

Requirements for Software to Support the Use of Social Media in Emergency Management: A Delphi Study

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ABSTRACT

Social Media contain a wealth of information that could improve the situational awareness of Emergency Managers during a crisis, but many barriers stand in the way. These include information overload, making it impossible to deal with the flood of raw posts, and lack of trust in unverified crowdsourced data. The purpose of this project is to build a communications bridge between emergency responders and technologists who can provide the advances needed to realize social media's full potential. We are employing a Delphi study survey design, which is a technique for exploring and developing consensus among a group of experts around a particular topic. Participants include emergency managers and technologists with experience in software to support the use of social media in crisis response, from many countries. The topics of the study are described and preliminary, partial results presented for Round 1 of the study, based on 33 responses.

Keywords

Social media, emergency management, crisis informatics, software requirements, Delphi method

INTRODUCTION

Social Media (SM) contain a wealth of information that could improve the situational awareness of Emergency Managers (EMs) during a crisis (Power et al., 2014; Palen and Hughes, 2018) but agencies are often reluctant to use SM, especially to gather unverified crowdsourced data (Plotnick et al., 2015; Plotnick and Hiltz, 2016). There is also a disconnect between the technologists who design and build automatic data processing systems to analyze SM data and the EMs who could benefit from using them. EMs do not know what is technically possible while technologists do not know what EMs want. Moreover, most existing systems rely only on a single SM data source (e.g., Twitter or Facebook). However, combining informative signals from multiple SM data sources could be useful in several ways e.g., determining the trustworthiness of SM data (Sherchan et al., 2013; Panteras et al., 2015), obtaining missing information (Mahmud et al., 2012), etc. Furthermore, these diverse SM data sources produce different content types. For instance, Flickr is best for images, YouTube for videos, whereas Twitter and Facebook are good for both text and images. Diversity in content types not only brings complementary information (Panteras et al., 2015), it is also useful to gain contextual understanding (Bontcheva et al., 2014). Despite the fact that complementary information in the form of either images or videos is readily available on many SM platforms, many past efforts to build automated systems for disaster response and management only focused on the textual content available on SM.

The purpose of this project is to build a communications bridge between emergency responders (for both governments and NGOs) working in Emergency Management and technologists who can provide the advances needed to realize SM's full potential. Moreover, we aim to solicit software requirements beyond the use of a single SM data source and single content type. To build this bridge, we employ a Delphi study, which is a technique for exploring and developing consensus among a group of experts around a particular topic (in this case, SM use in emergency management). Our study includes emergency responders and technologists from many domains and nations. The final product of the study will be a set of software requirements to better enable EMs to gather organized information from SM that is rated for trustworthiness and usable for decision making. Our overarching goal is to inform technologists of EM needs and to help EMs understand the feasibility of, and possible solutions to, meeting those needs.

In the sections that follow, we review the prior literature on software to support the use of social media by emergency managers, and briefly describe the Delphi method. We then describe the methods used in the Delphi study that is underway as of November 2018.

LITERATURE REVIEW

Social Media (SM) have become ubiquitous and are often used by emergency management organizations to disseminate information (Plotnick and Hiltz, 2016). However, prior studies (Hughes and Palen, 2012; Plotnick and Hiltz, 2016) suggest that there is great hesitation by emergency management (EM) organizations to use SM to collect data from the public during an emergency. This hesitation can create missed opportunities to improve situational awareness. Additionally, the public expects EMs to respond to their SM queries (Petersen et al., 2017) which cannot be done if EM agencies do not accept and use public SM posts.

Software Enhancements for Social Media Use in Emergency Management

There are many barriers to the use of social media (SM) for emergency management (EM), both technical and organizational. Social media are examples of "socio-technical" systems; meaning that their use and effectiveness are determined not only by the features and quality of the systems themselves, but also by social context factors such as user attributes (e.g., skills and training, or the lack of them), and by organizational norms and policies and resources (Power and Kibell, 2017). This is especially true of the use of SM as part of an emergency response management system, when the information that could be retrieved and used is generated by the public and communicated via a public commercial system, rather than by trusted information systems under organizational control (Plotnick and Hiltz, 2016). Some of these barriers can only be overcome through organizational changes, but others, especially those having to do with issues of information overload (thousands to millions of tweets and posts on a specific disaster; too much information arriving too fast and in a disorganized manner) and trustworthiness of SM posts (Tapia et al., 2011; Plotnick et al., 2015; Hughes and Shah, 2016), could be dealt with through software pre-processing systems.

