Social Media and Emergency Services?
Interview Study on Current and Potential Use in 7 European Countries

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ABSTRACT

Social media is much just used for private as well as business purposes, obviously, also during emergencies. Emergency services are often confronted with the amount of information from social media and might consider using them – or not using them. This article highlights the perception of emergency services on social media during emergencies. Within their European research project EMERGENT, the authors therefore conducted an interview study with emergency service staff (N=11) from seven European countries and eight different cities. Their results highlight the current and potential use of social media, the emergency service's participation in research on social media as well as current challenges, benefits and future plans.

Keywords: Emergency Services, EMERGENT, Europe, Social Media

1. INTRODUCTION AND RELATED WORK

The need of emergency services to employ with social media has risen during the last years, as long as these kinds of media are used more and more – of course also during emergencies. Social media is thereby defined as a "group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content" (Kaplan & Haenlein, 2010).

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1.1. Previous Cases

Since now, the majority of research focuses on crises and emergencies in the USA and deals with Twitter (Reuter et al., 2012). Table 1 summarizes the literature in a structured way by providing an overview of studies with regard to their reference, the related case or scenario, a brief overview of the scientific contribution and a keyword. The cases are sorted by the year the event took place. They have been identified while searching in Google scholar for the keywords "social media", "emergency", "disaster", "crisis". However, due to the amount of studies, only the most project-related have been selected to provide an appropriate overview.

1.2. Previous Surveys with Citizens

Beside the several studies about the use of social media with regard to emergencies, just a few surveys on the perception of social media exist: With over 1,000 participants, a comparative study of the Canadian Red Cross (2012) aimed to figure out to what extent Canadian citizens use social media and mobile devices in crisis communication and what they expect from the emergency services both, currently and in the future. The American Red Cross (2012b) also studied citizens' use of social media during emergencies, with 1,017 online and 1,018 telephone survey respondents. However, these surveys only focus on citizens and not on professional emergency services.

1.3. Previous Surveys with Emergency Services

Another comparative study published by the American National Emergency Management Association (NEMA) contains the results of a survey conducted in 2012 among members of emergency services from 50 Federal States of the US (San et al., 2013). The survey, which involved 505 respondents, focused on the current degree of use of social media in crisis situations by emergency services and the future development of the organizations in respect of possible use. Additional questions were asked regarding general opinions of social media and the trustworthiness of citizen-generated information. Although the respondents indicated a positive attitude towards social media in general and valued its suitability for information dissemination, 75% mentioned the requirement of verifying citizen-generated content, and otherwise questioned its credibility. However, the main barrier identified, was the lack of personnel, experience and knowledge to take on additional responsibilities. However, they argued that the "largely untapped resource" of digital volunteers could "help to alleviate some personnel issues". The study revealed that 85% of US authorities already use social media.

A further survey of 241 US emergency managers at the county level in 2014 shows that only about half of these agencies use social media (Plotnick et al., 2015). Most of them do not have any formal policies to guide their use. Of those that do have formal policies, about one quarter actually forbid the use of social media. As main barriers for communication from authorities to citizens a lack of staff, guidance and skills have been identified; main barriers for the other way around (from citizens to authorities) are staff, trustworthiness and information overload. The authors conclude that "the agencies and their representatives are not yet ready to embrace social media and use it to its fullest potential. For the most part, current social media use is for dissemination of information, not the collection of it". Furthermore "in addition to technological advances, policy and management changes are needed as well, to remove the "red tape" (lack of guidelines or even prohibitions against use) that impedes the effective use" of social media (Plotnick et al., 2015).

Flizikowski et al. (2014) present a survey within Europe, conducted among citizens (317 respondents) and emergency services (130 respondents plus 33 interviews from Finland, France,

Table 1. Overview of selected cases in literature

Reference	Case	Contribution	Keyword
(Liu et al., 2008)	2004 Indian Ocean tsunami	Photo repository sites were used by citizens to exchange information.	Photo Sharing
(Murphy & Jennex, 2006)	2005 Hurricane Katrina	PeopleFinder and ShelterFinder	Finding
(Endsley et al., 2014)	2005 Hurricane Katrina, 2010 volcano Eyjafjallajökull in Iceland	Indicates that the perceived credibility of Social Media information is less than of printed, official online or televised news and information from family, relatives or friends.	Information Credibility
(Shklovski et al., 2008)	2007 Southern California wildfires	Photo repository sites were used by citizens to exchange information.	Backchannel communication
(Amanda Lee Hughes & Palen, 2009)	2008 hurricanes Gustav and Ike	Depicts differences between the use of Twitter in crises and the general use.	Microblogging
(Qu et al., 2009)	2008 Sichuan earthquake	Outlines that people gather and synthesize information.	Information synthesis
(Sutton, 2010)	2008 Tennessee River technological failure	Outlines the phenomena of broadcasting.	Broadcasting
(Heverin & Zach, 2010)	2009 attack on four police officers in Lakewood, Washington	Shows the ability of Twitter to organize and disseminate crisis-related information.	Types of Tweets
(Latonero & Shklovski, 2011)	2009 Los Angeles Fire Department	Public Information Officers highlight the importance of the information evangelist within organizations.	Information Evangelism
(Starbird & Palen, 2010)	2009 Oklahoma Fires	Highlights the role of retweeting.	Collective Intelligence
(Vieweg et al., 2010)	2009 Red River Floods	Highlights broadcasting by people on the ground as well as activities of directing, relaying, synthesizing, and redistributing.	Situational Awareness
(Birkbak, 2012)	2010 Bornholm blizzard	Shows that the geographical location and self-selection into groups create different views of a crisis situation	Emergent Groups
(Starbird & Palen, 2011)	2010 Haiti earthquake	Was analyzed with the help of translators and reveals the phenomenon of "digital volunteers".	Digital Volunteers
(Starbird, 2013)	2010 Haiti earthquake	Examines collective intelligence as transformations of information through activities.	Collective Intelligence
(Reuter et al., 2012)	2010 mass panic at the Love Parade music festival in Germany, 2010 volcano Eyjafjallajökull in Iceland	Outlines the need for duplex communication.	Crisis Management
(Nagy et al., 2012)	2010 San Bruno Californian gas explosion and fire disaster	Analysis for identifying and extracting subjective information by using language processing and linguistic approaches	Sentiment Analysis
(Starbird & Palen, 2012)	2011 Egyptian uprising	Shows how the crowd expresses solidarity and does the work of information processing through recommendation and filtering.	Information contagion and diffusion
(Wilensky, 2014)	2011 Great East Japan Earthquake	Emphasizes the use of Twitter to provide emotional support and mentions the problem of widely publishing obsolete or inaccurate information.	Commuters
(Perng et al., 2012)	2011 Norway attacks	The notion of peripheral response has been developed in relation to emergent forms of agile and dialogic emergency response.	Peripheral response
(Jennex, 2012)	2011 San Diego / Southwest Blackout	The availability of Social Media illustrates that "contrary to expectations, the cell phone system did not have the expected availability".	Availability of Social Media
(St. Denis et al., 2012)	2011 Shadow Lake fire	Shows the deployment of trusted digital volunteers as a virtual team to support a incident management team.	Trusted Volunteers
(Reuter et al., 2013)	2011 Super Outbreak	Distinguishes groups of twitterers, such as helpers, reporters, retweeters, and repeaters.	Volunteers
(Wulf et al., 2013)	2011 Tunisian revolution	Social media linked the young activists with actors in other cities.	Political

