Scientific Letter

Social Media in Emergency Management Capability Maturity Measurement

Background

In April 2013, Defence Research and Development Canada (DRDC) Centre for Security Science (CSS) initiated a project on Social Media in Emergency Management (SMEM) in order to address an awareness and expertise gap that exists within the Canadian emergency management community in the domain of social media and online collaboration [1,2]. One of the outputs of the project was a maturity model that summarizes the main elements and characteristics necessary to build an increasingly mature SMEM capability [3].

This letter explains how the SMEM maturity model was developed into an assessment tool and used to perform a measurement of SMEM maturity during the 2016 Canada-US Enhanced Resiliency Experiment, known as CAUSE IV [4]. The measurement was performed at the request of the CAUSE IV experiment design team comprised of both US and Canadian stakeholders. The results presented in this letter are limited to the portions of the CAUSE IV experiment that focused on the use of digital volunteers to leverage social media data.

Methodology

The model which is shown in Annex A describes SMEM maturity along four principal dimensions of People, Governance, Technology, and Implementation. Each dimension takes on changing characteristics as an organization implements and optimizes each of the essential elements. For example, the people dimension not only deepens but also broadens—to include, for example, collaboration with digital volunteers—with increasingly deliberate and mature application of SMEM. The model's horizontal axis should be viewed as a continuum with any incremental level of capability possible along a sliding scale from 'basic' to 'advanced'. Each dimension's essential elements, if addressed, will help to achieve the four maturity outcomes of (1) networked and resilient community; (2) trusted partnerships and collaboration; (3) accessible data and effective tools; and (4) trained and accredited stakeholders. More details about the model and how it was developed can be found in Ref. [3].

The model can be used by emergency management (EM) organizations as the basis for assessing the level of maturity of their SMEM capabilities. In order to deploy the model as an assessment tool for the CAUSE IV experiment, indicators of maturity associated with each of the essential elements were developed. For each essential element, nine indicators were created, three associated with

each level of maturity, from 'basic' to 'advanced'. As such, a total of 108 indicators were developed and they are presented in Annex B along with a mapping to the model.

Prior to the CAUSE IV experiment, a baseline measurement of maturity of the participating organizations was conducted by way of interviews with US and Canadian officials who are responsible for SMEM in their respective jurisdictions. The interview package which was shared with the respondents prior to the interviews is included in Annex C. The experiment participants and digital volunteers then received training on the use of social media in emergency management before the experiment was conducted. After the experiment took place, follow-up interviews were conducted to capture perceptions of what if any changes have been brought on by the organization's participation in the experiment.

