

# Civilian Crisis Response Models

Edited by

**Bernhard Katzy<sup>1</sup> and Ulrike Lechner<sup>2</sup>**

**1** Leiden University, NL, [bkatzy@liacs.nl](mailto:bkatzy@liacs.nl)

**2** Universität der Bundeswehr München, DE, [Ulrike.Lechner@unibw.de](mailto:Ulrike.Lechner@unibw.de)

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## Abstract

This report documents the program and the outcomes of Dagstuhl Seminar 13041 “Civilian Crisis Response Models”.

The vulnerability of modern societies to the threats of man made and natural disaster increases and scale and number of disasters are expected to rise. The earthquakes of Haiti with its subsequent Cholera epidemics, the natural disasters in Pakistan as well as the ongoing situation in Japan illustrate the need for effective and efficient crisis and disaster response organizations as well as humanitarian aid organizations in developing and first world countries. Disaster preparedness is a key to effectiveness and efficiency in case of crisis or disaster – but we observe that natural and human disasters are too often beyond what is being planned for.

There is a need for new and better approaches in disaster and crises response and humanitarian aid. There is a need for well designed systems as well as for models, methods, instruments and tools for analysis and decision making. This Dagstuhl Seminar is motivated by the fact that computer science is an enabler for the changes and should contribute to the body of scientific knowledge and instruments and tools alike.

The Seminar discussed approaches to Crisis Response from a variety of disciplines. In a workshop like setting with talks, panels and discussions, seminar participants worked on a common understanding of crisis and crisis response, characteristics of crisis situations and crisis response and research topics on crisis management. The participants developed on a research agenda for Networked Civilian Crisis Response Models.

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## 1 Executive Summary

*Ulrike Lechner*

*Bernhard Katzy*

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The vulnerability of modern societies to the threats of man made and natural disaster increases and scale and number of disasters are expected to rise. The earthquakes of Haiti with its subsequent Cholera epidemics, the natural disasters in Pakistan as well as the ongoing situation in Japan illustrate the need for effective and efficient crisis and disaster response organizations as well as humanitarian aid organizations in developing and first world countries. Disaster preparedness is a key to effectiveness and efficiency in case of crisis or disaster – but we observe that natural and human disasters are too often beyond what is being planned for.



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There is a need for new and better approaches in disaster and crises response and humanitarian aid. Think of IT-systems and how well designed systems can help or think of what science can contribute in terms of models, methods, instruments and tools for analysis and decision making. This Dagstuhl Seminar is motivated by the fact that computer science is an enabler for the changes and should contribute to the body of scientific knowledge and instruments and tools alike. This seminar on crisis response Models aims to make a contribution to the systematic development of a body of scientific knowledge for crisis and disaster response and Humanitarian Aid organizations. We invite researchers and practitioners in the field of humanitarian aid and crisis and disaster response as well as researchers in computer science and related disciplines to this Dagstuhl Seminar on Civilian Crisis Response Models. We address with this seminar on crisis response models questions concerning the design of systems in crisis and disaster response and humanitarian aid. Currently, there is a window of opportunity for redesigning the crisis response system as the proliferation of mobile phones, smart phones and social software facilitate novel services and new Command and Control (C2) systems allows for new designs. Many examples demonstrate the increasing use of social media in emergencies: For human and man-made disasters websites and Internet services are created to support the inflicted population as well as the aid organizations. A popular and successful example is Ushahidi, a NGO developed platform in response to civil war in Kenya 2008 mapping incidents of violence. In the ongoing crisis in Japan, Twitter and Facebook messages were compiled to provide guidance of what kind of help is needed. Web services are used widespread to locate missing persons. “Google Crisis” provides its set of services to be deployed in case via the Google website.

These systems, many of which have been created ad-hoc by volunteers illustrate the feasibility of better information systems in crisis response management. In many cases, they turned out to be efficient, precise and easy to operate. From these services, evaluation towards a permanent information system is needed. These novel systems illustrate the need for good governance and the need to analyze and reconsider the whole disaster response system with its information flows. What is the impact of the use of such systems in case of a disaster on communication, logistics, the behavior of the population and the aid organizations? Again, scientific methods eventually might be useful to build new systems and develop new processes and strategies.

With this Dagstuhl Seminar on Civilian Crisis Response Models we go beyond the design of technology and aims at contributing to the scientific body of knowledge of crisis and disaster response and Humanitarian aid. Disaster preparedness is the area in the field of crisis and disaster management that requires well developed, evidence-based quantitative models and theories to feed and guide the simulations, optimizations, serious games, analytical methods, architectures and process models, creative techniques or case studies. Disaster preparedness requires its body of scientific knowledge to be used for exploring disaster preparedness, for building IT-systems, for assessing humanitarian aid and disaster response organizations and for guiding the necessary changes in the crisis response system to adopt it to new threats and new scenarios. Methods and models are crucial for making better decisions in tight financial situations.

The seminar addressed the needs and solution options in a systematic way. The report documents on the presentations, the panel discussions and various workshop and working group sessions and their results.

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## 2 Table of Contents

### Executive Summary

<i>Ulrike Lechner and Bernhard Katzy</i> . . . . .	67
--	----

### Overview of Talks

Sorting enabling technologies for risk analysis and crisis management <i>Ivo Häring</i> . . . . .	71
Towards a framework for the conceptualization of command post exercises — an action research approach with staffs of disaster response organizations <i>Erich Heumüller</i> . . . . .	72
Usage of Social Media in Crisis Situations <i>Nicole Krämer</i> . . . . .	72
Geoinformation and disaster management <i>Wolfgang Reinhardt</i> . . . . .	73
End User Perspective <i>Heiko Werner</i> . . . . .	73
Navigation Support with Landmarks: A Design Case Study <i>Volker Wulf</i> . . . . .	74

### Plenary

Civilian Crisis Response Models – Panel Discussion <i>Ozgur Dehayir</i> . . . . .	74
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### Workshops on Research Topics for Crisis Response

Workshop Humanitarian Crisis Response Logistics <i>Ulrike Lechner</i> . . . . .	78
Workshop Overview Research <i>Nico Kaptein</i> . . . . .	79
Workshop Crisis management and governance <i>Edwin Bakker</i> . . . . .	79
Workshop Engagement Models for Entrepreneurs and Volunteers <i>Kateryna Bondar</i> . . . . .	80

### Plenary – A Research Roadmap for Crisis Response

A Research Roadmap for Crisis Response <i>Bernhard Katzy, Ulrike Lechner, and Christina Weber</i> . . . . .	82
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### Workshops Towards a Research Roadmap for Crisis Response