Many studies describe possible software enhancements and systems that could improve the usability and usefulness of social media for disaster management. See (Imran et al., 2015) for an extensive survey of these technologies as of about four years ago. A great many of these new technologies for processing social media data incorporate both human efforts (e.g. crowdsourcing to create training sets for machine learning) and automated tasks (Imran, Mitra & Castillo, 2016). The multiple challenges facing software developers include real-time parsing of brief and informal messages, determining information credibility, and prioritizing useful information (Imran et al., 2018).

In a survey of 477 U.S. county-level EMs (Plotnick and Hiltz, 2018), several of the specific potential software enhancements described in (Imran et al., 2015) that could help overcome the limitations of SM for EMs were rated with the result being that they are perceived as highly useful. These enhancements included the ability to view SM data as generated by geographical location on a map-based display, and categorization of SM data by sub-events (e.g., rescue issues). However, that study had several limitations: participants were limited to U.S. county level EMs and many potential enhancements that have subsequently appeared in the literature were not included. The current study aims to overcome these limitations by including software developers and researchers related to SM in EM, from many countries and types of organizations, and adding features from systems described in recent studies and proposed and vetted by the study participants.

The Delphi Method

A Delphi study consists of two or more rounds of structured written exchanges between anonymous experts with different types of expertise relevant for a topic (Linstone and Turoff, 1975, 2011). It was developed in the 1950s to obtain expert input on a particular problem while allowing the participants to remain anonymous. The

expert panels are given questionnaires (mailed or online) and answer them at a time and place convenient to them. The technique is particularly useful in cases where the expert panel is dispersed over a wide geographic area, and for complex, multi-disciplinary problems (Hendela et al., 2017).

The Delphi method utilizes a series of questions over two or more rounds where each participant may suggest additional items for consideration in subsequent rounds. An important aspect of a Delphi is that experts are generally asked not only to rate various alternatives or issues or items, but also to explain their rating in comments. The comments often surface the underlying reason for disagreement on ratings, such as one person assuming that a related development is likely, while another expert assumes that it is not. After each set of questionnaires is completed, a facilitator summarizes the experts' inputs and then distributes the summary with another round of questions. The results are annotated to show which category(ies) of expert provided each feedback item. Thus, although anonymity is maintained, expert participants know the domain of the person providing feedback. This is helpful when the experts evaluate the feedback. The experts can then revise their answers from the first round in light of the ratings and comments of others, and add ratings of newly surfaced items or issues.

RESEARCH METHOD

Our objective is to foster a dialogue and exchange of knowledge among software developers, emergency managers, and researchers on SM, from different nations and types of organizations. Thus, we aim to obtain a representative "spread" of diverse opinions from different types of stakeholders, rather than a random or representative sample of any particular population.

Expert Recruitment

In recruiting possible participants, we cast a wide net, using our professional networks. This included sending invitation messages to researchers who had published papers in the social media tracks of recent ISCRAM-sponsored meetings; sending emails to lists of U.S. emergency managers; posting on Linked In discussion boards for EMs; personal messages to software developers; and requests for those initially invited to suggest other experts.