continued on following page

Table 1. Continued

Reference	Case	Contribution	Keyword
(Yang et al., 2013)	2012 hurricane Isaac	Leads to knowledge which classification algorithms work best in each phase of emergency.	Four Phases of Emergency Management
(Amanda L. Hughes et al., 2014)	2012 hurricane Sandy	Shows that few departments used online channels in their response efforts and that communication differed between fire and police departments and across media types.	Officials Social Media use
(American Red Cross, 2012a)	2012 Online and Telephone Survey	States that 25% of the participants will download an emergency app and 12% of the general public used Social Media in crises.	Aid Organization
(Bergstrand et al., 2013)	2012 Analyses the Social Media use of government authorities	Presents an account type typology containing high-level organizational accounts, accounts for formal functions and roles, formal personal accounts and affiliated personal accounts.	Emergency Response
(Fuchs et al., 2013)	2013 European Flood in Germany	Confirms the potential of Twitter as a distributed 'social sensor' but at the same time highlights some caveats in interpreting immediate results.	Visual Analytics
(Reuter et al., 2015)	2013 European Flood in Germany	Identifies challenges (1) clarity and representation of relevant content, (2) moderation and autonomous work, (3) feedback and updates in interaction relationships and (4) integration of technologies and interaction types.	Moderators and Design Challenges
(Cobb et al., 2014)	2013 Investigates the current tools, work practices and ad hoc collaboration of distributed digital volunteer teams	Identifies design implications for integrating the activities of distributed volunteers.	Digital Volunteers
(Gorp, 2014)	2014 Investigation of V&TCs and aid organizations	Categorizes Volunteer and Technical Communities into software platform development communities.	Volunteer and Technical Communities (V&TCs)

Portugal, Norway, Ireland, Great Britain and Poland). The study focuses on the identification of user needs concerning crisis management with the support of social media and mobile devices. The main goal of the study was to identify possibilities and challenges of social media integration into crisis response management. Generally the participants had a positive attitude towards social media. During the study, both citizens and emergency services identified the same challenges, such as a lack of knowledge, personnel issues, and uniform terms of use, credibility of citizen-generated content, and accessibility for older generations.

1.4. Research Gap

As seen some of this related work is focusing on citizens' perception. Other work focuses on the perception of emergency services in the US. Just Flizikowski et al. (2014) focuses on European emergency services. However they study the current state and challenges, but did not explicitly focus on future plans and the activities in research. This gap is going to be addressed within this paper by our interview study. Our research question therefore was:

What is the use of social media by emergency services in Europe?

In order to answer this question the sub questions of (a) current use, (b) potential use, (c) participation in research, (d) benefits, (e) challenges and (f) future plans will be studied.

2. METHODOLOGY OF DATA COLLECTION

To collect information about the different types of authorities' users and their motivation and attitudes in the use or potential use of social media in emergencies, a number of interviews with authorities' professionals were conducted.

2.1. Methodology and Details of Question Asked

It was agreed to focus on qualitative rather than quantitative data, and in this respect, the interviews followed a semi-structured form. The openness provided by this kind of form, in comparison to a strictly form, is deemed to provide the opportunity for more direct communication between the interviewer and the interviewee. This approach allows a more in-depth exploration of the issues being covered, which provides a richer set of results due to ideas and topics brought up during the interview. Additionally, this form allows the interviewer to ask questions in ways more appropriate to each interviewee based on his/her background (see also Baxter & Courage, 2005). Before the conduction of the interviews, all participants were briefed about the general project idea and the purpose of the interviews (including the grant of the EmerGent). We also prepare a guidance document to ensure that interviewers explored the same topics in a similar way. The guidance document contains a framework of questions outlined in Annex A, with free answers or in some cases multiple choice answers or rating scale answers.

The interview covered different topics, structured in six sections:

A. Introduction to the organization
B. Information about the PSAP and/or emergency dispatching center
C. Technical information about the PSAP and/or emergency dispatching center
D. The use of social media in emergencies
E. Challenges and benefits of the use of social media in emergencies
F. Future plans

2.2. Collection of Results

Members of the project EMERGENT conducted interviews during May 2014, in face-to-face or telephone sessions. The results were usually collected offline and were later added by each interviewer to an online tool for consistency and further analysis. The results are provided in the following sections anonymously and neither with an indication of the country nor the interviewee. The sections provide a detailed analysis of the data collected during the interviews and describe the current and potential future use of social media in emergency management, by taking into account participant perceptions and experiences so far.

Overviews of the collected responses are presented in tables. Conclusions and important highlights of the analysis of results are provided within each section. The first sections are focused on presenting the profile and operational characteristics of the respondents and their organizations (section 3), their media use for operations and communication (section 4) while the remaining section focus on social media use (section 5).

3. ORGANIZATION PROFILE

3.1. Participants (Question A4)

The selection criteria focused on collecting responses from a wide range of authorities and emergency services. Interview participants were selected across the networks of consortium partners and from a variety of Public Safety Answering Points (PSAPs) and emergency dispatch centers. Here, the aim was to cover all types of authorities relevant for the project. While the interviews collected responses from authorities across different countries, the selection criteria were not explicitly based on the geographical location. Similarly, use of social media was not a prerequisite for participating in the study, but on the contrary responses from both authorities using and not using social media were welcome.

Due to the nature and wide range of the topics covered, for example operational and technical topics, in some cases more than one person from the same organization contributed to the interview. In total, eleven interviews with 19 participants were conducted. The participants come from seven European countries and eight different cities, including five national capital cities, both represented within the consortium of the project and outside it. The exact locations of the interviews are not provided in this article to ensure the anonymity of the respondents.

3.2. Type and Size of Organization (Question A1)

A wide range of authorities, such as police, fire departments, emergency medical and governmental authorities participated in the study, in addition to respondents who were responsible for directly receiving and answering emergency calls (PSAPs). The conducted interviews involve organizations that operate on all administrative levels at local, regional and national level, while most of them operate locally. The case of service providers not directly responsible to handle emergencies, such as a police information service, was also studied as such types of providers are directly related to emergencies, collaborate during emergencies with the emergency services and also use social media in their daily activities.