Workshop Research Topic Resilient Systems <i>Ivo Häring</i> . . . . .	86
Workshop Considerations for Research (projects) on Social Media used for Crisis Response, Disaster Management, and Civil Protection <i>Jens Schwarter</i> . . . . .	87

Requirements for Information Systems in Crisis, Disaster Response and Humanitarian Aid <i>Bernd Hellingrath</i> . . . . .	87
Workshop Research Topic Risk Assessment and Communication <i>Ivo Härting</i> . . . . .	88
Workshop on Coordination and Collaboration in Crisis Management <i>Francesc Miralles</i> . . . . .	88
<b>Participants</b> . . . . .	<b>93</b>

### 3 Overview of Talks

#### 3.1 Sorting enabling technologies for risk analysis and crisis management

*Ivo Häring (Fraunhofer Ernst-Mach-Institut – Efringen-Kirchen, DE)*

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The talk presented an approach to define crisis response research in terms of relevant categories (aspects, dimensions, properties) for such research, including e.g. types of threats (hazard sources, crisis triggering events), crisis management steps which are supported, hardware technologies employed, disciplines involved or software technologies used. If existing crisis research is sorted into such a categorization scheme, foci of on-going research efforts can be identified as well as missing combinations. Such definition by examples and attribute ranges also avoids exclusions and is open for a truly interdisciplinary (trans-disciplinary) approach.

Besides this top level approach, examples of emerging application tools were given that implement risk management or analysis steps. All tools are currently developed within EU FP7 research projects and at least parts of their functionalities are relevant for crisis management. In BESECURE we apply risk management to structure an urban security enhancement process. It gives access to best practice methods for enhancing security, urban attractiveness and performance. In a similar way in cases of crisis methods can be selected in a systematic way and employed for achieving user-defined objectives. In VITRUV we show how urban planning for countering terrorism can be supported by empirical (data-base driven) and quantitative analysis. Taking measures for susceptibility, vulnerability and risk into account the software supports urban planning at plan and detail level. This allows countering crisis by preventive urban design with focus on non-physical measures, in particular rearrangement of geometries and urban space design. In ENCOUNTER risk analysis of explosive improvised (home-made) devices in urban environments is conducted taking into account organizational and physical counter measures including neutralization and removal options. This provides scenario assessment input for crisis management. In D-BOX we contribute to a toolbox for improving humanitarian demining worldwide. In particular quantitative hazard and damage analysis is applied to this domain. Also interactive databases are provided on hazards sources, neutralization, removal and personal protective equipment. Mine fields are at the core of many (long- term) crisis-like developments in developing countries.

For defining a roadmap for crisis research a step-wise approach is proposed. The steps are conducted in a very exemplary and incomplete way. First, we give three examples for step-wise informed schemes for risk analysis schemes, risk management and crisis management schemes are given, respectively. Second a list of technological and societal enablers is given. Third it is shown how this enablers are expected to influence the respective risk analysis steps, with respect to short-term, medium term and long term effects, respectively. It is indicated how in a similar way the effects of the enablers on risk management and crisis management, e.g. using the residence circle, can be conducted. Finally we provide a summarizing schematic.

### 3.2 Towards a framework for the conceptualization of command post exercises — an action research approach with staffs of disaster response organizations

*Erich Heumüller (Universität der Bundeswehr – München, DE)*

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**Joint work of** Erich Heumüller, Sebastian Richter, and Ulrike Lechner

The goal of our research is the support of command post exercises. We develop a framework to support conceptualization of command post exercises emphasizing exercise goal-achievement and exercise evaluation. The presentation at the Dagstuhl Seminar Civilian Crisis Response Models contains the framework with a classification of exercises, a framework for goal-oriented and evaluation-driven exercise conceptualization. The focus lies on the conceptual model of staffs that is the basis for a systematic exercise evaluation. This model is based on scholarly literature on teams and leadership. It analyzes staff processes and has as constructs Resource Management, Decision, Responder, Information Management, Task Coordination and Commander's Intent. The method follows an Canonical Action Research approach with an empirical basis of four command post exercises.

### 3.3 Usage of Social Media in Crisis Situations

*Nicole Krämer (Universität Duisburg-Essen, DE)*

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**Joint work of** Nicole C. Krämer, German Neubaum, Leonie Rösner, Astrid Rosenthal-von der Pütten, and Jennifer Klatt

Nowadays, every major crisis is accompanied by massive activity in social media. Against this background the presentation discussed whether and by which means social media (such as e.g. blogs or social networking sites) can support governmental efforts to avoid or reduce the impact of major hazards on the public. From a media psychological as well as social psychological perspective it has to be analyzed which motives the public has for using social media during and after catastrophic risks and what effects can be expected from using social media for crisis communication. With regard to the latter, it is important to – on the one hand – understand how the public's discussion in social media might change their attitudes towards the crisis and whether the dynamics lead to beneficial or unfortunate effects. On the other hand, it has to be analyzed whether governmental institutions can benefit from using social media platforms for addressing the public (given that recent data show that especially younger audiences and target groups tend to turn to the Internet instead of the TV in order receive timely and authentic information). Here, empirical data have to show a) how governmental institutions can present themselves in a trustworthy, believable way within social media platforms and b) which steps have to be taken before a major hazard in order to be able to communicate e.g. within a social networking site when a crisis starts. Additionally, it can be tested whether governmental institutions might be able to use the information that is discussed within social media applications in order to support immediate rescuing (e.g. when information on potentially threatened victims are posted as it was the case during Katrina) or to monitor the public's fears, attitudes and intended behaviors.

In the presentation, media psychological and social psychological theories were presented which can help to understand the processes. Also, a multimethod study on the usage of a social networking site during and after the Love Parade stampede in Duisburg 2010 (Neubaum et al., 2012) was presented and discussed. Results showed that social media usage fulfilled various needs and functions such as information seeking as well as emotional regulation.

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### 3.4 Geoinformation and disaster management

Wolfgang Reinhardt (*Universität der Bundeswehr – München, DE*)

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In the presentation first an overview on relevant national and international programs as well as on activities of the authors group is given. After that the “phases-approach” to disaster management is discussed and some of the used phases models are outlined. After that the usage of Geographic Information (GI) for the prevention and preparedness phases is introduced by means of examples. It is emphasized that especially Geo Web Services play an important role here which is illustrated by examples from the Alpine Space Project “TranSafe-Alp”. The main message of the presentation is to demonstrate that GI plays an important role — among other factors — for all phases of disaster management.