Results and Discussion

(a)
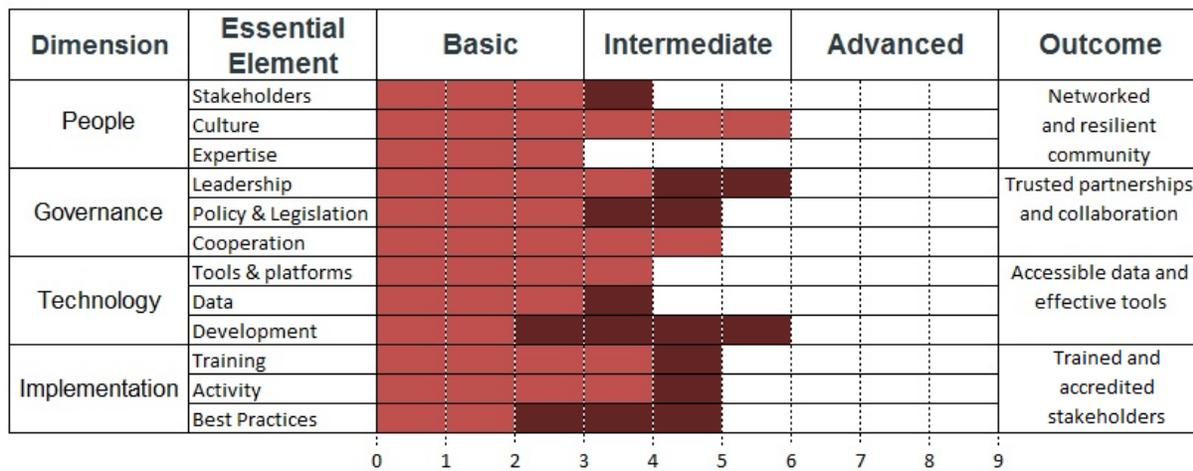
(b)
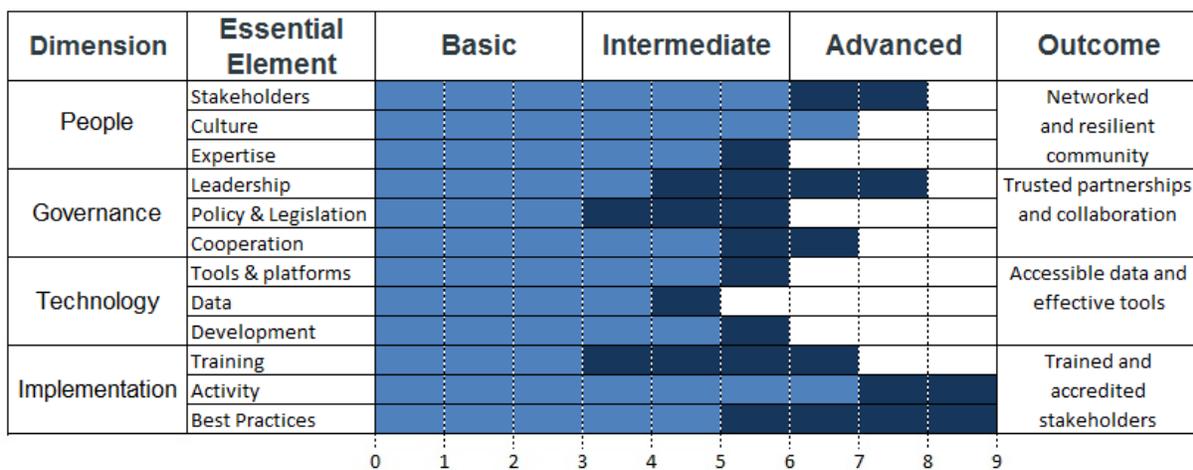
Figure 1: Results of SMEM maturity assessment for (a) Canada; and (b) the US. Light regions show pre-experiment measurements and dark regions include post-experiment measurements. The bottom linear scale represents SMEM maturity (arbitrary units).

Figure 1 presents results pertaining to the state of maturity of SMEM capabilities within EM organizations participating in the CAUSE IV experiment, based on answers provided during pre- and post- experiment interviews by Canadian (a) as well as US respondents (b). Table 1 shows the average capability maturity rating for the Canadian and US organizations participating in the interviews, in arbitrary units, on a scale from 0 to 9, along with the change in the average rating from pre- to post-experiment.

The assessment results indicate that both the Canadian and the US organizations have improved the maturity level of their SMEM capabilities for at least one key element in each dimension after the training received and after participating in the experiment.

On the Canadian side, each of the four principal dimensions had at least one component that placed, even pre-experiment, beyond a 'Basic' maturity level, along the 'Intermediate' part of the scale. The 'Culture' element in the 'People' dimension was the farthest along the maturity scale, placing at the top of the Intermediate level. The least mature elements were 'Development' (in the 'Technology' dimension) and 'Best Practices' (in the 'Implementation' dimension). Notably, these two elements have shown the most improvement post-experiment. At least some improvement can also be observed for 'Stakeholder' engagement, 'Leadership' attitude and acceptance of SMEM, 'Data', 'Training', 'Activity', and 'Policy and legislation', while the remaining elements showed no change.

The US organizations started out with more advanced SMEM capability levels before the CAUSE IV experiment. This finding holds across all four principal dimensions: 'People', 'Governance', 'Technology', and 'Implementation'. Post-experiment, the level of capability maturity has increased for every essential element except for 'Culture'. The finding that no change has been observed for this particular element is not unexpected, since it scored along the 'Advanced' part of the maturity scale even pre-experiment, and organizational culture change always takes time. The level of capability improvement observed for the US EM organizations through their participation in CAUSE IV is quite significant, and it speaks to the degree of commitment, participation, and enthusiasm on the part of the US participants at all levels—from volunteers to Emergency Operations Center Staff as well as leadership.

