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# Leveraging social media and digital volunteers for building cross-border disaster resilience: lessons from the Canada-US enhanced resilience experiments

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**ABSTRACT:** Defence Research and Development Canada's Centre for Security Science (DRDC CSS) partnered with the US Department of Homeland Security (DHS) Science and Technology Directorate (S&T) in the development of a series of experiments designed to test how social media-aided collaboration can improve disaster response and recovery. The experiments demonstrated that integration of non-traditional resources, including crowd-sourced information, open technologies, and digital volunteers can augment traditional disaster management practice. This paper describes the experiments and their role in enabling enhanced situational awareness and cross-border disaster resilience.

*Keywords:* social media, digital volunteers, humanitarian technology

## 1. INTRODUCTION

In our networked world, public dialogue about crises increasingly occurs on social media. According to statistics from 2012, over two-thirds of all Canadians are active on social media (Statistics Canada, 2013) and their level of activity spikes during times of crisis (Kaminska and Rutten, 2014). People turn to online social networks to find and validate information, connect with family and friends, look for advice, and in some cases to find ways to be actively involved. They want to communicate with officials, volunteer organizations, or those who are seen as the best crisis information resources. Social media offers disaster management organizations the opportunity to connect with the public, improve situational awareness, and to reach people quickly with alerts, warnings and preparedness messages (Kaminska and Rutten, 2014). However, its ever increasing popularity can also lead to 'information overload' which can prevent disaster management organizations from leveraging social media information effectively. This limitation can be overcome through collaboration with 'digital volunteers'— tech-savvy volunteers, who are leading the way in crisis-mapping and crowdsourcing of disaster information. Since the 2010 earthquake in Haiti, their involvement has become an integral part of the international community's response to major disasters (Meier, 2015).

### 1.1 DRDC SMEM research

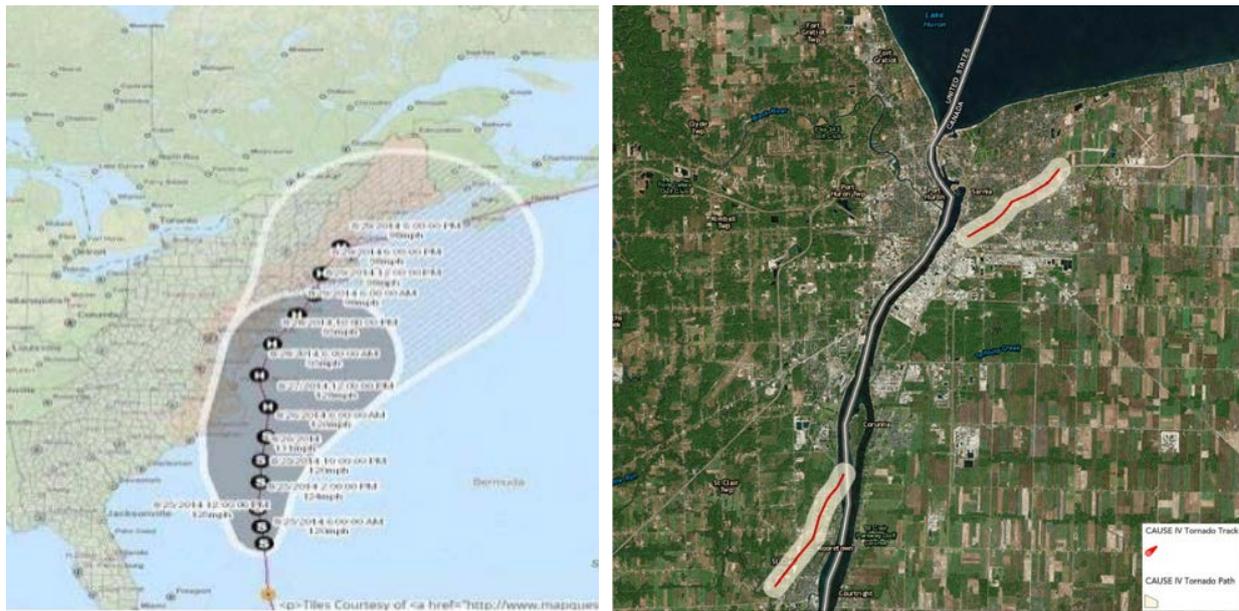
In 2013, DRDC CSS initiated a project on the use of social media in emergency management (SMEM) in order to address an awareness and expertise gap that was found to exist within the Canadian disaster management community in the domain of social media and online collaboration (Kaminska and Rutten, 2014). As part of the project, DRDC CSS held a "SMEM Expert Roundtable" that brought together subject matter experts from amongst emergency management (EM) officials, first responders, digital volunteers and non-governmental organizations (NGOs) (Kaminska, Dawe and Rutten, 2013). The workshop gave participants the opportunity to connect and bring forward critical issues, such as the unfulfilled potential of digital volunteers in bridging disaster response capability and capacity gaps. The event also revealed the need for a SMEM-focused exercise or experiment involving support provided by volunteers in order to assess and demonstrate the value of social media-aided cooperation between the volunteers, disaster management officials, first responders and NGOs for better response and recovery outcomes. This led to the development of the SMEM components of the Canada-US enhanced resilience experiments, known as 'CAUSE'.