### 3.5 End User Perspective

Heiko Werner (*Bundesanstalt Technisches Hilfswerk, DE*)

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Disaster Management in Germany is a federal business. Across the world, the structure of THW is unique: As a Federal agency, THW belongs to the department of the Federal Ministry of the Interior. However, only one percent of the staff works full-time for the authority. 99 percent of the THW- members work on a voluntary basis for THW. Nationwide more than 80,000 volunteers commit themselves during their leisure time in 668 local sections in order to provide professional help to people in distress. THW flexibly adapts its structures to changing threat situations. Modern equipment and well-trained specialists are the basis of its high efficiency. Security Research is a key element in enabling THW to prepare for future challenges.

### 3.6 Navigation Support with Landmarks: A Design Case Study

Volker Wulf (*Universität Siegen, DE*)

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The presentation comprises the Design Oriented Research method and various design cases on the design of IT for fire fighters as well as empirical work on the use of social media in the so-called Arab Spring.

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## 4 Plenary

### 4.1 Civilian Crisis Response Models – Panel Discussion

Ozgur Dedehayir (*Tampere University of Technology, FI*)

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Joint work of Ozgur Dedehayir, Simon French, Bernhard Katzy, Dietmar Kühne, Nils Weidmann

#### The Setting

Dagstuhl seminars are aimed to bring together leading minds in connected fields of research to generate new, potentially ground breaking pathways in scientific endeavor. The seminar on “Civilian Crisis Response Models” similarly brought together experts from different yet related fields of investigation pertaining to crisis management. Commensurate with the ideology and objectives of Dagstuhl meetings, a panel discussion was organized to establish a consensus on how the group could work together in a trans-disciplinary project. Four panelists with prior experience in such projects were invited to take center stage, including Professor Simon French from the University of Warwick, Professor Bernard Katzy from Leiden University, Mr. Dietmar Kühne from the German Army / Landeskommmando Bayern, and Dr. Nils Weidmann from the University of Konstanz. The panel discussion was held on Tuesday 22nd January (from 16:00 until 18:00).

Prior to the panel discussion, the seminar participants had witnessed presentations from several colleagues with respect to their own research agendas, and also took part in workshops designed to align the thinking of participants towards a roadmap of collaborative research. However, these prior events had demonstrated that while seminar participants had come from connected research realms, there were differences on how they approached the ‘crisis’ phenomena. Different theoretical models were used as lenses through which the phenomena was viewed, and a variety of methodologies were employed in systematically studying the phenomena at hand. Nevertheless, the potential of reaching synergy was also evident and the panel discussion was aimed to unite the participants’ thinking towards a path of synergy and future collaboration.



## The Questions

Three overarching questions were posed to the panel discussants. The first question centered on what participants could learn from prior experience in trans-disciplinary projects. More specifically, the panelists were asked to comment on their own experiences concerning the pitfalls that should be avoided as well as the issues that should be emphasized or underlined as vital to successive collaboration. Secondly, the panelists were invited to comment on matters concerning the contribution of the project to crisis management science. Specifically, the panelists were asked to comment on the novel outcomes that they could foresee future research attaining, possible research gaps that could form the foci of such research, and the unique methodologies that could aid researchers reach these outcomes. And thirdly, the panelists were asked to remark on the next steps that could be taken for a roadmap of collaborative research.

Perspectives on Civilian Crisis Response Models:

1. The social dimension of “tacit knowledge” of a new research field

The panel firstly proposed that opportunities to participate in multidisciplinary projects should not be relinquished. Furthermore, they underlined that successful projects generally have a “glue person” that binds the connected yet separate research streams, and that the participants of these projects are recommended to respect the contribution of other fields of investigation on common phenomena. Hence, according to the panel, although difficult to generalize, the starting point rests on identifying the phenomena that need to be analyzed. Moreover, for such an interdisciplinary group, establishing the common grounds or elements is pertinent.

2. Shared research questions

The justification for the collaborative research agenda seemed to be clear to some participants, considering that the EU commission has recently awarded funding to the NITIM project which aims to study crisis management networks and processes, with an emphasis on key performance indicators such as faster recovery and reduced damage, in the face of a higher number of disasters. Nevertheless, it became apparent from the dialogue of the panelists that the unifying research themes or questions remained masked at this point of the seminar. A set of common expectations and coherent group ideas would pave the way towards more concrete research goals. At this point some of the research themes may include the role of entrepreneurs in crisis management, leadership and the performance of organizations, and the role of technology in new ways of reacting to crises, however, these would require agreement among all partners. The lack of clarity as to the seminar objectives was also expressed by some audience members, who enquired of the central ideas that bound them together. Furthermore, it was also proposed that different research projects and teams were already active in a similar manner across Europe and USA, and therefore the identification of the *raison d'être* of this seminar was brought forward.

3. Typologies of Crisis and relation to existing work

The possibility of developing a typology of crises to help the seminar focus its research agenda and to help participants see the types of crisis for which knowledge exists and others where there is no or little knowledge, was subsequently considered. Despite the difficulty of generating such a typology (for example identifying the dimensions that could be used remained ambiguous) and the fact that several attempts had already been made, an all-encompassing framework of types was deemed to be an important contribution to the field of research. Concerning research outcomes, the panelists proposed that the most important point is relevance for society. They also suggested that the novelty of

the research would naturally depend on the outlets that would be targeted; although the panelists agreed that unifying outlets that disseminate project findings would likely to be a futile task. It was recognized by the audience that a number of journals already existed in this field, potentially making novel contribution difficult. However, the role of technological development and its influence on crisis management, e.g. making redundant the role of the government as manager of the crisis, and paving the way for new governance structures, which were highlighted as under-researched themes in these journals.

4. “Technology Push” for social innovation in crisis management

From the dialogue between the panel and the audience a unifying research theme began to emerge in the form of ‘technological factors’, i.e. technology enhanced communication at various levels that involve different actors, which can act as tools that help citizens in times of crisis but also pose risks in crisis issues. For instance, the use of social media can help citizens understand what is happening in crises situations. At the same time researchers can acquire data from social media to understand how people actually behave during crises. Nevertheless, the need to narrow the focus of this research theme, towards specific research questions also emerged as a necessary step. An additional though related research theme was proposed to be the leadership or governance matters in crisis situations, especially when influenced by technological factors. Some specific questions that were posed under this theme included: what are the types of leader that emerge in crisis situations? And: how can successful entrepreneurs be trained to be leaders in such situations? With respect to the methodological considerations, panelists were divided over the usability of several crisis cases to derive concrete questions for investigation.

Overall, the seminar group made significant progress through the panel discussion concerning unifying research themes, means of making scientific contribution, and employable methodologies. In the following days, these topics would be honed to arrive at more tangible research questions and suitable theoretical methodologies.