Following approval of the study by the New Jersey Institute of Technology Institutional Review Board (which included the consent form, screening questionnaire, and Round 1 questions of the Delphi), the initial invitation to participants was to complete a screening questionnaire. We used email to send the prospective participants a link to a Recruitment survey to build our expert panel prior to the actual Delphi. The Recruitment survey asked for information such as years of experience in EM and in software development for SM in EM, to make sure the volunteers qualified as "experts." We had hoped to obtain funding for the study, and the consent form stated that if we did obtain funding, those who completed both rounds would receive a \$200 honorarium, payable to themselves or to a disaster-related charity, such as Doctors Without Borders. The screening questionnaire asked if they were willing to participate with or without such funding; it was reassuring that all but one of those who responded said they would participate "with or without" the funding, especially because we did not receive the funding. Since it was stated that the Delphi rounds of the study may take between 30 minutes and two hours per round, depending on how many comments a participant makes, this might have affected the response rate. There were 48 valid respondents to the Recruitment survey who indicated they were willing to participate out of over 400 prospective participants who received invitation messages or may have seen one on a discussion board.

We reviewed the responses to the Recruitment survey to confirm that the respondents were qualified by their expertise and experience to participate as members of the Delphi panel of experts. Those few respondents (N=9) to the Recruitment survey who were deemed unqualified either failed to complete the survey beyond the consent or did not have experience as a researcher, practitioner, and/or academic in the focus area of use of social media for emergency management. We maintained a list of the qualified respondents and then sent email to only these respondents with the link to the Round 1 Delphi questionnaire. The Recruitment survey took, on average, four minutes for the respondents to complete.

Delphi Questionnaires

Once the panel was formed, our Delphi process consisted of two rounds of surveys with feedback to the experts from each. This paper reports on the results of the Round 1 questionnaire.

The Round 1 questionnaire was a mix of qualitative and quantitative questions focused on four broad topic areas of participant demographics and experience, social media platforms, tool features, and recommendations. These topic areas were determined from the literature survey (particularly Imran et al., 2015 and Plotnick and Hiltz,

2016) and through iterative discussion within the research team. Once these broad topic areas were determined, they were refined and expanded into the specific survey questions, again through iterative discussion. In Round 1, we asked participants to rate the desirability and feasibility of a list of possible tools and features (provided by the research team) as well as to suggest others and to comment on software requirements. We were mindful of the trade-off between obtaining comprehensive answers from respondents and the time taken for them to complete the survey. With this in mind, the questions were structured as a mix of closed questions (using rating scales) and optional open-ended questions to provide further detailed information about the reasoning behind each rating. The Round 1 questionnaire is included as Appendix 1. We deployed the questionnaires using the Survey Monkey® system. Round 1 took place in late November 2018 through January of 2019. The Round 1 questionnaire took respondents an average of 36 minutes to complete.

For the second round, to occur in early 2019, the results will be fed back, including new suggestions and re-ratings, to try to reach a greater agreement. Data will be analyzed using SPSS® and a system that supports collaborative text content analysis, such as Dedoose®.

PRELIMINARY RESULTS OF ROUND 1

Characteristics of the Expert Panel Respondents

As of the end of January 2019, 33 of the invited and referred experts had responded to Round 1 of the Delphi study. The participants are diverse and well balanced among different types of background experiences, as shown below in Tables 1 and 2. A little less than half (16) are from the U.S., with 5 from Spain, two each from Germany and New Zealand, and one each from several other countries in Europe, Asia, the Middle East, and Canada.

Table 1. Work experience is in the domain of (check all that apply)

Software Design	NGO EM	Local gov't EM	State gov't EM	National gov't EM	Research
17	5	10	6	6	20

Note that participants could choose more than one domain. To further explore these work domains, we created mutually exclusive categories by first grouping participants as Practitioners if they were the EM for local, state, or National levels or an NGO. Then we coded as shown below:

Table 2. Work Experience Domains

	Frequency	Percent
Software Design only	2	6.1
Research only	6	18.2
Practitioner only	7	21.2
Software design and practitioner	4	12.1
Software design and research	7	21.2
Practitioner and research	3	9.1
Software design, practitioner and research	4	12.1
Total	33	100

In terms of relevant years of work experience related to social media use for EM, only 3 had 2 years or less; 10, 3-5 years; 12, 6-10 years; and 7, over 10 years. Given the recency of the emergence of this field of expertise, this is a very experienced set of experts. They are about 2/3 male, which reflects the gender makeup of the field.