The finding that improvement was observed on both sides of the border in post-experiment measurements compared to pre-experiment ratings demonstrates the benefits of participating in events such as CAUSE IV, which presented opportunities for training, testing, evaluation, as well as developing engagement strategies with stakeholders in a risk-free experimental environment.

Table 1: Average SMEM maturity rating.

Participant Country	Pre-experiment	Post-Experiment	Delta (Post – Pre)
Canada	3.6	4.8	1.2
United States	4.9	7.0	2.1

Conclusion

The experimental findings described in this letter demonstrate how an assessment tool developed based on the SMEM maturity model [3] was used to measure the level of maturity of SMEM capabilities in Canadian and US emergency management organizations who participated in CAUSE IV. The results presented in Figure 1 and Table 1 show advances in

maturity levels on both sides of the border, with an especially marked improvement on the US side, which had the lead in developing the digital volunteer and social media component of the experiment. The findings speak to the fact that emergency management officials are becoming more comfortable with and more convinced of the benefits of using digital volunteers and integrating social media data to enrich the operational picture during the early warning, response, and early recovery phases of an emergency. Experiments such as CAUSE IV facilitate this higher level of comfort by providing the means to test and observe the value of deploying SMEM capabilities in a risk-free experimental setup, as well as facilitating learning and further improvement before deploying such capabilities in real-life emergencies.
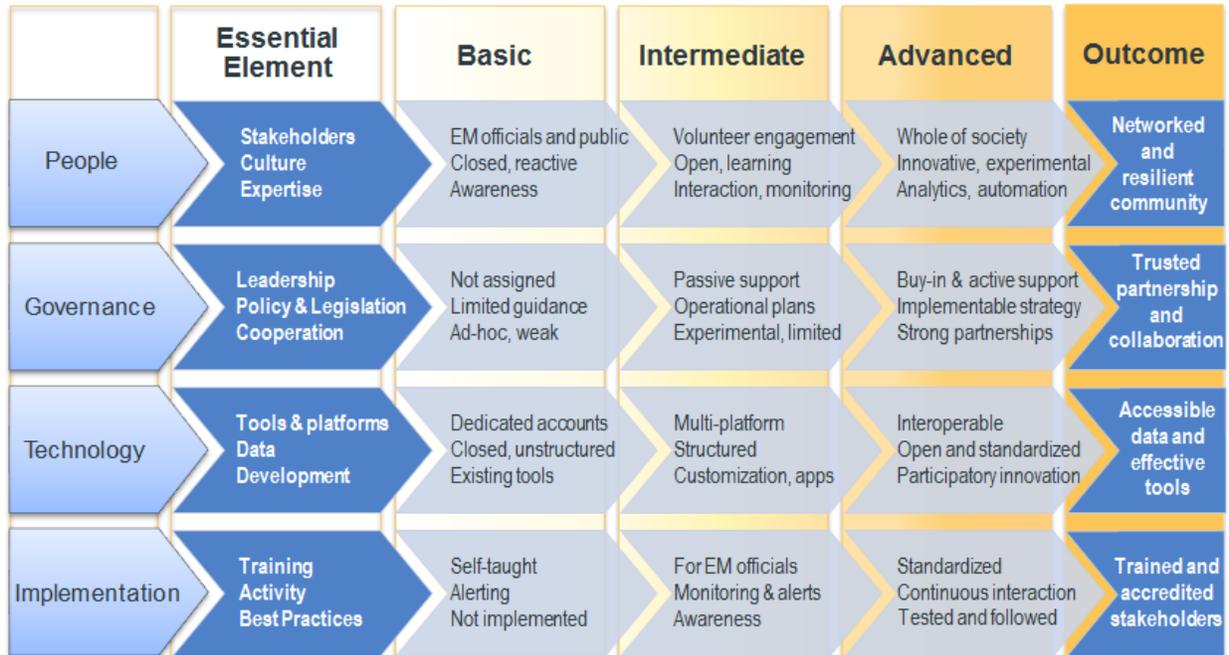
Prepared by: Kate Kaminska (Office of Chief of Staff(S&T)) and Simona Verga (DRDC – Centre for Security Science).