### Panel Discussion Notes

- Relevant for society? Identifying the phenomena- How do you go about solving this? Difficult to give general recommendation. Where do I want to get my work published? Up front need to establish the common elements.
- Standardization of interfaces, Software Structure
- Justification for bringing together this project, There is money. Agree with Nils that we have a relevant question. Go from “technology push” to “demand pull”, hence, search for a unifying need, More disasters, engage more people, recover is faster, damage is lower (key performance indicators), Unifying question based on these, Joint question that we all believe in. Can we standardize the outlets for our work? not possible. But creating impact is about just being visible, Ability to find common points in discussion, Fragmentation is a problem
- What makes successful multi-disciplinary research. “success is going from one failure to another without losing enthusiasm”- Respect the other disciplines, understand where their theories are coming from and vice versa, Have some people to act as glue from different disciplines, Don’t design multi-disciplinary research, you just jump on when they come, time, money, assessment? these are critical attributes for any project
- Need the explicit idea behind this, need to focus on expectations, more coherent group and ideas needed, good outcomes will come out but how?

- More combinations between technological and social
- What is the question we deal with? (“how do we react to crises?”), the role of entrepreneurs is important, leadership and performance of organizations, the role of technology in new ways of reacting to crises
- Do we need a typology of crises? lots of types out there, presence of amateurism which acts as a hindrance, the politicians are perhaps the biggest amateurs in times of crises, be very clear on the types of crises we are looking at, come up with a topography (nobody has been able to come up with)
- Start with a typology – this helps us to see for which types of crises there is knowledge and others where there is none or little
- Crisis could be seen as not a bad thing but an opportunity to change an existing system, not aware of an existing topography, could be based on personal harm
- Database exist? of scenarios?
- In the area of terrorism there are some, especially in USA, department of security, this database has been used to extract frequency of attacks, for example, or scenario generation, skeptical about real content but still used (you can say “it has happened”) – get an idea of trends
- In the area of political sciences there exist macro and micro databases (e.g. in a given conflict what events took place), we need to define key concepts – cant see how things will work without key definitions (e.g. crises)
- Not sure if definition is helpful, puzzled with what brings us together – no need for yet another group to tackle this crisis issue, what is it that binds us together? many journals exist already, but one way of creating “impact” would be the factor of technological development, and the government not being the crisis of manager anymore (given technological developments) – hence, new governance structures
- Social systems are coupled more so than before
- Would be beneficial to focus on technological factors that can be tools that help us but also pose risks in crisis issues, need to narrow down the focus
- Leadership is changing, technological drivers which is enabling so called “leadership” or governance in crisis situations, what are the type of leaders that are emerging in crises? can we train successful entrepreneurs are possible leaders in such situations?
- What are the catch words, headline, short abstract of project? if we talk about research roadmap, we need the above
- A concrete question can be formulated by investigating an interesting theme across different crisis cases
- Not able to make conclusions from study of the different cases, agree with Prof. Bakker about the technological factors that help us understand crises management, but leadership issues are not viable, need to focus: on a unifying question and common elements for the group at the outset, conceptual definition (perhaps typology), find topical niche (leadership change in technological change and the role of entrepreneurs)
- Either to learn about what is happening out there (in crisis management), or then come up with new strategies to deal with the issues
- Technological development is the unifying theme, considering that we are in an interdisciplinary group, this is perhaps more relevant than a particular question
- Technology enhanced communication at various levels, new actors are coming into the picture, use of social media can help understand what is happening in crises situations (people actually tell us what they need), technology enhanced communication at various levels that involve different actors

## 5 Workshops on Research Topics for Crisis Response

The first workshop series was about identifying research topics and discussing networked crisis response from various perspectives. The structure of topics follows the structure of the NITIM project Networked Crisis Management with five topics

1. Crisis Network Management and Governance
2. Communication and collaboration infrastructures for crisis management
3. Coordination and collaboration in heterogeneous actor networks
4. Humanitarian, crisis response logistics
5. Engagement models for entrepreneurs and volunteers

The workshop participants got questions to guide the discussion:

- Phenomenology: What are the phenomena being studied?
- Theories: What are the models and theories used?
- Integration: What are the interfaces and relations to the other topics?
- Education: What do we need to teach?
- What is being done? What to do to be prepared? What to rethink and reconceptualize?
- What are the 3–5 most important topics for a researcher?

### 5.1 Workshop Humanitarian Crisis Response Logistics

*Ulrike Lechner (Universität der Bundeswehr – München, DE)*

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Logistics is Crisis Management on a day-to-day basis. What distinguishes a crisis from day-to-day business? The workshop draws its motivation from a discussion around business continuity, automatization of computing centers, cases contributed by the workshop participants. Cases that the participants mentioned were Edeka and its role in the crisis response after the Elbe-Flut disaster, and various examples for exercises and logistics in disasters at county level.

The involvement of volunteers and response forces was one topic that was discussed. What happens if forces are in a conflict between helping their families or their own business on the one side and doing their duty in a disaster response organization?

A second topic discussed was public private partnerships as well as engagement models for volunteers. Given the scarcity of financial resources on the one side and the increasing expectations by media and general public as well as the increasing vulnerabilities on the other hand, different models of crisis response logistics need to be developed. Private – public partnership are one way. Think of a major city in which the urban population has stocks of food and water for, say two or three days. Would it possible to engage retailers to provide water and food as the capacities of the disaster response organizations would hardly suffice in such a case? Also, the equipment of the disaster response organizations and the material that they would be able to obtain from, say, logistics organizations might not be compatible and up to date. Such new models however have implications for business continuity management in organizations as well as the information systems supporting this. The workshop participants discuss protocols, legal regulations as well as sensitivity of information shared in such a case.

## 5.2 Workshop Overview Research

*Nico Kaptein (COT – Den Haag, NL)*

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1. We have recognized that seminar participants come from different backgrounds and disciplines and use different 'languages' and definitions in the field of crisis management and civilian response. However, it is not our aim to harmonize these definitions. We accept the existence of different conceptual frameworks and have agreed to share the ones we prefer and work with – to enable common understanding and exchange of ideas and results. The example we work with (and have amended) at COT is the British Standard for Crisis Management, as published by the British Cabinet Office.
2. We do want to invest in research that identifies the most relevant dimensions in crisis management and civilian response. What characteristics are relevant and make a difference in the way a crisis should be handled and response is best organized. How will crisis and disasters develop in the future? What characteristics can be used to guide strategy? Can we deduct early warnings for potential crisis situations? What existing theoretical frameworks can we then meaningfully use and how to these need development and elaboration in the future?
3. For specific areas we need literature research. We do not aim for a full all-encompassing literature review – we do aim to have an up to date overview for specific areas, for instance on transparency and sharing incidents or lessons learned, with peer organizations as well as with the general public. Another example is on dynamic models in logistics. Another example could be cyber-related crisis management. Both theoretical frameworks and case studies may be relevant.
4. Especially mechanisms to identify and learn from what went wrong may need attention. At least in some areas political pressures to come with positive evaluations seem to block insight and progress.