Selected Preliminary Results

Systems to be Included

Many of the existing prototype systems for collecting, categorizing, and analyzing Social Media posts for disaster work with only one Social Media platform, most often Twitter or Facebook. The feasibility of creating systems for a single platform thus has been repeatedly demonstrated. However, it is not reasonable to expect EMs to use different software aids for different social media platforms and somehow integrate this information; 61% of the experts say it is not useful to have a system that uses only one SM platform. However, if the

software analysis system could handle both Facebook and Twitter, then the majority say it would be useful, as shown below:

Table 3. How useful to an EM would a system be that handles both Facebook and Twitter posts, but not other systems?

	Frequency	Percent
Not useful	0	-
2	1	3.0
3	3	9.1
4	2	6.1
5	4	12.1
6	9	27.3
Very useful	13	39.4
Cannot say	1	3.0
Total	33	100

Perceived as most useful would be a real-time system that handles all “major” SM platforms, customized for a particular country, as shown in Table 4.

Table 4. How useful would it be to have a real-time system that handles and integrates information from “all major” SM platforms customized for a particular country?

	Frequency	Percent
Not useful	0	-
2	0	-
3	0	-
4	1	3.03
5	4	12.12
6	4	12.12
Very useful	24	72.73
Cannot say	0	-
Total	33	100

What are these “major” platforms that should be included? They do vary by country of the respondent, but after Twitter and Facebook, mentioned by almost all, Instagram was checked by 21 out of the 33 participants, WhatsApp by 14, YouTube by 12, Flickr by 9, and several other platforms suggested by one to three.

Though this design requirement, to include all major SM platforms, is considered very important, the feasibility of doing so is questioned by many of the experts, as shown in Table 5. Thus, the panelists have identified in the first round, an important design challenge for the research community.

There were many comments from participants that highlighted the types of challenges posed, of which the following two quotes reflect frequent themes:

“There are several aspects to developing the SM platform that integrates multiple social platforms. One of the primary issues that I struggle with is the restrictions applied on the data – while Twitter is one of the best options, Facebook has a lot of content that is more promising – however, accessing FB is a massive struggle given the platform restrictions. Most often, creating public FB pages that many people ‘like’ and contribute to is one of the very few means of getting data but is highly restrictive, time consuming and potentially biased.”

“I think it would be incredibly useful to have a system that integrated multiple social media platforms, especially if it could be tailored to a local area. However, there are a lot of challenges. First, one has

to identify the most commonly used platforms (which is in flux). Second, there are many interoperability issues. Each social media platform has a different API, different types of data (and associations between those data), different privacy settings, different terms of services, and different ways of representing user data and messages.”

Table 5. How feasible is it to implement a real-time system that handles and integrates information from “all major” SM platforms customized for a particular country?

	Frequency	Percent
Not feasible	0	-
2	2	6.06
3	3	9.09
4	3	9.09
5	6	18.18
6	2	6.06
Very feasible	4	12.12
Cannot say	13	39.39
Total	33	99.99

In analyses of the completed research, we will also present results for the desirability and feasibility of many specific features or capabilities that could or should be included in the ideal SM analysis system for the future. These were rated on 1 to 7 semantic differential scales; the scales are from 1 (not useful/not feasible) to 7 (very useful/very feasible). In the preliminary and partial results shown below in Table 6, the means for some of the most highly rated design options are reported with the “cannot say” responses removed.

Table 6. Desirable and Additional Features – MEANS

	Mean	Std Dev
Usefulness of viewing SM data as classified by geographic location with map-based display	6.74	0.682
Usefulness of viewing SM data as generated by categories of users	6.68	0.599
Usefulness of filtering incoming SM data for relevancy using NLP and expert ratings	6.68	0.599
Usefulness of a system that can automatically process SM images to identify relevant ones	6.55	0.675
Usefulness of a system that could dynamically extract emerging/unanticipated types of information	6.53	0.681
Usefulness of a system that can automatically process SM images to identify whether or not an image shows damage	6.48	0.890
Usefulness of a system that can identify the location of SM posts even without GPS tagging	6.44	1.162
Usefulness of the ability to view SM data as categorized by sub events	6.42	0.958
Usefulness of having a way to automatically integrate SM data into any major IS system currently used by EMs	6.38	1.264
Usefulness of a system that can automatically process SM images to identify injured, trapped, or displaced people	6.32	0.871

There is a clear pattern that the usefulness of features is rated higher (over 5.5 for all listed, including several not included in Table 6) than the feasibility of developing or having the features (not shown). Statistical significance is not calculated but it appears that while there is enthusiasm for the features, there is less confidence that they can be implemented.