3.3. PSAP Models (Question A2)

A list of different models (Machado, 2014) was used as the common basis for reporting and comparing the conducted interviews. While this list is not exhaustive and does not cover the entire call handling model or all possible models available worldwide, it was found sufficient for this study, because it helped quickly and easily refer to the major characteristics of operation amongst the respondents. The majority of PSAP model of operation was represented in the study. The participants from PSAPs followed mainly four models:

- **Model 1:** Emergency Response Organizations handling emergency calls
- **Model 2:** Filtering stage 1 PSAP and resource dispatching stage 2 PSAPs
- **Model 3:** Data gathering by stage 1 PSAP, resource dispatching by stage 2 in an integrated control room. In model 3 all involved emergency services use the same infra-structure (hardware / software), in contrast to model 2, where emergency services use the different infra-structure and interoperability can be a major issue.
- **Model 4:** Emergency Response Organizations independent PSAP

Each model is depicted in the following figures (Figure 1).

Table 2 provides an overview of the participants' organizational profile in terms of the PSAP model they follow and their operational level.

3.4. Participant Position and Functionalities (Question A3)

Participants in the interviews came from different professional backgrounds, including operations, communications, technical etc. Since in most cases, more than one participant contributed to each of the eleven cases, 19 professionals with senior positions participated in this study, including:

- Senior specialist in crisis communications
- Head of the Communication Centre
- Head of the Centre
- Commander
- PSAP leader

Figure 1. PSAP MODELS (Machado, 2014)

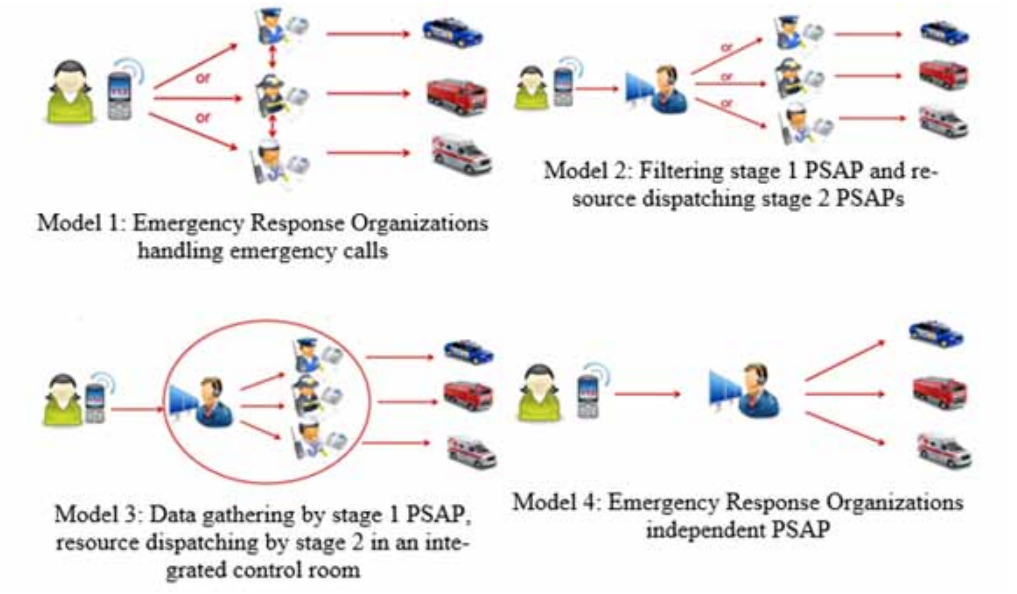

Table 2. Organization profile (Source: May 2014 Survey of authorities)

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11
PSAP	X	X	X	X	-	X	-	-	X	X	X
PSAP Model	1	3	3	4	n/a	2	n/a	n/a	2	2	2
Operation level	loc	loc	reg	loc	nat	loc, reg	loc, nat	loc, reg, nat	loc	loc	loc

loc = local; reg = regional, nat = national

- Technical team leader
- Head of training department

Their responsibilities in their organizations included dispatch planning, field support, logistics, communication management, team coordination, crisis management, technical administration, exercise preparation etc.

This data is provided to help understand the perspectives on the use of social media in relation to the operational/organizational responsibilities. It was important all participants, regardless of their position and background, acknowledged the importance of social media in emergencies, considered it an interesting topic that they like to follow and agreed it cannot be overlooked despite the difficulties currently encountered.

3.5. Risks, Vulnerabilities and Operational Size (Questions A5-A8)

The following table (see Table 3) aims to highlight among others the likelihood and intensity of bilateral communication needs, i.e. from citizens to authorities and vice-versa that results out of the characteristics of population, given risks, hazards and vulnerability as well as the current calls/missions.

Table 3. Characteristics of the analyzed interviews (Source: own elaboration)

	Case 1	Case 2	Case 3	Case 4 and 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11
Region										
Population in thousands	500 – 1000	≤ 500	500 - 1000	> 1000	≤ 500	≤ 500	≤ 500	> 1000	≤ 500	500 - 1000
Risks, Hazards and Vulnerability										
High population density	X	X	X		-	-	X		X	X
Large industrial sites	-	X	X	X	X	X	X		X	X
Harbors	X	X	X	X	-	-	-	X		X
Railways	X	X	X	X	X	X	X	X	X	X
Tunnels	X		X	X						
Major motorways	X	X	X	X	X	X	X	X		
Earthquakes				-	X	X	X			X
Storms / bad weather conditions	X			-	X	X	X		X	
Water catchment area	-	X		X	-	n/a	n/a			
Flooding	X	X		X	-	X	X		X	X
Cultural heritage, old cities		X	X	X	X	n/a	n/a	X	X	X
Touristic attraction	X	X	X	X	-	X	X	X		
Cultural Events	X		X	X						
Calls / Missions	17135	19500	1432	3942	1467	59458	0	1700000	240000	140000

3.6. Operational Tasks (Question B1-B3)

All participants share the task of responding to the public, or have a direct role in responding to emergency incidents. Case 5 is an exception to this as it holds a higher level role in emergency management. With the exception of case 7, most of the participants are involved in notifying the public and providing information. Similarly, case 10 is the only organization in the study, not directly responsible for receiving emergency calls. Table 4 summarizes the results.

Table 5 identifies how each participant is involved in the four stages of the emergency management cycle[1].