## 5.3 Workshop Crisis management and governance

*Edwin Bakker (Universiteit Leiden, Campus Den Haag, NL)*

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The workshop first looked into the concepts of crisis network management and governance, agreeing on the idea that there is no single definition, but also agreeing on the notion that any actors are involved with a wide range of responsibilities, capacities, and/or needs. Regarding today's context of crisis management, the workshop agreed on the impact and importance of rapid changes in technologies and societal changes.

Discussing trends in crisis network management and governance there was a common understanding of the limitations of formal, hierarchical and fixed management structures. These types of organizations might do well in dealing with incidents. When it comes to crises, in particular those with unexpected or new effects/elements there is a need for flexibility requiring new or ad hoc governance structures with different types of actors who have no formal relationship with each other. This notion goes back to the general notion of networked societies and changes in (technological) ways of communication, information sharing and risk analysis.

Regarding the level and willingness of cooperation between a wide variety of actors during times of crisis it was mentioned that a high degree of altruism and the need of out-of-the-box-thinking provides opportunities for innovations in terms of establishing new relationships, networks or even operational standards. “Never waste a good crisis” was mentioned several times, indicating that crises allow for changes for improvement of ways in which we can prevent crises or respond to them.

Regarding theoretical and methodological approaches, the workshop discussed the need to develop new ideas, strategies, structures or models with regard to crisis management, by way of exercises and simulations. The group also stressed the need to learn from cases studies and sharing best practices. Relevant academic sources that were mentioned ranged from decision making theory and network dynamics to e-sociology and big data studies.

#### 5.4 Workshop Engagement Models for Entrepreneurs and Volunteers

*Kateryna Bondar (Universität der Bundeswehr – München, DE)*

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The workshop discussed the following topics:

1. Engaged scholarship — how do you engage people to do things? Fundamental shift of how you deal with people
2. Shift in the institutional mind that there are people there outside who can help in crisis response
3. Engaging people involved in the crisis with the technology
4. It cannot be a specific technology, as the hype of some technology can be gone with time
5. We need to better understand what impact Twitter, Facebook are doing to people on the ground
6. Twitter is not free to the commercial organizations
7. Network effect comes into place
8. We should be clear about the type of the crisis and each type of crisis should have a different response
9. Can we rely on the data coming from people on the ground? How representable and reliable is it?
10. In Wikipedia there is 1% of people who is writing information and 9% who is checking, so the check takes place
11. We need to design what crisis is: 1. Uncertainty of information, 2. Dynamics.
12. Agent-based modeling: we want to understand and predict to a certain extend how agents are moving and acting, hetero-generating the population
13. The technology is very helpful for the scientists to learn about crisis and then bring the information back to people
14. Questions: uncertainty, how do you learn something from the information you get
15. Using the wisdom of the crowd
16. Decentralization of decision-makers
17. In Facebook you cannot access the information if you are not part of the network
18. The problem with Twitter is that the sentences are so short and the linguist cannot extract the information from these sentences
19. What characteristics should the network have in order to promote engagement?

20. What is happening is that the network's behavior is changing
21. How do you make sense of the knowledge you gain? One approach is to go into depth understanding of one case, another approach is to build a single model that could explain the events happening — generalizability
22. Different methodologies: design methodology, descriptive methodology
23. What are the characteristics of the social system that would affect crisis response? And this could have a predictive power by knowing the characteristics of the system
24. How do you establish credibility?
25. Legal issue of information release
26. Paradigm shift from control of information to free access
27. From which sources/organizations will information be credible and trusted?
28. How do credibility and trust move along the networks?
29. Empowerment of individuals through technology
30. How do you coordinate individuals: the balance between autonomy and control?
31. Looking at recovery from entrepreneurial point of view: for example, how do you rebuild the houses?
32. Impact evaluation: e. g., would the Arab spring have happened without social media?
33. Relevance of European research for the US journals
34. Where to publish?
35. Position ourselves in different journals
36. Journal of Computer Supported Corporate Work has a special issue on crisis management, Journal of Risk and Uncertainty, Journal of Disaster Research, Journal Risk Research, Journal of Business Continuity
37. ISCRAM topics: use of mobile phone applications for rescuing, voice recognition; use of social media before, during and after the crisis → citizens' response, crisis mapping
38. How do markets respond to the change of technology?
39. Nature creates opportunities within one crisis
40. Doing experiments: field research, living labs; sense-making; post hoc analysis; multi-method approach

Interests of the workshop participants:

1. Social systems, questions of uncertainty, reliability, patterns in the data
2. Dynamics of crisis situations
3. Analyzing social media processes
4. Integration of governmental organizations into the usage of social media
5. Understanding practices dealing with disasters, what role the IT systems are playing
6. Action research
7. Actor-network theory

Underlining points:

1. Dynamics
2. Trust and credibility
3. Impact

Theories:

1. Use and ratification approach, communication of information availability
2. Mass and personal communication assumptions by Fock
3. Systems theory

Methodology:

1. Descriptive methodology
2. Design-oriented
3. Engaged scholarship (action research)

## **6** Plenary – A Research Roadmap for Crisis Response

### **6.1** A Research Roadmap for Crisis Response

*Bernhard Katzy, Ulrike Lechner, and Christina Weber*

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#### **The Setting**

Dagstuhl Seminars aim to advance the field and explore new topics. In a workshop setting the participants of the Seminar Civilian Crisis Response Models discussed future topics of Crisis Response. In this discussion eight core future research topics have been identified and discussed. This documentation includes topics and notes from the discussions on these topics.

#### **The Research Topics**

- Overview Research
- Social Media
- IS Application
- Coordination
- Dynamic Models
- System Resilience
- Risk Communication
- Network Strategies

Subsequently, each topic is presented with the ideas grouped within a topic and the results of the group discussion.

#### **Topic Overview Research**

The ideas:

- Research Overview
- Typology of Crises
- Research Matrix-Crises
- Phases Competencies
- The genesis of crises management system: Actors, Connections, Bottlenecks.

The results from the group discussion:

- Literature review



- typology of crises depending on focused dimensions
- Compilation of COT heuristics
- UN definitions and more already existent typologies for comparison
- exemplification on data/statistics.