Future analyses will look at how ratings of usefulness and feasibility of the various potential software tools vary by the nature of the work experience/background of the participants (practitioners vs. technologists and U.S. vs. other nations).

CONCLUSION

In this paper, we share preliminary findings from a Delphi Study designed to understand how software can better support the SM needs of emergency managers. Already experts in the study have identified many useful and desirable features for managing SM, but it seems that at least some of these features may be difficult to develop. Completion of the Delphi study and more analysis is needed to fully understand the feasibility of developing these features. Additionally, several of the experts who volunteered for the study noted its potential for providing needed information to guide the future of software development for social media use in emergency management. For instance, one emergency manager said, “Thank you for your work. We rely on SM as a primary means of public information and warning. Any improvements would have significant social benefit for our rural communities.” Another Delphi participant exclaimed, “Excellent area of study! Much needed!” With the cooperation of the experts to complete the two rounds of the Delphi study, we hope to fulfill these expectations.

ACKNOWLEDGMENTS

Authors are listed in alphabetical order. We are grateful to all of the participants in this study, who gave generously of their time.

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APPENDIX 1

The Round 1 questionnaire consisted of 64 questions organized into eight sections focused on the themes of: consent (2 questions), participant emergency management experience (1), social media platforms (9), desirable features (2), additional features (14), other features (28), recommendations (3) and participant demographics (5). There were 39 mandatory and 25 optional questions with a mix of 28 free text responses, one check box for multiple responses, three check boxes that also included a free text “other” option and 32 radio buttons for a single response. A full copy of the questionnaire is available from the authors upon request.

The questionnaire begins with details of the co-investigators and references the principle institution conducting the research before asking for the participants name as shown below.

*** 1. Your name:**



Then an overview of the research and participant instructions are provided, as shown below, followed by a question to obtain explicit consent from the participant as shown in Figure 1 below.

PURPOSE:

The purpose of our project is to build a communications bridge between emergency responders for both governments and NGOs (non governmental organizations) working in Emergency Management and technologists and researchers who can provide the advances needed to realize SM's (social media) full potential. This will create a synergy that will lead to a set of software requirements to better enable EMs (emergency managers) to gather an organized set of information from SM postings that is rated for trustworthiness and usable for decision making.

DURATION:

My participation in this study will last for approximately 4 months (2 surveys several months apart), each requiring 1-2 hours to read background material and then answer thoroughly.

I have been told that my participation in this research is important for the success of the research and that the results of this research study are expected to produce the following benefits to society and for me as a subject.

BENEFITS FOR SOCIETY AND THE SUBJECT:

I have been told that the benefits are:

For society: recommendations and software requirements that will lead to more effective use of social media in crisis management, thus better protecting lives and property.

For you: opportunity to exchange information and ideas with peers about future needed software systems related to social media and emergency management.

PROCEDURES:

I have been told that, during the course of this study, the following will occur:

1. Potential participants will be asked to answer a short questionnaire indicating their interest and describing their relevant expertise.
2. From these applicants, a balanced panel of experts will be invited to participate in two rounds of online questionnaires (known as a “Delphi” design of a study, which consists of two or more rounds of structured written exchanges between anonymous experts with different types of expertise relevant for a topic.) Our topic is the desirability and feasibility of a number of software enhancements for managing social media input to emergency managers. Our 8 categories of experts include software developers, researchers, government emergency managers, and NGO emergency managers, from the U.S. and internationally.
3. Results of Round 1 will be fed back to participants, with Round 2 asking for re-ratings.
4. Participants will receive a draft report of findings prior to public release and invited to comment.