3.7. Inbound Communication (Question B4)

The communication channel most frequently reported and used as a source of input messages from citizens is the telephone. Another frequently reported channel is SMS, which in some cases is also used by people with hearing disabilities. Social media is usually not reported as an inbound message source, with the exception of two cases. In the first case, it is reported that social media is so tightly integrated in our daily life and communication channels, that is too important to ignore nowadays and it would be unthinkable not to respond to it. In the second case – although social media is not officially acknowledged as an inbound message source – messages are received, read and certainly taken into account. In both cases and in the context of this study, social media is used as a communication channel for inbound information in practice, while officially it is not acknowledged or promoted as an information channel. Other communication channels reported: Case 1 and 3: fax (deaf and persons hard of hearing); case 2 is planning to implement SMS and email channels in the near future, as it is important to widen the ways to reach the 112 PSAP; case 8: WAP, Video Call. Table 6 summarizes the results of all cases.

Table 4. Operational Tasks (Source: own elaboration)

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11
Receiving urgent calls from 112	X	X	X	-	-	X	X	X	n/a	-	X
Receiving direct urgent calls	X	X	X	X	-	X	X	X	X	-	X
Notification	X	X	X	X	-	X	-	X	X	X	X
Providing information	X	X	X	-	-	X	-	X	X	X	X

Table 5. Participant involvement in four stages of an emergency (Source: own elaboration)

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11
Prevention	n/a	-	X	n/a	n/a	X	-	-	X	X	X
Preparedness	n/a	-	X	n/a	n/a	X	X	-	X	X	X
Response	n/a	X	X	n/a	n/a	X	-	X	X	-	X
Recovery	n/a	-	n/a	n/a	n/a	-	-	-	X	-	X

3.8. Outbound Communication (Question B5)

The purpose of sending messages to citizens follows the same patterns as with receiving messages and finds the telephone as the most commonly used channel. All other channels are similarly used as for inbound messages (see Table 7).

3.9. Broadcasting (Question B6)

Authorities appear less reluctant in using social media for broadcasting messages. Most participants use the radio for broadcasts, although it was commented there has been a shift from the press and the radio to the online channels. The use of their websites, other online media websites and social media provide the opportunity to inform the public very fast and allow the message to spread rapidly. In some cases, social media, such as Twitter, were previously used for communicating with the media, and have proved to present an excellent opportunity for providing public information. The results are summarized in Table 8.

Table 6. Communication Channels for inbound messages (Source: own elaboration)

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11
Telephone calls	X	X	X	X	n/a	X	X	X	X	X	X
SMS	-	-	-	-	n/a	X	-	X	X	-	-
Paging	-	-	-	-	n/a	-	-	-	-	-	-
Email	-	-	-	-	n/a	-	-	-	-	-	X
Webform	-	X	-	-	n/a	-	-	-	-	X	X
Radio Traffic	X	-	-	-	n/a	X	X	X	-	-	-
Social Media	-	-	-	-	n/a	-	-	-	-	X	X

Table 7. Communication Channels for outbound messages (Source: own elaboration)

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11
Telephone calls	X	X	X	X	n/a	X	X	X	X	X	X
SMS	-	X	-	-	n/a	X	-	X	X	-	-
Paging	-	X	-	-	n/a	X	-	X	-	-	-
Email	-	-	-	-	n/a	X	-	X	-	-	-
Webfor	-	-	-	-	n/a	-	-	X	-	-	-
Radio Traffic	-	X	-	-	n/a	X	X	X	-	-	-
Social Media	-	-	-	-	n/a	X	-	-	-	X	X

Table 8. Communication Channels for broadcasting warning messages (Source: own elaboration)

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11
Radio	X	X	X	X	-	-	X	-	X	X	X
Local TV	-	-	-	X	-	-	X	-	X	X	-
SMS-Broadcast	-	-	-	-	-	-	-	-	-	-	-
Social Media	-	-	-	-	-	X	-	-	X	X	X
Sirens	-	-	-	-	-	-	X	-	-	X	X
Special warning 1)	-	-	-	-	-	-	-	-	-	-	-
Offline media & press	-	X	-	X	-	-	-	-	X	X	X
Online media	-	X	-	X	-	-	-	-	X	X	X

[1)]Systems like KatWarn or AmberAlerts

4. SOCIAL MEDIA IN EMERGENCIES

4.1. Current Use (Questions D1-D14)

Most of the analyzed case studies use social media (except case 4 and 5) for different purposes that will be described below. Twitter is often used, sometimes Facebook and YouTube. Other services are rather seldom used. The following table (see Table 9) gives an overview about what kind of social media is present at the institutions/authorities that were part of the survey. The different tools were not predefined, but collected during the interviews.

4.2. Potential Use (Question D15-D23)

The analysis of the first stage interviews highlighted that, in general, social media is seen as an important tool for the future, among others for gathering of information, interpretation of incidents and communication to/with the public. It is seen as one of the fastest ways to disseminate

Table 9. Current use of social media (Source: own elaboration)

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11
None	-	-	-	X	X	-	X	X	-	-	-
Twitter	X	X	X	-	-	X	-	-	X	X	X
Facebook	X	X	-	-	-	X	-	-	X	-	-
YouTube	-	X	-	-	-	-	-	-	X	-	-
Flickr	-	-	-	-	-	-	-	-	X	-	-
LinkedIn	-	-	-	-	-	-	-	-	X	-	-
Tweedeck	-	-	X*	-	-	-	-	-	X	-	-
Hootsuite	-	-	X*	-	-	-	-	-	-	-	-

*Individual key players

information about prevention or to inform the public with warnings or notifications before, during and after a major incident. Further, social media supports a bi-directional communication and can support all stages of an emergency management cycle: starting with identification of potential hot spots and informing or warning the public about certain facts regarding an incident (prevention or mitigation), informing the public about certain warnings or directions regarding an incident like spread of hazardous substances (preparedness), informing the people about forthcoming evacuation out of exposed areas, and reduce or avoid the possibility of emergency escalations (response), inform the people about medical aid and further behavior (recovery).

The intensity and degree of "information exchange" concerning relevant phases of the emergency management cycle making use of social media is diverse. Case 1 for example distinguishes between the foci "operation" and "general". Concerning the operation, the focus is set up on the receipt of relevant information for operation. This information is used for e.g. necessary intervention concerning the process of communication (e.g. information provided by e.g. media) and thereby control and regulation of information (e.g. instructions concerning behavior, revision and correction of wrong information). In general it concerns public relations, information about training positions and advertisements.