References

[1] K. Kaminska and P. Dawe, Social Media for Emergency Management Roadmap, DRDC-RDDC-2015-B002 to DG and Executive of DRDC CSS, 31 March 2015.

[2] K. Kaminska, P. Dawe and B. Rutten, Social Media for Emergency Management Expert Roundtable Workshop: Summary of Findings, DRDC CSS TN 2013-046, 2013.

[3] K. Kaminska and B. Rutten, Social Media in Emergency Management: Capability Assessment, DRDC-RDDC-2014-R16, 2014.

[4] D. Cotter, D. Gusty, M. Caplan, J. Booth, J. Thomas, S. Estes Cohen, E. Endrulat, M. Amoabeng, P. Dawe, K. Kaminska, J. Pagotto, K. Forbes and D. O'Donnell, Canada–US Enhanced Resiliency Experiment Series "CAUSE III": Northeastern Experiment After Action Report, US Department of Homeland Security, Science and Technology Directorate, First Responders Group, DRDC-RDDC-2015-N096, 1 June 2015.

Annex A   SMEM Maturity Model

	Essential Element	Basic	Intermediate	Advanced	Outcome
People	Stakeholders Culture Expertise	EM officials and public Closed, reactive Awareness	Volunteer engagement Open, learning Interaction, monitoring	Whole of society Innovative, experimental Analytics, automation	Networked and resilient community
Governance	Leadership Policy & Legislation Cooperation	Not assigned Limited guidance Ad-hoc, weak	Passive support Operational plans Experimental, limited	Buy-in & active support Implementable strategy Strong partnerships	Trusted partnership and collaboration
Technology	Tools & platforms Data Development	Dedicated accounts Closed, unstructured Existing tools	Multi-platform Structured Customization, apps	Interoperable Open and standardized Participatory innovation	Accessible data and effective tools
Implementation	Training Activity Best Practices	Self-taught Alerting Not implemented	For EM officials Monitoring & alerts Awareness	Standardized Continuous interaction Tested and followed	Trained and accredited stakeholders

Annex B   Maturity Indicators

Dimension	Essential Element	Basic			Intermediate			Advanced			Outcome
People	Stakeholders	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	Networked and resilient community
	Culture	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	
	Expertise	PE1	PE2	PE3	PE4	PE5	PE6	PE7	PE8	PE9	
Governance	Leadership	GL1	GL2	GL3	GL4	GL5	GL6	GL7	GL8	GL9	Trusted partnerships and collaboration
	Policy & Legislation	GP1	GP2	GP3	GP4	GP5	GP6	GP7	GP8	GP9	
	Cooperation	GC1	GC2	GC3	GC4	GC5	GC6	GC7	GC8	GC9	
Technology	Tools & platforms	TT1	TT2	TT3	TT4	TT5	TT6	TT7	TT8	TT9	Accessible data and effective tools
	Data	TD1	TD2	TD3	TD4	TD5	TD6	TD7	TD8	TD9	
	Development	TE1	TE2	TE3	TE4	TE5	TE6	TE7	TE8	TE9	
Implementation	Training	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	Deliberate use and development
	Activity	IA1	IA2	IA3	IA4	IA5	IA6	IA7	IA8	IA9	
	Best Practices	IB1	IB2	IB3	IB4	IB5	IB6	IB7	IB8	IB9	

Note: In the model each indicator is given an equal weight of 1 on a linear maturity scale (arbitrary units).

Stakeholders

PS1	Leadership is aware of social media, but wants the messaging controlled to avoid risks.
PS2	EM managers see social media as a unidirectional means of feeding carefully vetted information out to the public.
PS3	Public seeks information on emergencies from social media but not necessarily from official channels.
PS4	Volunteer organizations engaged with citizens on SM, but not necessarily linked into official organizations.
PS5	Volunteer organizations act as the conduit for inserting SM channels into response/recovery.
PS6	Public active in amplifying official messaging via SM.
PS7	EM organizations see SM as an important channel to exchange information across the whole of the EM spectrum (prevention/preparedness/response/recovery).
PS8	Volunteer organizations linked into official systems processes, and working with members of the public as trusted partners and potential capacity enhancers.
PS9	The public is fully engaged in EM activities on SM, ensuring the volume and accuracy of related information and responding to calls to be prepared, or to help when needed.