## Topic Social Media

The ideas:

- Using Social Media to communicate and engage (as opposed to broadcast or for situation awareness)
- What makes networks trustable in hierarchies
- Social Media can enhance performance of networks of organizations in dealing with emergency sites?

The results from the group discussion:

- Theories & Models
- Customer needs, Existing “things” & their combination (e.g. applications, capabilities)
- Communities (actors), Information domains
- Future technologies (e.g. Web 4.0, post-Facebook)
- Social impact
- International dimensions
- Resources required & their management

## Information System Application

The ideas:

- IT-Systems, developed with end-users for different scenarios like no electrical energy
- Medical aid etc for different time steps
- How can we use/build technology to advance
- Optimize communication between actors (civilians, institutions)
- Interoperability of applications
- Standard operating procedure (SOP) based Information systems
- Managing information reliability.

The results from the group discussion:

- Customer needs
- Existing “things” & their combination (e.g. applications, capabilities),
- Communities (actors)
- Information domains
- Future technologies (e.g. Web 4.0, post-Facebook)
- Social impact
- International dimensions
- Resources required & their management

## Coordination

The ideas:

- Best Practices and bullshit sessions from the field

- What crisis management capabilities do we need when physical and virtual worlds get further intertwined?
- Integrated assessment and operations planning
- Portfolio – / program (cross team) coordination & autonomy
- Handling changing uncertainties through a crisis
- How can we improve the coordination skills or possibilities of decision-makers in a dynamic environment
- Crisis management

The results from the group discussion:

- Volunteers see themselves as a part of a club, but also want to be part of a government (we are the big ones)
- There are only less people in the professional staff who do the operational business
- People accept THW as a governmental organization
- Command system is characterized by “Auftragstaktik” this is a German tradition
- How to find the right people? → internal and external
- Platoon leaders know their team and are responsible for recruitment
- The issue is the find people who are willing to spend amount of time for the leader training ... normally our leaders are also leaders in a company
- We get the information where the respective experts are (bottom up)
- My problem is to find the experts (even scientist) outside the THW
- We are monitoring the field (research, technology, ...) through a lens of technical need, then we bring both sides together ... it is very time consuming
- There is a lack of underwater equipment
- THW has mostly contact to business continuity staff
- Recruitment is normally done by somebody knows somebody
- Performance, number of members depends very strong on the respective leader ... lifecycle of a Ortsverband is about 15 years (“lifetime” of a leader)
- The field of coordination in the THW (professional, volunteers but also force coordination and resource management (equipment)) is relevant and interesting
- What can we learn about management of technical innovation, management of who-is-who?
- Even in international disasters you meet the same people. There is a personal network and know each other.
- Also of interest:
  - Management of the volunteer rescue teams.
  - There is research from the EU, mgmt. of resources in civil protection
  - INKA-project — volunteers in civil protection
  - How is the coordination and management in higher levels?
  - Visibility is important in the coordination of the NGOs.

## Dynamic Models

The ideas:

- Loosely coupled coordination
- Understanding Complexity
- Leadership in networks and dynamic crises
- Leadership in Dynamic Crises situations with engaged civilians

## System Dynamics

The ideas:

- usability
- acceptance of C2 structures
- system of systems
- resource management
- the evolution of crises management socio-technical systems → innovations in subsystems that facilitate and necessitate changes in other stages

The results from the group discussion:

- Resilient systems
- How can we have systems reconfigure themselves
- Resilient response (when damage occurs, it is about restricting the damage)
- Dynamic system modeling
- Understand the granularity of analysis
- Develop reconfiguration strategies
- Human influence on resilience
- Develop quantities for assessing resilience quality
- Applying engineering models for realistic system modeling
- Operator response strategies, SOP for resilience systems operation and citizen behavior
- Resilience by design
- Validation, field testing, simulation

## Risk Communication

The ideas:

- Interdisciplinary
- Study on risk communication based on GIS and simulation methods (technical, social aspects)
- Visibility
- Development of simulation and analysis tools
- new social media applications

The results from the group discussion:

- IS-Application should be end-user driven development
- Transformations of processes and procedures in tasks and workflows
- Standard formats & interfaces (meta-models)
- Scalability (green and white IT)
- Integration and evaluation of heterogeneous data sources eg social media
- Creation of cooperation network toolbox -> structuring according to processes
- Online-offline-efficiency of data transfer and volumes

## Network Strategies

The ideas:

- Structuration
- Network evolution pattern
- Network capabilities
- loosely coupled coordination

The results from the group discussion:

- Studies on different Levels of coordination: leadership vs implementation level
- Who is who in organizations — meetings for coordination, building of personal networks between organizations, hubs of knowledge, integration of social media, webplatforms and cell phones
- Comparison of networks in crises management in different regions of the world: highly industrialized vs. least developed regions of the world, actors involved, media used, high or low government involvement
- Analysis of network cooperation in different phases, development of indicators of network performance dependent on size/central or multicentered networks

## 7 Workshops Towards a Research Roadmap for Crisis Response

The second workshop series was about deepening the understanding of future research topics that emerged from a group discussion process. The topics of the workshops are

1. Resilient Systems
2. Risk Assessment and Communication
3. Considerations for Research (projects) on Social Media used for Crisis Response, Disaster Management, and Civil Protection

The summaries of the workshops are provided below.

### 7.1 Workshop Research Topic Resilient Systems

*Ivo Häring*

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Research on resilient systems extends classical system analysis, modeling and simulation approaches. Of interest are system architectures and behaviors that are capable of dealing with partial, major or complete system damage in such a way that the intended overall system performance is recovered very fast. Examples for systems include infrastructure grids, critical infrastructure, communication networks, organizational structures, societal structures and their respective technical support. Examples for partial system damage are power grid interruptions due to terror attacks, or effects of earthquakes on urban infrastructure. Hence research on resilient systems will contribute to avoid and mitigate crisis effects as well as to improve crisis prevention and shorten recovery times.

The concept of resilience goes beyond reliability by redundancy or reliability by design. It allows for dynamic reconfiguration, resulting in systems that may differ from the original systems. Further it asks for the analysis of a large system trajectory/evolution space and measures for assessing the system reconfiguration options and performance. The time scales of coupled systems under analysis may be very different, also typically very different disciplines are involved, asking for flexible and scalable system analysis, modeling and simulation.

Resilient systems are allowed to fail partially, thus allowing for optimized overall performance taking system operation as well as recovery costs into account. Along with the technical research questions of defining, analyzing, modeling, simulating, testing and validating resilient systems societal needs and requirements are expected to drive and determine research options.