Even if the use of social media is seen as important, there are some special restrictions concerning the "exchange" (gathering and mining) of data, not only due to the limited resources, but also limited tools and authorization. Case 10 differentiates the responsibility according to the dimension: in special cases and big emergencies the responsibility lies with the police communications department. In other "simpler" or pure information cases everyone in the dispatching center is responsible for social media use. Due to missing technical possibilities and tools ("Internet lock out") for example in case 1 only the staff of the press office (fire department) are allowed to gather data (here data filtering/gathering is done only – if at all – when this is connected to a clear operation). A similar situation is seen in case 2, where the communication service local (government) and communication service (fire service) is only allowed to spread data (responsibility belongs to the experts in the service) or case 6 the dispatching center (responsible there: dispatch officer, IT staff) or as in case 11 the officer in command.

Nevertheless, some of the analyzed cases already use (more or less) social media tools. Case 2 uses the Twitter platform, Hootsuite, Storify, Social Mention and aims to use Coosto in future. Here, the observation of current communication processes is used. Some other examples are crowd sourced maps including OpenStreetMap, Google Crisis Map or crowd sourced information management, crowd sourced pictures, information about smoke spread is used by e.g. case 2. Case 10 was said to use several tools (Hootsuite, Tweetdesk and Coosto) when preparing for a big event but not in urgent emergencies. During an emergency one or two people are gathering the data. Case 11 did not use any specific tools or applications.

In one case, the use of a specialized Twitter service, Twitter Alert was reported. Twitter Alert was launched in late 2013 and aims to enable authorities to keep people well informed by providing accurate and important information during an emergency. It is open to be used by authorities, government services and NGOs worldwide.

Beside the limited human and technical resources, the financing of using new social media is quite problematic and constrains its use. In some cases (case 1, 4, 5) there is no financing for social media. Nevertheless, in other cases (2, 3, 6, 10, 11) a budget is available or could be provided (local, regional, own budget) to guarantee this task, even if it is not part of the regular budgets and not marked as a use for social media.

The strategy for implementation into the organization differs through the case studies. Some case studies have no clear plans (like case 1); other organizations (case 3) are experimenting with the use of social media in case of an emergency. There have been experiments developed

throughout the use of Coosto but these experiments were sporadic and without reciprocal reconciliation. Others (case 2) have clear expectations and define the first steps how to use and implement social media. Case 2 is running experiments with the active role of citizens during emergencies: they use social media on a daily basis to monitor and to gather information about incidents. Up to now this is performed manually, but in the near future it is aimed to implement software to automate this process and to implement social media in the dispatching rooms of the fire service and police (in the police, social media monitoring through specific software is already used to improve intelligence).

In case 6, fire officers and dispatchers are using social media without a clear and determined goal. This way, it is present in their daily routines. However none of the staff have received any training on how to use it so far. They plan to provide warning messages via Twitter and Facebook in incidents, where more than two fire brigade units are present at the spot or during incidents with hazardous materials. Nevertheless and as mentioned before, there might be some problems with integrating it with the existing software. As any new software has to be checked and verified by the PSAP director, this might take a while (in future, there might be a chance to integrate it into the existing software). While there are no formal or documented implementation strategy or guidelines in case 10, search for information and monitoring of social media is done continuously and in parallel with all normal activities. This is similar to the situation in case 11, where the information is used (one person in the PSAP is responsible for posting messages, all people are responsible for reading messages), but no formal workflow, method, or guidelines exist and no special tools are used.

Case 2 aims at a distinction between expert social media users and basic users: Basic users are, for example, PSAP operators who just have to get information from social media when it's relevant. For these users, case 2 is focusing on buying software that will allow it to build a dashboard to show the right information when it is available. Expert users are the ones who control the dashboard and choose the search protocol. They are also the users that provide crisis communication on social media, as there is a requirement to be very familiar with social media "language" to be able to communicate in the most appropriate way. At this moment, implementation is still a problem as a lot of the necessary knowledge is only held by experts in the organization.

4.3. Research (Questions D24-D27, F5)

The importance and position of new social media will increase in future. This is stated in the cases analyzed, although most interviewees are not active in the field of research (e.g. cases 6, 7, 8 and 11). Therefore, a further use is in principle welcome and recommended. Nevertheless due to missing technical and time resources, an implementation in case 1 is currently not possible. Case 2 plans to use social media for e.g. gathering information, communication to the public, cooperation between services (for example Google Hangouts to communicate between the gold and silver command). There are concerns to follow research and development on social media as stated by case 2 in the field of monitoring tools (e.g. implementation of Coosto), continuous evaluation of social media use (what works and what doesn't), strengthen the cooperation with universities and the "team D5", a newly formed team of public communication specialists who help each other during crisis ("team D5" have a specific section on social media monitoring).

Case 11 states that possibilities of social media are currently being considered, even there are no formal plans for using it. Here, the verification of information is important as well as the possibility of an account being hacked is considered a serious risk, especially if at the same time there is a serious emergency.

4.4. Benefits (Question E1)

Basically all possible benefits (warning, reachability, situation awareness for authorities and citizens) have been mentioned by all interviews. The following table (see Table 10) shows an overview about the benefits of social media use not only for the public but also for authorities.

In times of an incident, inhabitants want to be informed by the authorities in the same way as they daily gather news. That is dependent of the involvement and curiosity of the inhabitants. Case 11 states social media has taken away some of the distance between the public and the Police, resulting in the police coming closer to citizens. Case 10 highlighted that people know they get valid information from emergency services and that they can trust this information. Here, trust is seen as a prerequisite for an appropriate relationship between local / regional authorities and the society. Trust has a key role in dealing with given risks and communication and should be regarded as fundamental for risk interpretation and awareness of the public between "real" and "perceived" risks (interpretations of "risk" differ according to individual and social contexts).

It has to be kept in mind that public decision-making, which is based only on the factual "scientific" dimension of risk leads to distrust, not taking into account the "socio-cultural" dimension, which includes how a particular risk is viewed when values and emotions are concerned (e.g. whether a risk is judged acceptable, tolerable or intolerable by society is partly influenced by the way it is perceived to intrude upon the value system of society). In addition, it contributes to the vulnerability of institutional settings as well as affected individuals. Case 3 stated that when the government takes a position in the social media networks, they will be able to deliver an interpretative perspective and handling perspective to the inhabitants in the area of the incident. This causes effects on the resilience of a community, because only those who are well informed and integrated in the process will accept the decisions made by different authorities and undertake the right choices/decisions in cases of risks. Furthermore it "proves" the image of the organization. Case 3 highlighted the fire service has a fine (positive) image towards the inhabitants compared to different other services and the government, where their image is significantly perceived worse.

The government must be a reliable partner concerning information exchange in the daily life, before they will be considered reliable at times of an incident. By quickly providing the "correct" information (concerns quality and quantity), the inhabitants will be provided only this kind of information they really want and especially need. By this way, the government can prevent panic situations during a big incident or a critical event.