Culture

PC1	Culture is risk adverse, concerns about reputation management, rumours, and miss-information may overshadow usefulness of SM.
PC2	SM seen as a tactical tool, strategic aspect is not necessarily fully understood/appreciated.

PC3	Information held close, attitude is reactive to SM trends.
PC4	Organization culture is more open to exploring/understanding full potential of SM for EM.
PC5	EM organizations open to learning about operational and technical aspects of SM.
PC6	EM organizations open to learning about how to leverage SM to complement more traditional channels.
PC7	Organizations open to proactive engagement with multiple SM actors in a whole-of-community approach.
PC8	Willingness to experiment with more advanced analytics to glean more in-depth intelligence.
PC9	Openness to making decisions based on evidence generated by applying advanced tools and innovative approaches to process SM information.

Expertise	
PE1	Limited expertise among staff with SM use, mostly acquired through personal use.
PE2	Some staff has awareness of basic capabilities to explore SM data, limited experience with applying them.
PE3	Analysts involved in SM engagement/analytics "on the side of their decks," while doing other day jobs, rather than having specific /SMEM positions.
PE4	Organizations have dedicated staff for SM monitoring.
PE5	Organizations employ junior analysts with basic level of expertise in SM analytics.
PE6	Staff formally assigned to interact with actors on popular SM platforms.
PE7	Staff includes experienced analysts versed in applying advanced analytics.
PE8	Organizational knowledge about automation and integration of SM monitoring.
PE9	Organizational knowledge about automation and integration of SM analytical processes.

Leadership	
GL1	While social media is used in operations, it may not be clear who has ultimate responsibility (e.g. Public Information Officer [PIO] vs intelligence, ops, etc.)
GL2	Senior leadership of the organization is aware of social media use.
GL3	Reliance on staff who may have acquired social media experience elsewhere or for different purpose (typically students or communications staff).
GL4	There is support from management cadre and/or senior leadership for the organization using social media and/or digital volunteers.
GL5	The place for social media function within the incident management system is clear (e.g. PIO).
GL6	It is clear who has ultimate authority over social media (this may be with or without associated dedicated resources).
GL7	Management and senior leadership is actively involved in supporting the use of social

	media and digital volunteers.
GL8	Dedicated resources are made available for tools, training, implementation, continuous learning, etc. in the SMEM domain.
GL9	Senior management participates in SMEM-related training and fulfills the role of champion through 'leading by example'.
Policy and Legislation	
GP1	While no formal guidance may be in place for use of social media, there is awareness of policy and legislative requirements from other domains (e.g. privacy).
GP2	Reliance on policy and guidance that do not explicitly cover social media or digital volunteers (e.g. general policies on information use, sharing, etc.)
GP3	Social media guidance documents (frameworks, conops, and plans) used may be from other jurisdictions.
GP4	Organization specific social media and/or digital volunteer policies and plans developed and implemented.
GP5	Concept of operations for digital volunteers is understood and policies are in place to support it.
GP6	Requirements for social media data verification are documented and practices to ensure veracity of information are implemented.
GP7	Policies and guidelines followed and clearly linked to higher level (e.g. provincial/state/national) policy and legislation on privacy, data management and protection, cyber security.
GP8	Plans related to social media and digital volunteers are exercised, validated and regularly updated recognizing the fast evolving nature of the domain.
GP9	Policies include considerations for language, accessibility and other community specific requirements.
Cooperation	
GC1	The public is viewed as a client rather than potential partner.
GC2	Engaging non-traditional stakeholders (e.g. the voluntary sector) is not encouraged or practiced only on an ad-hoc basis.
GC3	While there may be awareness of digital volunteers, ways of engaging them are not clear or formalized.
GC4	The emergency management organization has engaged with/ interacted with digital volunteers (not necessarily in an emergency situation).
GC5	There is a dedicated liaison among the emergency management organization staff for interaction with the voluntary sector (which may include digital volunteers).
GC6	Digital volunteer representatives are embedded (in-person or virtually) in the emergency operation center during disaster response.
GC7	Nontraditional stakeholders (including digital volunteers) are regularly approached to

	participate in joint training, preparedness campaigns, and outreach.
GC8	There are formal agreements (e.g. MOUs) in place for engaging with digital volunteers.
GC9	There is regular contact (pre, during, and post disaster) and information sharing with non-traditional stakeholder communities (including digital volunteers).