For instance the level of reconfiguration or the partial loss of system performance must be subject to public involvement, discussion and assessment.

## 7.2 Workshop Considerations for Research (projects) on Social Media used for Crisis Response, Disaster Management, and Civil Protection

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- Theories & Models
- Customer needs
- Existing “things” & their combination (e.g. applications, capabilities)
- Communities (actors)
- Information domains
- Future technologies (e.g. Web 4.0, post-Facebook)
- Social impact
- International dimensions
- Resources required & their management

The workshop participants identified the relation of Theory and Practice of Customers and Practitioners for research in Crisis Response as follows:

- |             |                  |
|-------------|------------------|
| a) Research | a) Theory        |
| driven      |                  |
| b) Customer | b) Practitioners |

## 7.3 Requirements for Information Systems in Crisis, Disaster Response and Humanitarian Aid


*Bernd Hellingrath*

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A number of different requirements have to be met by Information Systems in crisis, disaster response and humanitarian aid. First of all there is the primary necessity to adapt to the needs of the users, being in a stressful situation to cope with where these systems have to give a support. Principles of user centered design have therefore to be followed in the design of such systems. The highly diverging situations in which the systems have to be applicable demand a flexible architecture allowing an adaptation to the specific needs and also towards the scale of the crisis situation. This leads to a modular design making it able to configure the applied solutions out of a number of different building blocks. On the functional side, the information systems should allow secure and reliable communication capabilities among the different actors. Information from different sources should be integrated and shared among the users of the system. A joint resource management has to be a basis for the coordination of the different activities being supported by the crisis management system.

## 7.4 Workshop Research Topic Risk Assessment and Communication

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The ubiquitous presence of communication means, the increase of technical options for citizen participation and new emerging policies for citizen involvement and engagement ask for a rethinking of risk assessment and communication before, during and after crisis events. For example in case of potential landslide areas, the assessment and communication of risks might be critical because of undesired economic effects of for reasonable counter measures, for avoiding undesired economic effects, etc. Similar arguments hold true for other potential risks of crisis like earth-quakes, flooding, power grid loss, terror events. However, how should the ever increasing analysis options and assessment tools along with their refined visualization options be shared with the public? How should the public and responders become part of a shared risk assessment? Research questions include:

- Public and scientific credibility of means of risk assessment, e.g. for earth quakes, land slides, terror events, flooding, storm, social deprivation, etc.
- Further improvement of analysis options for different types of crisis events
- All risk/all hazard approach, measures for risk comparison
- Big data options for risk analysis, e.g. data-driven risk assessment
- Selection of analysis results relevant for crisis management cycle: type of analysis, resolution of analysis, etc.
- Legal and economic issues, e.g. privacy concerns, self-fulfilling prophecy
- Public perception, involvement and feedback
- Foundations of risk analysis supported or based on social media data
- Real time risk analysis and management supported or based on responder data, sensor data, citizen data
- Risk analysis for recovery phase
- Use of geo data and spatial information service infrastructure
- Mobile applications
- User involvement during design of solutions

## 7.5 Workshop on Coordination and Collaboration in Crisis Management

*Francesc Miralles (Ramon Llul University, ES)*

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### Introduction

The main goal of this workshop was to identify those research strands that can be of interest in the field of crisis management from the perspective of coordination and collaboration. In this workshop, the discussion focus was to propose a first group of components that can help to delineate the scope of the relevant research strands. The main point to start this discussion is that crisis management, in general, and coordination and collaboration issues, in particular, have been affected by new drivers that require new perspectives on this research field.

These workshop outcomes are structured in three blocks. Firstly, a description of the main phenomena to be addressed in a research agenda for coordination and collaboration efforts in disaster situations. Secondly, the set of education areas that have to be updated to be able to face the research challenges that these phenomena pose. Finally, which are the tools and instruments that should be faced to progress in this research endeavors.

### **Setting the Stage. What is a crisis? And what is crisis management?**

The participants in this workshop agreed on a definition of crisis that can be synthesized by the following definition by the National Consortium (START Programme, University of Maryland, <http://www.start.umd.edu/start/>). A crisis is a “serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources”

A crisis can be a natural disaster, like a flood, an earthquake or a hurricane; or it can be man-made, like a technology failure, or a terrorism act. Crisis management is the discipline whose aim is to study how a community foresees threats to its citizens, and reacts to those threats effectively. Crisis management governance is moving from a hierarchical perspective to a more networked structured. In this vein, coordination and collaboration research has to provide new light on the research challenges that this move produces.

**Key drivers of change** The workshop participants agreed on the fact that Information, Information Technology, and Information Systems are in the root of effective Crisis Management approaches and are primary enablers of coordination and collaboration structures. In this vein, two key drivers were identified by the participants to delimitate the changes to crisis management from the perspective of coordination and collaboration: Technology Evolution and Networked Society.

**Technology Evolution** An important pillar on the evolution of structures for coordination and collaboration in disaster situations is the study of the role of ICT, in a wide sense, as enabler of strategic proposals for Networks of organizations and linkage of crisis management and communication. The Internet, social media, sensor networks, and multiple communications networks, provide multiple sources of data that foster a change in the decision making process and in building and valuing collaborative structures in disaster situations. Consequently, new challenges are posed in the research agenda of coordination and collaboration structures among crisis management agents.

**Networked society** Furthermore, although Web 2.0 and social media platforms allow for the participation of the public to provide field information and to widen the communication channels, new challenges have appeared. Social Networks and Web 2.0 technologies are becoming more present in today’s society and there is an increasing need to analyze their effects on public participation in disaster settings. Moreover, ICTs have offered new infrastructures to make it easier to enhance collaboration among small and medium size companies. Recently, network research has been extended to address multi-stakeholder environments crossing the domains of public and private sector as well as social networks and networks of social production. These extensions seem particularly relevant to study crisis management phenomena.

### **Why do we talk about Coordination and Collaboration?**

Following the trends of the key drivers mentioned above, crisis management can be faced by creating dynamic ad-hoc networked organizations. Consequently, crisis management is shifting from hierarchical organized structures to agile organizations tailored to the situation.

**Coordination** Coordination is “managing interdependencies between activities, enabling all resources to work together harmoniously in achieving a common goal” [2]. The agility gained in a networked organization comes at the cost of an increased coordination effort, especially when the coordination is performed by people. Coordination efforts in disaster situations have been challenged by the plethora of new agents that can have a relevant role in this kind of situations. Technology evolution allows for a reduction of efforts to propose new coordination structures but increases the complexity of coordination settings.