Table 10. Benefits of Social Media use (Source: own elaboration)

	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**	**Case 9**	**Case 10**	**Case 11**
Better public warning	X	X	n/a	X	n/a	X	X	X	X	X	X
Better reachability of citizens	X	X	n/a	X	n/a	X	X	X	X	X	X
Improvement of the situation awareness for authorities	X	X	n/a	X	n/a	X	X	X	n/a	n/a	X
Improvement of the situation awareness for citizens	X	X	n/a	X	n/a	X	X	X	n/a	n/a	X

4.5. Challenges (Question E2)

In parallel to the benefits, the interview study highlights additional challenges (even if some of the case studies have no experience with it, the difficulties could be estimated, as seen in the table below (Table 11). The biggest challenge is reliability of the sources, followed by the liability, believability and objectivity. Less important challenges are timeliness, reproducibility, understandability and legal uncertainty.

Additionally to this, case 3 stressed that some identified difficulties are the speed information is released with, it is never possible to quickly discover in which communities the most critical information is shared; you do not know who needs the information at most and messages cannot be quickly or sufficiently checked concerning their truth. In fighting a crisis, there is a crucial process of validation of the facts to prevent the ex-post evaluation and the wrong conclusions.

4.6. Future Plans (Questions F1-F4)

Our interview study reveals that concerning future plans for using social media in emergencies the impact is estimated increasing (cases 1, 2, 4, 5, 6, 7, 8). Furthermore, case 2 stated that in 5-10 years crowdsourcing and big data will be standard technologies in crisis management. Therefore, it is necessary to focus on such items. In a crowd sourced and big data world (cf. Ludwig et al., 2015), verification becomes the main skill of the PSAP operator and the information manager. Nevertheless case 1 voiced the concern that as long as the technical and personnel circumstances will stay as they are, there will be no significant change. In cases 4 and 5 there are no examples of using social media in emergences by public administration. Probably some will be observed as important issue only when this gap will be filled by citizens. For sure social media will be used mostly in the field of situation monitoring and public warning.

Case 6 dispatching center will promote the implementation of notifications such as warnings or alerts. The attention should be moved also to gathering information from the public. Case 8 has no clear concept, but will place the social media growth and usage on the own agenda shortly. Case 11 will consider the use of Instagram and Facebook, but there are no precise plans at the moment ("we know what social media is only for a few years").

Table 11. Difficulties of using social media (Source: own elaboration)

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11	average
Reliability of the different sources	high	medium	n/a	high	n/a	high	high	high	n/a	high	high	High (2,9)
Liability of the different sources	medium	medium	n/a	high	n/a	high	high	high	n/a	high	high	High (2,8)
Believability / Verifiability	medium	medium	n/a	high	n/a	high	high	high	n/a	high	high	High (2,8)
Objectivity	high	medium	n/a	medium	n/a	medium	high	high	n/a	high	high	High (2,6)
Timeliness	low	low	n/a	no	n/a	medium	high	high	n/a	high	medium	Medium (2,0)
Reproducibility	low	low	n/a	medium	n/a	medium	high	high	n/a	high	n/a	Medium (2,1)
Understand-ability	low	low	n/a	medium	n/a	low	high	high	n/a	high	n/a	Medium (2,0)
Legal uncertainty	low	low	n/a	high	n/a	high	high	high	n/a	low	n/a	Medium (2,1)

High=3; medium=2; low=1; no=0

Concerning new technologies, case 2 is focused on Coosto and case 6 aims at providing information to the general public using one app. This app should post a warning message to everybody on that area, regardless of the follower status. Case 6 and case 1 highlighted social media will be present in the daily routines in dispatch centers, PSAPS, etc. and it is possible that the reporting of the fire departments will focus more toward social media and the "older" solutions (such as a website) will lose importance.

The units (as in case 3) are aware about the development around social media and know that they will have to work with it. Nevertheless, for government agencies this is a new phenomenon. At this moment, there are only experiments, for example Coosto, put together to look how and what you are able to do with social media during a crisis. However, all interviewed institutions / units agree in opinion that research projects like EMERGENT are helpful to gain new insights.

5. CONCLUSION

Social media is and has already been widely used during a variety of emergencies. After presenting a definition for social media, various related studies are presented. Our performed study includes a variety of respondents who helped collecting the reported results. Participants were from different European countries and their profile varied in terms of their role in emergency management, operational size, methods and tasks. The main results are given in Table 12.

Social media provides a direct and fast channel for communicating with the public and spreading accurate and trusted information, especially during emergencies, when it is even more important for people to have access to trusted information. Social media provides the possibility for bi-directional communication and it is currently used in the majority of the cases. However, the current practice shows higher use of broadcasting information to citizens, rather than responding to individual cases.

The use of social media during the different stages of an emergency management cycle highlighted the importance of information gathering and validation. This is considered as one of the great challenges in the use of social media and in some cases it may prohibit or restrict further use. To overcome this barrier, an alternative model of operation is explored by some authorities, where the purpose of using social media is distinguished between use for operational purpose versus informational purpose, or use during an emergency versus use during normal operation. The emerging difficulty in handling the data streams from social media, trigger the opportunity for supporting these processes with applicable tools. Authorities already experiment with the

Table 12. What is the use of social media by emergency services in Europe?

Question	Answer
Current Use	Twitter often, sometimes Facebook and YouTube. Other services rather seldom.
Potential Use	Gathering of information, interpretation of incidents and communication to/with the public
Research	Most interviewees are not active in the field of research
Benefits	Basically all possible benefits (warning, reachability, situation awareness for authorities and citizens) have been mentioned by all interviews.
Challenges	Reliability of the sources, followed by the liability, believability and objectivity. Less important challenges are timeliness, reproducibility, understandability and legal uncertainty
Future Plans	Impact is estimated increasing

use of different tools, although the current study reports a lack of a clear understanding of what tool to use or which tool is better in different situations.

While implementation strategies or models for integration with current workflows are clearly interesting topics and some authorities currently explore or discuss different options, no clear or documented plans or goals were identified. Interviewees were not active in the research field of social media and emergency management. However, all shared an interest to follow the advances of this theme and expect the importance of social media in emergencies to rise in the future.

To achieve a broader view across Europe, larger studies are necessary. The project EmerGent conducted an additional European survey in 2014 and 2015 (a) among 700 people (working within emergency services) across 27 countries and (b) among 1000 citizens to investigate their experiences and visions on how to use social media nowadays and in the future. These qualitative and quantitative results will give the project directions on how to use social media more effectively in the future and how to support both emergency services and citizens in a better way during emergencies.