Tools and Platforms

TT1	Uses at least one social media channel/account for emergency management purposes.
TT2	Has considered the demographic of target population and which social channel (Twitter, Facebook, and Instagram) may be most appropriate to use for maximal reach (targeted vs convenience).
TT3	Access to social account(s) is controlled and assigned to specific role(s) under the incident command structure (ICS).
TT4	Uses multiple social channels for emergency management purposes and/or a monitoring platform (e.g. Tweetdeck, Topsy, etc.).
TT5	Takes advantage of geo-location technology to display and interpret social data.
TT6	Uses some form of automated analytics to sift through and interpret social data.
TT7	Uses common operating picture (COP) technology and/or integrates multiple social data sources in a single dashboard view within the emergency operations centre (EOC) environment.
TT8	Social media alerts are integrated with other public alerting systems such that alerts are automatically deployed via multiple channels.
TT9	Social information is seamlessly/automatically integrated with more traditional data sources (e.g. dispatch information and city available information such as road closures, etc.) for sense making and decision support.

Data

TD1	Data generated from social media is used in passive (e.g. observational) mode.
TD2	Social data remains in the native platform (i.e. Twitter, Facebook) during emergency operations.
TD3	There is awareness of social data during emergency response, but it is not necessarily considered alongside more traditional data sources (e.g. dispatch, media) for situational awareness.
TD4	Some form of archiving of social data is implemented (e.g. Storify).
TD5	Social data is used for situational awareness and decision support.
TD6	Social data is captured and stored in a structured format to enable analysis and searchability.
TD7	Open data standards are implemented to the extent possible.
TD8	Social information is organized, linked, searchable, easily retrievable and machine readable (e.g. data gathered during recovery can be accessed and referenced).

TD9	Data standards are known and implemented (e.g. NIMS).

	Development
TE1	Reliance on commercially available (and/or free) tools.
TE2	Social data available but separate from systems deployed in operations (e.g. alerting, or common operating picture systems).
TE3	Operational requirements for social media not explicit.
TE4	Information products generated by digital volunteers are exploited.
TE5	Custom tools and/or apps are developed for public and/or emergency management use.
TE6	Data and information fusion is enabled by tools.
TE7	Citizens' contributions/crowdsourcing is exploited for tool development (e.g. hackathons are held).
TE8	New tools are evaluated and incorporated into operations as appropriate on an on-going basis recognizing the fast evolving nature of social media tools (e.g. Periscope, Snapchat, and Kik).
TE9	Innovative, open source applications, including open data, are developed and implemented.

	Training
IT1	Use of social media and associated tools is self-taught.
IT2	Tools deployed are influenced by the expertise of the individual assigned to them.
IT3	Word of mouth and community of practice/interest feedback are factors in tools deployment and exploitation.
IT4	Training on social media and related tools is available for emergency management officials.
IT5	Deliberate training on social media is implemented for person(s) assigned to social media related duties.
IT6	Participation in communities of practice/interest for emergency management officials is encouraged (e.g. #smemchat).
IT7	Standardized training on social media is available (e.g. via FRG training seminar series) and mandatory for employees engaging with social media related duties.
IT8	Social media and/or digital volunteers are integrated into exercises.
IT9	Integrated, standardized training for emergency management officials (including senior decision makers) and digital volunteers (e.g. VOST) is available and implemented.

	Activity
IA1	Social media is used primarily for pushing information to the public (e.g. alerting).
IA2	Social media is most used primarily in one phase of emergency management (e.g. primarily for preparedness or primarily during response).