**Collaboration** Collaboration refers to groups of stakeholders who work together to face crisis situations. Collaborative governance includes broader participation and better balance among diverse interests of engaged agents. Main benefits of collaboration settings in crisis management are trust-building among participants, improved deliberation, and beneficial conflict resolution [4].

Technology evolution and a networked society pose opportunities for collaboration in disaster situations. However, new research is needed to understand the balance between these new opportunities and their efficiency.

**Phases in a Crisis Situation** As a starting point, participants agreed on the basis that coordination and collaboration endeavors are different for the different phases or stages of a crisis situation. In this vein, a four-phase schema was adopted: Preparation, emergency, recovery, and mitigation. Although participants realized that this is not the only schema for crisis stage, they agreed on the fact that this framework is good enough to analyze how coordination and collaboration can affect the evolution of crisis management. Additionally, this four phase’s framework has been widely used in previous studies on crisis management [1]. Using this four-phase framework, crisis management activity can be considered an ongoing process and all phases should be analyzed as part of an iterative and continuous cycle.

### Outcomes – Identifying relevant phenomena

In a kind of brainstorming activity, participants proposed the most important issues for each one of the four phases of a crisis situation. The goal was to identify which aspects have been affected the most by the key drivers under a perspective of coordination and collaboration.

#### Preparation

- Analysis for preparedness (vulnerability; risk analysis, hazard analysis, damage analysis, susceptibility analysis)
- Identification of relevant actors (reliability)
- Emergency plans
- Risk analysis and communication
- Scenario identification
- Standards for recovery (rebuilding) in a short / long term emergency – raising awareness

#### Emergency

- Reliability, Responsibility, Communication
- Awareness, Situation awareness
- Sense-making, Decision making
- Dealing with uncertainty
- Real time risk awareness/sense
- Simulation/prediction of damages / cascading effects
- Societal and governmental issues
- Legal issues



- Inter organizational collaboration
- Flexibility to involve additional actors
- Adaptability of processes and structure

#### Recovery

- Dynamic reconfiguration (resilience behavior)
- Identification most effective actions (operations)
- Self help of people, crowd sourcing, “Internet sociology”
- Citizenship empowerment
- Visualization of progress (communication)
- Allocation of resources
- Measurement / criteria / standardization of “normal stage” -> opportunity for new standardization
- Entrepreneurial action
- Debriefing

#### Mitigation

- Analysis of the crisis (learnt lessons)
- Adaption of emergency plans etc.
- Plan for new infrastructures
- Adaption of governmental, organizational, structure, legal issues
- Implementation of the lessons learnt
- Network structure
- Scenario update
- Risk mitigation

### **Outcomes – Summary of the findings to identify relevant phenomena**

This activity allowed the participants to propose the following relevant research areas.

- Identification of relevant actors and management of these actors. In a networked society the number of potential actors that can participate in each phase of crisis management grows exponentially, current technological features can make viable the participation of many actors. Citizens, NGO, civil protection agencies, governmental units, and so on can participate in any disaster. Coordination & collaboration of the different agents is a challenge to assure effectiveness.
- Citizenship involvement. Social Media has been the enabler of citizenship involvement in crisis management. Many examples illustrate how the role of citizenship can be important in dealing with the consequences of a crisis situation (a citation is needed here). In this area, citizenship involvement is related to the improvement of chances for citizenship participation. This is a special area that refines the previous one on identification of relevant actors.
- Analysis and Simulations for crisis management. This is a wide area of research. It includes the collection of data during a disaster, all the algorithms that can help in the analysis of the data, the synthesis of the results to provide information to decision makers, and finally the presentation of the outcomes in a suitable way to be part of command and control centers.
- Risk communication is considered a central component in the handling of disaster management. Although this centrality applies to all phases of a crisis, dealing with risk communication requires a specific approach in each one of the phases. Harnessing risk communication for specific issues in a disaster situation can sensitize the citizenship to

specific problems, create legitimacy for the actions of government agencies, and thus enhance the strategic capabilities of crisis managers.

- Resilience Reconfiguration. Resilience has been defined as “the capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.” ([3] p. 21). Participants agree to propose that resilience reconfiguration should be a research area where coordination and collaboration can play a specific role.
- Simulating exercises and training.

### Outcomes – Education

To identify the research challenges, the participants identified the most relevant education subjects needed to be able to face the aforementioned phenomena. In this vein, the following education subjects were proposed to be included in the crisis management field:

- Comparative studies, terrorism, crisis
- Security studies, safety
- Cultural issues (media, communication studies)
- Transnational studies
- Social resilience
- Data analysis (interactive research methods)
- Crisis models

### Outcomes – What is missing in the field? What are possible further topics?

The following research subjects were proposed to progress in these research areas:

- Overarching theoretical approach (kind of ...)
- e-Sociology
- Effects of extreme conditions on models and decision making, Governance
- Hazard & risk approaches (an overall perspective)
- Policy oriented approach applied sciences – assistances for disaster management (processes, guidelines, rules, technologies, ...)
- Tool development

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## Participants

- Edwin Bakker  
Universiteit Leiden, Campus Den Haag, NL
- Oliver Block  
Landeskommando Bayern, DE
- Kateryna Bondar  
Universität der Bundeswehr München, DE
- Matthias Brechmann  
Unternehmensberatung H & D GmbH München, DE
- Ozgur Dedehayir  
Tampere University of Technology, FI
- Simon French  
University of Warwick, GB
- Hanno Friedrich  
TU Darmstadt, DE
- Ivo Häring  
Fraunhofer Ernst-Mach-Institut, Efringen-Kirchen, DE
- Bernd Hellingrath  
Universität Münster, DE
- Erich Heumüller  
Universität der Bundeswehr München, DE
- Nico Kaptein  
COT – Den Haag, NL
- Bernhard Katzy  
Leiden University, NL
- Nicole Krämer  
Universität Duisburg-Essen, DE
- Erik Kropat  
Universität der Bundeswehr München, DE
- Dietmar Kühne  
Landeskommando Bayern, DE
- Ulrike Lechner  
Universität der Bundeswehr München, DE
- Francesc Miralles  
Ramon Llul University, ES
- Stefan Pickl  
Universität der Bundeswehr München, DE
- Wolfgang Reinhardt  
Universität der Bundeswehr München, DE
- Jens Schwarter  
Bundesministerium für Verteidigung, DE
- Gideon Shimshon  
Universiteit Leiden, Campus Den Haag, NL
- Christina Weber  
Strascheg Center for Entrepreneurship München, DE
- Nils B. Weidmann  
Peace Research Institute – Oslo, NO
- Heiko Werner  
Bundesanstalt Technisches Hilfswerk, DE
- Volker Wulf  
Universität Siegen, DE