PARTICIPANTS:

I will be one of about 50 participants in this study.

EXCLUSIONS:

I will inform the researcher if any of the following apply to me:

1. You must be at least 18 years of age.
2. You must be fluent in written English.

RISKS/DISCOMFORTS:

I have been told that the study described above may involve the following risks and/ or discomforts:

As an online participant in this research, there is always the risk of intrusion by outside agents (i.e. hacking) and, therefore the possibility of being identified exists.

There also may be risks and discomforts that are not yet known.

I fully recognize that there are risks that I may be exposed to by volunteering in this study which are inherent in participating in any study; I understand that I am not covered by <redacted>'s insurance policy for any injury or loss I might sustain in the course of participating in the study.

CONFIDENTIALITY:

I understand that confidential is not the same as anonymous. Confidential means that my name will not be disclosed if there exists a documented linkage between my identity and my responses as recorded in the research records. Every effort will be made to maintain the confidentiality of my study records. If the findings from the study are published, I will not be identified by name. My identity will remain confidential unless disclosure is required by law.

Note 1: You will be assigned an ID based on this form; the file that matches the names and ID number will be kept separately and in a secure location; thus the data file that contains your answers will not be identifiable by name.

Note 2: If you agree, the final report on the study will list your name in a list of expert participants; if you do not explicitly agree, your name will not be included as a contributor to the research.

RIGHT TO REFUSE OR WITHDRAW:

I understand that my participation is voluntary and I may refuse to participate, or may discontinue my participation at any time with no adverse consequences. I also understand that the investigator has the right to withdraw me from the study at any time.

INDIVIDUAL TO CONTACT:

If I have any questions about my treatment or research procedures, I understand that I should contact the principal investigator at: <redacted>

If I have any additional questions about my rights as a research subject, I may contact: <redacted>

* 2. I have read this entire form, or it has been read to me, and I understand it completely. All of my questions regarding this form or this study have been answered to my complete satisfaction. By clicking on "Continue" I agree to participate in this research study. By clicking on "Do Not Continue" I do not agree to participate in this research study and the survey will exit.

☐ Continue

☐ Do Not Continue

Figure 1: The Consent question.

The figures below show a selection of questions from the survey instrument. The question in Figure 2 corresponds to the results shown in Tables 1 and 2 above. Note the asterisk (*) next to the question number (3 in this case) indicates that the question is mandatory. This is an example of a check box question where the participant can select multiple responses.

* 3. My work/experience is in the domain of (check all that apply)

- | | |
|---|--|
| <input type="checkbox"/> Software design with experience related to social media and/or emergency management systems. | <input type="checkbox"/> Emergency management for a government agency at the state or province level. |
| <input type="checkbox"/> Emergency management for an NGO (non-government organization). | <input type="checkbox"/> Emergency management for a government agency at the national level. |
| <input type="checkbox"/> Emergency management for a government agency at the local (city or county) level. | <input type="checkbox"/> Research on the topic of social media and emergency management Software Enhancements. |

Figure 2: Participant work/experience.

Figure 3 shows the first four questions in the social media section of the survey where each is a radio button allowing only a single response. This section is preceded by an introduction describing the purpose of the survey in terms of identifying software enhancements as follows:

Our overarching goal is to make social media more usable for emergency managers (EMs) to gather and assess information from the public, to aid in "situational awareness" and decision making. In the research literature, there are many systems described that take the form of gathering information from social media (SM) posts during a crisis and processing it by organizing it, displaying it, and/or assessing its validity, etc. The purpose of this study is to gather expert wisdom about the potential usability and feasibility of a number of such possible software enhancements, in order to arrive at a set of requirements to guide future developments. We begin in this round with your ratings of an initial set of possible improvements that are already specified in the current literature, and then ask you to add additional improvements you think will help EMs more effectively use SM. Please supply as many comments as you can in the text boxes, in terms of additional ideas or reasons for your ratings.