### 1.2 The CAUSE experiments

At almost 9,000 kilometers long, the Canada-US border is the longest in the world, with many adjacent communities along the way. Since disasters do not respect international borders, the CAUSE series of experiments was initiated to build bi-national resilience to cross-border emergencies through communications interoperability and to connect, test and demonstrate emerging operational capabilities between the two countries (Cotter et al., 2015). The CAUSE series began in 2011 as a collaborative effort between DRDC CSS, Public Safety Canada and DHS S&T, in partnership with various federal, provincial, state, local and non-governmental organizations. Since 2011, there have been four CAUSE experiments, each focused on a disaster scenario taking place in different communities along border. The CAUSE III experiment, which took place in Nova Scotia (Canada), Main and New Hampshire (US), was the first of the CAUSE series to consider social media and digital volunteers as an emerging operational capability which can support building cross-border resilience (Cotter et al., 2015 and Kaminska et al, 2015). CAUSE IV took place in Ontario (Canada) and Michigan (US) and built upon the findings of CAUSE III to further mature this capability.

## 2. EXPERIMENT METHODOLOGY AND DISCUSSION

The overarching objective of the SMEM components of CAUSE III and CAUSE IV was to develop a cross-border operational capability incorporating social media and digital volunteers. Lower tier experimental objectives were developed with input from experiment stakeholders, including representatives from the lead participating organizations, and provided a basis for scenario development. The scenario for the CAUSE III experiment took place during the recovery phase following a Category 3 Hurricane impacting Maine, New Hampshire and Nova Scotia (Cotter et al., 2015 and Kaminska et al, 2015), whereas the CAUSE IV scenario involved response to an EF-4 tornado touching down in Michigan before continuing over to Ontario (see Figure 1). Both scenarios included a high volume of simulated social media traffic and digital volunteers were called upon to provide ‘surge capacity’ to assist disaster management agencies with sifting through social media for information that may be pertinent to response and recovery operations. As the experiment unfolded social media injects were used to prompt participant action and drive experiment play. Participants were expected to respond to the evolving conditions by using the available tools to coordinate actions and resources and to carry out disaster management strategies in real-time.



(a) Fictitious Hurricane track in CAUSE III scenario.

(b) Fictitious Tornado track in CAUSE IV scenario.

Fig. 1: Illustration of disaster scenarios in CAUSE III and CAUSE IV experiments.