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REFERENCES

American Red Cross. (2012a). More Americans Using Mobile Apps in Emergencies. Retrieved from http://www.redcross.org/news/press-release/More-Americans-Using-Mobile-Apps-in-Emergencies

American Red Cross. (2012b). Social Media in Disasters and Emergencies. Retrieved from http://a1881.g.akamai.net/7/1881/26640/v0001/redcross.download.akamai.com/26640/PollData/Social

Baxter, K., & Courage, C. (2005). *Understanding Your Users: A Practical Guide to User Requirements Methods, Tools, and Techniques*. Morgan Kaufmann.

Bergstrand, F., Landgren, J., & Green, V. (2013). Authorities don't tweet, employees do! *Proceedings of the MobileHCI 2013*.

Birkbak, A. (2012). Crystallizations in the Blizzard : Contrasting Informal Emergency Collaboration In Facebook Groups. *Proceedings of the Nordic Conference on Human-Computer Interaction (NordiCHI)* (pp. 428–437). doi:10.1145/2399016.2399082

Canadian Red Cross. (2012). *Social Media during Emergencies*. Retrieved from http://www.redcross.ca/cmslib/general/pub_social_media_in_emergencies_survey_oct2012_en.pdf

Cobb, C., McCarthy, T., Perkins, A., & Bharadwaj, A. (2014). Designing for the Deluge: Understanding & Supporting the Distributed, Collaborative Work of Crisis Volunteers. *Proceedings of the Conference on Computer Supported Cooperative Work (CSCW)*, Baltimore. doi:10.1145/2531602.2531712

Endsley, T., Wu, Y., & Eep, J. (2014). The Source of the Story: Evaluating the Credibility of Crisis Information Sources. *Proceedings of the Information Systems for Crisis Response and Management*, *1*, 158–162.

Flizikowski, A., Hołubowicz, W., Stachowicz, A., Hokkanen, L., & Delavallade, T. (2014). Social Media in Crisis Management – the iSAR + Project Survey. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)* (pp. 707–711).

Fuchs, G., Andrienko, N., Andrienko, G., Bothe, S., & Stange, H. (2013). Tracing the German Centennial Flood in the Stream of Tweets: First Lessons Learned. *Proceedings of the SIGSPATIAL International Workshop on Crowdsourced and Volunteered Geographic Information,* Orlando, USA (pp. 2–10). doi:10.1145/2534732.2534741

Heverin, T., & Zach, L. (2010). Microblogging for Crisis Communication: Examination of Twitter Use in Response to a 2009 Violent Crisis in the Seattle-Tacoma, Washington Area. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)*, Seattle, USA.

Hughes, A. L., & Palen, L. (2009). Twitter Adoption and Use in Mass Convergence and Emergency Events. In J. Landgren, & S. Jul (Eds.), *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)*, Gothenburg, Sweden. doi:10.1504/IJEM.2009.031564

Hughes, A. L., St. Denis, L. A. A., Palen, L., & Anderson, K. M. (2014). Online Public Communications by Police & Fire Services during the 2012 Hurricane Sandy. *Proceedings of the Conference on Human Factors in Computing Systems (CHI)*. doi:10.1145/2556288.2557227

Jennex, M. E. (2012). Social Media – Truly Viable For Crisis Response? In L. Rothkrantz, J. Ristvej, & Z. Franco (Eds.), *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM),* Vancouver, Canada (pp. 1–5).

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons*, *53*(1), 59–68. doi:10.1016/j.bushor.2009.09.003

Latonero, M., & Shklovski, I. (2011). Emergency Management, Twitter, and Social Media Evangelism. *International Journal of Information Systems for Crisis Response and Management*, *3*(4), 1–16. doi:10.4018/jiscrm.2011100101

Liu, S., Palen, L., & Sutton, J. (2008). In search of the bigger picture: The emergent role of on-line photo sharing in times of disaster. In *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)*, Washington D.C., USA.

Ludwig, T., Reuter, C., Siebigteroth, T., & Pipek, V. (2015). CrowdMonitor: Mobile Crowd Sensing for Assessing Physical and Digital Activities of Citizens during Emergencies. *Proceedings of the Conference on Human Factors in Computing Systems (CHI)*, Seoul, Korea. ACM Press. doi:10.1145/2702123.2702265

Machado, G. (2014). PSAPs Organisation in Europe. Retrieved from http://www.eena.org/ressource/static/files/2013_04_16_psaporgeurope.pdf

Murphy, T., & Jennex, M. E. (2006). Knowledge Management, Emergency Response, and Hurricane Katrina. *International Journal of Intelligent Control and Systems*, *11*(4), 199–208.

Nagy, A., Valley, C., & Stamberger, J. (2012). Crowd Sentiment Detection during Disasters and Crises. In *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM),* Vancouver, Canada (pp. 1–9).

Perng, S.-Y., Büscher, M., Wood, L., Halvorsrud, R., Stiso, M., Ramirez, L., & Al-Akkad, A. (2012). Peripheral response: Microblogging during the 22/7/2011 Norway attacks. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)* (pp. 1–11).

Plotnick, L., Hiltz, S. R., & Kushma, J. a, & Tapia, A. (2015). Red Tape : Attitudes and Issues Related to Use of Social Media by U. S. County- Level Emergency Managers. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)*, Kristiansand, Norway.

Qu, Y., Wu, P. F., & Wang, X. (2009). Online Community Response to Major Disaster : A Study of Tianya Forum in the 2008 Sichuan Earthquake. *Proceedings of the Hawaii International Conference on System Sciences (HICSS)*, Waikoloa, USA.

Reuter, C., Heger, O., & Pipek, V. (2013). Combining Real and Virtual Volunteers through Social Media. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)* (pp. 1–10).

Reuter, C., Ludwig, T., Kaufhold, M.-A., & Pipek, V. (2015). XHELP: Design of a Cross-Platform Social-Media Application to Support Volunteer Moderators in Disasters. *Proceedings of the Conference on Human Factors in Computing Systems (CHI)*, Seoul, Korea. ACM Press. doi:10.1145/2702123.2702171

Reuter, C., Marx, A., & Pipek, V. (2012). Crisis Management 2.0: Towards a Systematization of Social Software Use in Crisis Situations. *International Journal of Information Systems for Crisis Response and Management*, *4*(1), 1–16. doi:10.4018/jiscrm.2012010101

San, Y. S., Wardell III, C., & Thorkildsen, Z. (2013). Social Media in the Emergency Management Field: 2012 Survey Results, June.

Shklovski, I., Palen, L., & Sutton, J. (2008). Finding Community Through Information and Communication Technology During Disaster Events. *Proceedings of the Conference on Computer Supported Cooperative Work (CSCW)*, San Diego, USA, ACM-Press.

St. Denis, L. A., Hughes, A. L., & Palen, L. (2012). Trial by Fire: The Deployment of Trusted Digital Volunteers in the 2011 Shadow Lake Fire. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)* (pp. 1–10).