IA3	There is a dedicated resource (on a part time or full time basis) to social media.
IA4	Social monitoring/listening is implemented.
IA5	Social media is used for pushing (e.g. alerting) and pulling (e.g. monitoring for threats to human life) information.
IA6	Social media is considered in all phases of emergency management (prevention/mitigation, preparedness, response, recovery).
IA7	Social media is used for pushing (e.g. alerting), pulling (e.g. monitoring for threats to human life) information as well as engagement with the public (two-way conversational use).
IA8	Community (social media) influencers are identified and leveraged (for message amplification etc.).
IA9	Social media is monitored 24/7.
Best Practices	
IB1	Social media practices tend to be ad-hoc and not necessarily based on established practices.
IB2	There may be awareness of what other emergency management organizations are doing in the digital space, but practices are not necessarily sought out or validated.
IB3	After action reviews are performed but may not include review of social media components.
IB4	There is awareness of best practices and resources in SMEM.
IB5	Best practices for social media use and engaging with digital volunteers are sought out.
IB6	Emergency management officials are engaged in communities of practice/interest in SMEM (e.g. #smemchat).
IB7	Social media and digital volunteer engagement is considered in considered in post-incident analysis.
IB8	A continuous learning environment is fostered by encouraging participation in practitioner conferences, training exercises and forward deployment opportunities related to SMEM.
IB9	Best practices are created, documented and shared within the emergency management and digital volunteer communities.

Annex C   SMEM Capability Interview Questionnaire

Interview Objective

The purpose of this interview is to determine the current capabilities and uses of social media in the organizations participating in the CAUSE IV experiment. The pre-experiment interview questions will aim to determine a baseline measurement for the maturity of social media capabilities in the participating organizations. A follow-up interview will be scheduled post-experiment to capture what if any changes have been brought on by the organization's participation in the experiment.

Your Participation

You have been identified as a relevant and important stakeholder. Your perspective and input are essential.

Time Commitment

We estimate the interview will take approximately one hour. Thank you very much for your time!

Confidentiality

- The information gathered via this process will be used for purposes of analysis and future consultation.

- Results that identify you, and others, by name will be kept within the team administering this study.

- For reporting purposes no individuals or organizations will be identified and information will be reported in aggregate form.

- Any sensitive and/or classified information will be handled accordingly.

- The use and publication of information pertaining to any individual partners within this study will require the prior approval and review by said partner.

Questions?

If you have questions or concerns about the nature of this study, please contact

Simona Verga, Defence Scientist at DRDC Centre for Security Science, at
Simona.Verga@drdc-rddc.gc.ca.

Q1: Query on **Stakeholders**

When it comes to SMEM, who are the stakeholders and what is their level of comfort? How consistent are the different stakeholders in their view of SM, and how collaborative?

Q2: Query on **Culture**

How would you describe the perception of the value added by SM, and what are some of the predominant attitudes with regards to mainstreaming SM into EM?

Q3: Query on **Expertise**

What is the current level of expertise with using and exploiting SM for EM in your organization? (Follow up: Are there processes in place, or planned in the near future, to professionalize/institutionalize SM expertise within EM professionals?)

Q4: Query on **Leadership**

Who has the lead on social media within your organization (both during regular operations and in an emergency situation)? (Follow up: How does senior leadership within your organization view social media?)

Q5: Query on Policy and Legislation

Can you tell me about the policies (including plans) and legislation (if applicable) related to social media and digital volunteers that are used within your organization?

Q6: Query on **Cooperation**

How does your organization engage with what may be viewed as non-traditional stakeholders (e.g. digital volunteers)? (Follow up: Are those relationships ongoing and/or formalized in any way?)

Q7: Query on **Tools and Platforms**

Can you tell me about the social media channels and related technologies that your organization uses? (Follow up: How are those tools integrated within the EOC environment and other technologies you may be using?)

Q8: Query on **Data**

Can you tell me about how your organization currently exploits social media data? (Follow up: Is your organization implementing open data formats and standards?)

Q9: Query on **Development**

Has your organization worked with developers to implement any custom tools or apps? (Follow up: Do any of the tools integrate multiple data sources?)

Q10: Query on **Training**

Can you tell me about training related to social media and digital volunteers within your organization?

Q11: Query on **Activity**

Can you describe how social media is used within your organization before, during and after emergencies?

Q12: Query on **Best Practices**

Are you aware of best practices around the use of social media and digital volunteers and if so can you tell me if and how they are implemented within your organization?