### 2.1 Experiment versus exercise

Our research has shown that Canada’s EM community has not yet fully embraced social media, and collaboration with digital volunteers is an emerging requirement (Kaminska and Rutten, 2014). NGOs, such as the Canadian Red Cross, are more experienced with engaging digital volunteer groups, but the processes of engagement are largely ad-hoc and not formalized. Furthermore, there is little existing formal guidance, in terms of documented procedures or policies on engagement between these different SMEM stakeholder groups. Exercise, as traditionally understood in the EM context, implies that one is testing existing plans and procedures, whereas in this case draft concepts of operation had to be created and tested through experimentation (Duncan, 2015). Therefore “experiment” rather than “exercise” is a more fitting description for the CAUSE activities. Furthermore, many of the tools used in the experiment are not yet deployed in operations and CAUSE provides a forum for participants to test and experiment with emerging concepts.

### 2.2 Experimenting with social media

Consultations with subject matter experts have indicated that the live-use of social media tools in disaster-scenario based exercises is unadvisable, because of the potential of creating public panic if the information posted openly online gets misconstrued and amplified. As such an important requirement of the CAUSE experiments was a realistic simulation to replicate the core functionality of popular social media tools. In CAUSE III, a closed, web-based experiment portal simulating social media applications like Facebook, Twitter and YouTube was used to deliver a high volume of pre-generated injects to prompt participant reactions and enable participants to interact with one another in a risk-free environment. In CAUSE IV, closed and password protected Twitter accounts and Facebook groups were created for the purpose of the experiment. The digital volunteers were asked to analyze the social media data and to provide operationally-relevant reports based on the social media activity.

### 2.3 Evaluation and measurement

Monitoring and evaluation of the experiment followed a data collection and evaluation strategy. In one measurement, metrics developed for the experiment were derived from the SMEM maturity model developed by Kaminska and Rutten (2014) and shown in Figure 2. The model 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. 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.