Starbird, K. (2013). Delivering Patients to Sacré Coeur : Collective Intelligence in Digital Volunteer Communities. *Proceedings of the Conference on Human Factors in Computing Systems (CHI)* (pp. 801–810). doi:10.1145/2470654.2470769

Starbird, K., & Palen, L. (2010). Pass It On?: Retweeting in Mass Emergency. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM),* Seattle, USA (pp. 1–10).

Starbird, K., & Palen, L. (2011). Voluntweeters: Self-Organizing by Digital Volunteers in Times of Crisis. *Proceedings of the Conference on Human Factors in Computing Systems (CHI),* Vancouver (pp. 1071–1080). ACM-Press. doi:10.1145/1978942.1979102

Starbird, K., & Palen, L. (2012). (How) Will the Revolution be Retweeted? Information Diffusion and the 2011 Egyptian Uprising. *Proceedings of the Conference on Computer Supported Cooperative Work (CSCW)* (pp. 7–16).

Sutton, J. (2010). Twittering Tennessee: Distributed networks and Collaboration Following a Technological Disaster. In S. French, B. Tomaszewski, & C. Zobel (Eds.), *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)*, Seattle, USA.

Van Gorp, A. F. (2014). Integration of Volunteer and Technical Communities into the Humanitarian Aid Sector: Barriers to Collaboration. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)* (pp. 620–629).

Vieweg, S., Hughes, A. L., Starbird, K., & Palen, L. (2010). Microblogging During Two Natural Hazards Events : What Twitter May Contribute to Situational Awareness. *Proceedings of the Conference on Human Factors in Computing Systems (CHI)* (pp. 1079–1088). doi:10.1145/1753326.1753486

Wilensky, H. (2014). Twitter as a Navigator for Stranded Commuters during the Great East Japan Earthquake. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)* (pp. 695–704).

Wulf, V., Misaki, K., Atam, M., Randall, D., & Rohde, M. (2013). "On the Ground" in Sidi Bouzid: Investigating Social Media Use during the Tunisian Revolution. *Proceedings of the Conference on Computer Supported Cooperative Work (CSCW)* (pp. 1409–1418). New York: ACM.

Yang, S., Chung, H., Lin, X., Lee, S., & Chen, L. (2013). PhaseVis: What, When, Where, and Who in Visualizing the Four Phases of Emergency Management Through the Lens of Social Media. In *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM),* Baden-Baden, Germany (pp. 912–917).

ENDNOTES

[1] See for example: https://www.providenceri.com/PEMA/about/emergency-management; often is "mitigation" used instead of prevention (we define mitigation as part of the prevention stage).

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APPENDIX A: INTERVIEW QUESTIONS

Section A: Introduction to the Organization

• A1. Specify the type of your organization.
• A2. Specify your PSAP model.
• A3. General Information about you
• A4. Geographical and regional information
• A5. What are the main risks in your region?
• A6. Specify the vulnerability of your region:
• A7. Estimate the average number of calls / emergency calls per anum for the following categories.
• A8. Estimate the average number of emergency operations per anum for the following categories.
• A9. Specify the number of your workforce (ft/pt)
• A10. On which administrative division is your organization operating in your state?

Section B: Information about the PSAP and/or Dispatching Center You Are Part Of, or Responsible For

• B1. Select the main tasks within your PSAP (Multiple choices are welcome)
• B2. Are there any further tasks your PSAP is responsible for?
• B3. Specify in which phases of the emergency management cycle your organization operates and describe the main tasks.
• B4. Select the communication channels that your PSAP supports to handle input messages (i.e. messages from citizens).
• B5. Select the communication channels that your PSAP supports to send out messages (i.e. messages to inform or support citizens)
• B6. Select which communication channels your PSAP uses to broadcast warning messages. A warning message should inhabitants make aware of a danger.
• B7. Please describe the special warning systems that your PSAP uses to send out warning messages.
• B8. Select the responsible roles for output messages.

Section C: Technical Information about the PSAP and/or Dispatching Center You Are Part Of, or Responsible For

• Not analyzed for this article.

Section D: The Use of Social Media in Emergencies

• D1. Does your organization already use Social Media, e.g. to gather or spread information?
• D2. Select the Social Networks that are used by your organization.
• D3. Who is allowed to post/send out data?
• D4. Is information from Social Media provided by citizens used in authorities?
• D5. Which tools do you use to analyze/collect data from Social Media (e.g. Twitcident)?
• D6. Who is allowed to use gathered data from Social Media in your organization?
• D7. Does your organization use other web 2.0 technologies?

• D8. In which phases of an emergency do you use Social Media? Please select and describe the usage.

• D9. Please try to categorize the main purposes in using Social Media.

• D10. What is the main purpose in using Social Media? Please describe in detail.

• D11. How does your organization finance Social Media usage?

• D12. Please try to categorize the implementation strategy that would fit at most to your current implementation.

• D13. Describe your organizations' implementation strategy on Social Media in detail.

• D14. Please describe how you or your organization has implemented Social Media into workflows or processes within your organization. Try to describe the main workflows and how the implementation is done.

• D15. Is Social Media an interesting topic for your organization?

• D16. Select the Social Networks which are most interesting for your organization in order to inform, encourage or engage citizens.

• D17. Please try to categorize the main purposes that you would like to focus in Social Media.

• D18. Describe the main purposes in the use of Social Media.

• D19. How would you finance the usage of Social Media?

• D20. Please try to categorize the implementation strategy that would fit at most.

• D21. Please try to describe a suitable implementation strategy on Social Media for your organization.

• D22. Please describe how you or your organization would implement Social Media into workflows or processes within your organization. Try to identify the main workflows and describe how the implementation is done.

• D23. Please describe why Social Media isn't an interesting topic for you.

• D24. Does your organization make research and development on Social Media?

• D25. Please describe the research and/or development that your organization does on Social Media.

• D26. Is your organization following or would like to follow research and development on Social Media?

• D27. Please describe the research topics you're interested in.

Section E: Challenges and Benefits on Social Media in Emergencies

• E1. What are the main benefits of Social Media use?

• E2. What are the main difficulties or challenges experienced with working with Social Media?

• E3. If you have some interesting references to cases studies, SWOT- or risk-analysis regarding Social Media, especially Social Media in emergencies, please paste them below.

Section F: Future Plans

• F1. How do you think the impact of Social Media in emergencies will change in the next years?

• F2. How will your organization deal with Social Media in the next years?

• F3. How will workflows and tools evolve?

• F4. What are the new technologies you are looking at?

• F5. Do you think research projects like EMERGENT are helpful to gain new insights?