If you do not have experience with software engineering, you should check "cannot say" when estimating feasibility of a possible enhancement

One common issue that many EMs face is that they need different software solutions to process posts from different SM platforms. It is easier for software developers to have a software solution for one platform than for "any" and "all" systems. The purpose of this set of questions is to find out how important and feasible it is to process data from more than one platform.

* 4. Do you think it would be useful to have a system for EM that only uses one social media platform?

- ☐ Yes
☐ No

* 5. How useful to an EM would a system be that only deals with Facebook posts?

Not useful Very useful Cannot say

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

* 6. How useful to an EM would a system be that only deals with Twitter posts?

Not useful Very Useful Cannot say

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

* 7. How useful to an EM would a system be that handles both Facebook and Twitter posts, but not other systems, such as Instagram, Flickr, etc.?

Not useful Very useful Cannot say

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Figure 3: Example Social Media Platform questions.

Figure 4 shows the two “Desirable Features” questions while Figure 5 shows the first four questions from the “Additional Features” section. Questions 15 and 17 in Figure 5 show that some questions have multiple responses.

The ideas below for features to include in new systems are not mutually exclusive, nor complete. Note that space is provided in a comment box for your thoughts about additional features and functionality that you think would be helpful to EMs.

- * 13. During a crisis it would be _____ to have a way to automatically integrate SM data (e.g. Twitter feeds shown on a map) into any major information system currently used for information management by EMs, rather than running as a completely separate system.

	Not at all						Very	Cannot say
USEFUL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FEASIBLE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. (Optional) Please enter your thoughts about integrating output from SM data analysis into existing information systems.

Figure 4: Desirable Features questions.

- * 15. There are now research prototype systems that can use a combination of Natural Language Processing and expert ratings to filter incoming SM posts for relevancy to a disaster and to identify the major categories represented (e.g. injured or dead people reports, infrastructure damage reports) in the data and classify them in that way.

I think such a data classification system would be _____.

	Not at all						Very	Cannot say
USEFUL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FEASIBLE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. (Optional) Please enter your thoughts about filtering data and classifying it.

- * 17. During a crisis, the ability to view social media data as generated by categories of users (such as NGOs, local government representatives, local residents/beneficiaries, public eyewitnesses in the affected areas, etc.) would be seen as _____.

	Not at all						Very	Cannot say
USEFUL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FEASIBLE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. (Optional) Please enter your thoughts about the ability to view SM data as generated by different categories of users.

Figure 5: Example Additional Features questions.

Figure 6 shows the first four questions from the “Other Features” section.

- * 29. If a system for trustworthiness could prioritize posts by criteria that an organization sets (customizable), organizations would feel _____ trust in using SM posts to pull data.

Less A great deal more Cannot say

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

30. (Optional) Please enter your thoughts about the effect of prioritizing posts by a customizable set of criteria on trust in using SM posts to pull data.

- * 31. How feasible is a system that is customizable this way?

Not feasible Very feasible Cannot say

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

32. (Optional) Please enter your thoughts about the feasibility of a system that prioritizes posts by customizable criteria.

Figure 6: Example Other Features questions.

Figure 7 shows the three “Your Recommendations” questions and Figure 8 the participant demographics questions.

In the text boxes below please describe any other feature/functionality that future systems should aim to have. If you do not think there are any, or that use of social media in general would not be useful, please discuss that as well.

Note that only entering text in the first comment box is required. The other comment boxes are provided for you to (optionally) enter additional thoughts.

- * 57. Suggestion 1

58. (Optional) Suggestion 2

59. (Optional) Other suggestions

Figure 7: The three Your Recommendations questions.

* 60. I have been working, in some capacity, on projects or tasks related to social media for emergency management for:

☐ Less than 1 year

☐ 6 to 10 years

☐ 1 to 2 years

☐ more than 10 years

☐ 3 to 5 years

* 61. My age is:

☐ under 30

☐ 30 to 49

☐ 50 or over

* 62. I identify as:

☐ male

☐ female

☐ other

* 63. The primary country in which I am currently working is _____.

64. (Optional) Additional feedback: Please add any comments or issues, especially those that you think should be dealt with in round 2 of the Delphi.

Figure 8: Demographic questions.