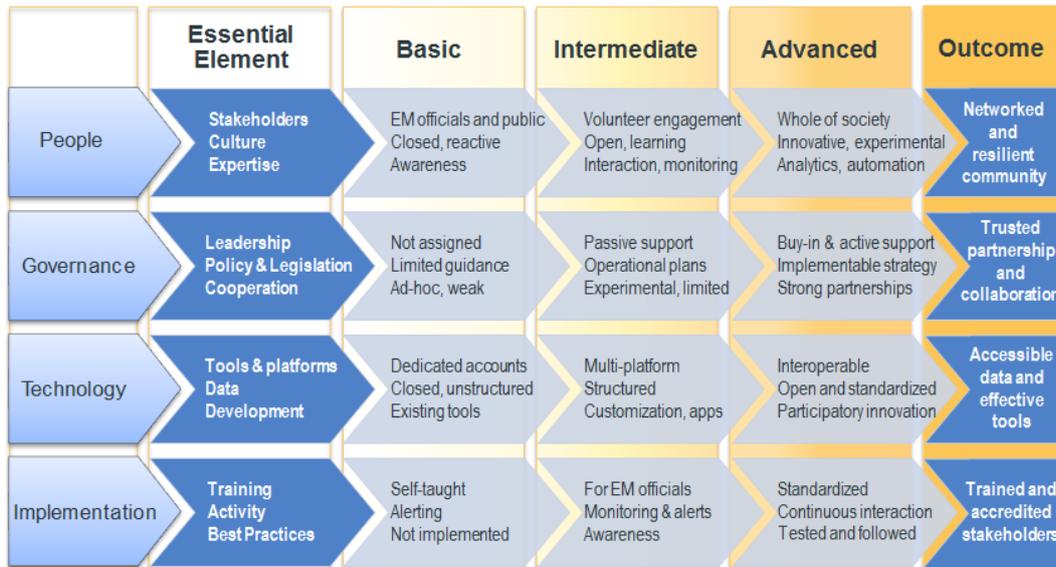


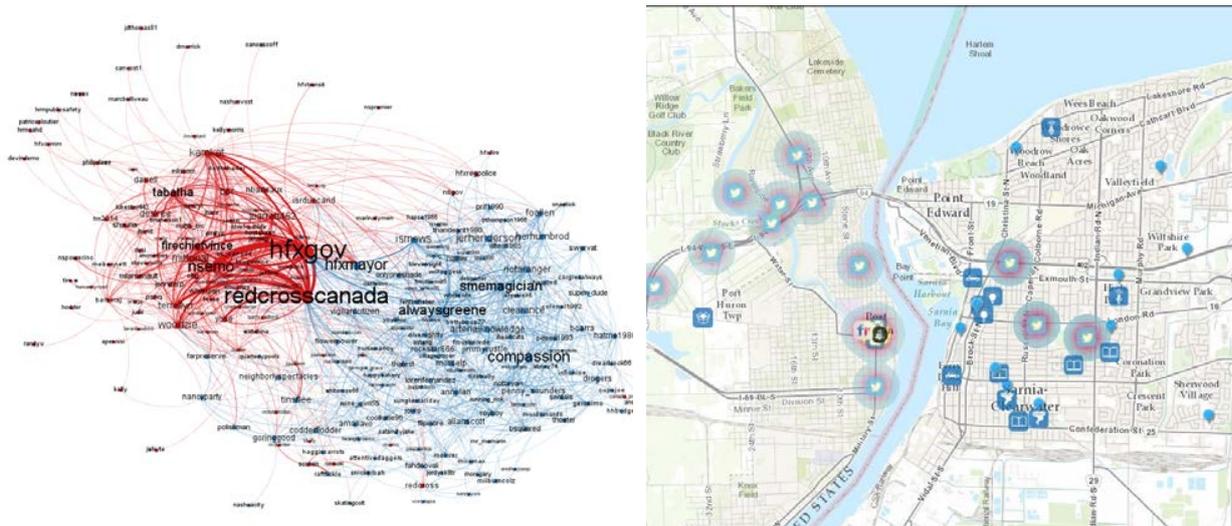
Fig. 2: The SMEM Maturity Model.

### 3. RESULTS

Our research has shown that, given its benefits, the use of social media for crisis management is required to enhance and optimize EM capabilities (Kaminska and Rutten, 2014). It plays a critical role in public information, situational awareness, and increasingly in community engagement and empowerment (Cameron et al., 2012, Sajuria et al., 2015, Simon, Goldberg and Adini, 2015). Through the CAUSE experiments we were able to demonstrate, in a measurable way, that social media-aided collaboration between digital volunteers and disaster management officials, along with deliberate engagement with the public through the use of social media, can improve response and recovery operations (Cotter et al., 2015 and Kaminska et al, 2015). The experiments allowed participants to learn about social media practices and opportunities, refine operational processes, and identify barriers. It demonstrated that digital volunteers are a valuable resource for providing ‘surge capacity’ to extract situational awareness from social media. However, the experiment also identified the need for disaster management organizations to develop internal capacity and capability to exploit the potential of social media by listening to, influencing, and engaging the public as resources and partners in disaster management. Detailed results from CAUSE III experiment are described by Cotter et al. (2015) and Kaminska et al. (2015) and the results from CAUSE IV are expected to be released in bi-national report at the end of 2016. Figure 3 provides a snapshot of experimental results.

### 4. ADDED VALUE FOR INTEGRATIVE RISK MANAGEMENT AND URBAN RESILIENCE

The Sendai Framework for Disaster Risk Reduction adopted by hundreds of countries, including Canada, explicitly highlights the use of social media and the involvement of non-state stakeholders, including civil society, volunteers, and community based organizations, as enabling the four priorities for action (UNISDR, 2015). Furthermore, the UNISDR Science and Technology Conference held in January 2016 underscored the importance of harnessing technology and methods such as crowdsourcing for improving risk assessment, enabling the collection of data, and reaching people quickly with alerts, warnings and preparedness messages (Fowler, 2016). Through the CAUSE experiments, Canada, together with its US partners, has been leveraging the opportunities of social media and collaboration with digital volunteers for building disaster resilience thus directly supporting the priorities for action outlined in the Sendai Framework.



(a) Social network graph of data collected from Twitter simulator in CAUSE III. (b) Map application used in CAUSE IV to allow geographical display of digital volunteer reports.

