analysis & Lessons Learned Centre.
- Okoli, C. and Shabram, K. (2010) A Guide to Conducting a Systematic Literature Review of Information Systems Research, *Sprouts: Working Papers on Information Systems*, 10, 26, <http://sprouts.aisnet.org/10-26>.
- Robinson, S. E. and Gaddis, B. S. (2012) Seeing past parallel play: Survey measures of collaboration in disaster situations, *Policy Studies Journal*, 40, 2, 256-273.
- Robinson, S. E., Eller, W. S., Gall, M. and Gerber, B. J. (2013) The core and periphery of emergency management networks, *Public Management Review*, 15, 3, 344-362.
- Scholl, H. J. and Carnes, S., (2017) Managerial Challenges in Early disaster response: The case of the 2014 Oso/SR530 Landslide disaster, *Proceedings of the 14th International Conference on Information Systems for Crisis Response and Management (ISCRAM)*, Albi, France.
- Skryabina, E., Reedy, G., Amlôt, R., Jaye, P. and Riley, P. (2017) What is the value of health emergency preparedness exercises? A scoping review study, *International Journal of Disaster Risk Reduction*, 21, 274-283.

- Steigenberg, N. (2015) Organizing for the big one - A review of case studies on multi-agency disaster response and a research agenda, *Proceedings of the 12th International Conference on Information Systems for Crisis Response and Management (ISCRAM)*, Kristiansand, Norway.
- Yang, K. and Lokman, I., M. (2006) Citation Analysis: A Comparison of Google Scholar, Scopus, and Web of Science, *Proceedings of the Association for Information Science and Technology*, 43, 1, 1-15.
- Wang, W. T. (2015) Evaluating organisational performance during crises: A multi-dimensional framework, *Total Quality Management*, 23, 6, 673–688
- Woltjer, R., Nevhage, B., Nilsson, S., Oskarsson, P.-A., Hermelin, J., Trnka, J., Thorstensson, M., Mattsson, K. D., Herrera, I., Grøtan, T. O., Branlat, M., Frøystad, C., Tøndel, I. A., Moe, M., Adini, B., Cohen, O., Marks, N., Giorgi, S., Rosi, L. and Cedrini, V. (2015) *Consolidation of resilience concepts and practices for crisis management (DARWIN D1.1)*.
- Woods, D. D. (2015) Four concepts for resilience and the implications for the future of resilience engineering, *Reliability Engineering & System Safety*, 141, 5-9.