Fig. 2: Sample of data analysis and results from the CAUSE experiments.

## 5. OUTCOMES AND CONCLUSIONS

As outlined in the Communications Interoperability Strategy for Canada, in the event of a large-scale, complex disaster, no single agency at any level of government would have the required capacity and expertise to act unilaterally (Public Safety Canada, 2011). Responding to such incidents requires multi-jurisdictional and potentially cross-border coordination predicated upon effective communications and trusted relationships. In that respect the CAUSE series of experiments serves to build cross-border relationships, capacity and capability to respond to and recover from large-scale disasters. The experiments allow Canadian and US participants to experiment with emerging concepts of exploiting social media and plan for mutual aid support and shared situational awareness.

Increasingly, social media and related technologies are considered essential in disaster management to serve not only as crisis communication tools, but also as valuable sources of crisis information and means of connecting and engaging with disaster survivors. Leveraging digital volunteers in disaster response and recovery presents a valuable emerging capability for enhanced situational awareness. The CAUSE experiments enhance resilience in the border region by aiding participants in developing disaster management plans and processes to improve shared situational awareness for first responders, emergency managers, and the public.

## 6. REFERENCES

- Cameron, M.A.; Power, R.; Robinson, B.; Yin, J.; (2012). Emergency situation awareness from Twitter for crisis management. *Proceedings of the 21st international conference companion on World Wide Web*, pp. 695-698.
- Cotter, D.; Gusty, D.; Caplan, M.; Booth, J.; Thomas, J.; Estes Cohen, S.; Endrulat, E.; Amoabeng, M.; Dawe, P.; Kaminska, K.; Pagotto, J.; Forbes, K. (2015). *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.
- Duncan, D. (2015). *Digital Volunteer-Supported Emergency Management Concept of Operations*. Defence Research and Development Canada – Contract Report, DRDC-RDDC-2015-C265.
- Fowler, J. (2016). *Scientists pledge Sendai action*. UNISRD News Archive, 29 January 2016.
- Kaminska, K.; Dawe, P.; Rutten, B. (2013). *Social Media for Emergency Management Expert Roundtable Workshop: Summary of Findings*. Defence Research and Development Canada – Technical Note, DRDC-CSS-TN-2013-046.
- Kaminska, K.; Rutten, B. (2014). *Social media in emergency management: capability assessment*. Defence Research and Development Canada – Scientific Report, DRDC-RDDC-2014-R16.
- Kaminska, K.; Dawe, P.; Forbes, K.; Duncan, D.; Becking, I.; Rutten, B.; O'Donnell, D. (2015). *Digital Volunteer Supported Recovery Operations Experiment*. Defence Research and Development Canada – Scientific Report, DRDC-RDDC-2014-R16.
- Kryvasheyev, Y.; Chen, H.; Obradovich, N.; Moro, E.; Van Hentenryck, P.; Fowler, J.; Cebrian, M. (2016). Rapid assessment of disaster damage using social media activity, *Science Advances*, 2, e1500779.
- Meier, P. (2015). *Digital Humanitarians: How Big Data Is Changing the Face of Humanitarian Response*. CRC Press, Boca Raton, FL.
- Public Safety Canada (2011). *Communications Interoperability Strategy for Canada*. Public Safety Canada.

Sajuria, J.; vanHeerde-Hudson, J.; Hudson, D; Dasandi, N.; Theocharis, Y. (2015) Tweeting Alone? An Analysis of Bridging and Bonding Social Capital in Online Networks. *American Politics Research* ,43, pp. 708-738.

Simon, T.; Goldberg, A.; Adini, B. (2015). Socializing in emergencies—A review of the use of social media in emergency situations. *International Journal of Information Management*, 35, pp. 609–619.

Statistics Canada (2013). *Individual Internet use and e-commerce 2012*, The Daily, Statistics Canada.

UNISDR (2015). *Sendai Framework for Disaster Risk Reduction 2015-2030*. United Nations Office for Disaster Risk Reduction.

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