Social Media in Crisis Events

Open Networks and Collaboration supporting Disaster Response and Recovery

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***Abstract* — Large-scale crises challenge the ability of public safety and security organisations to respond efficient and effectively. Meanwhile, citizens' adoption of mobile technology and rich social media services is dramatically changing the way crisis responses develop. Empowered by new communication media (smartphones, text messaging, internet-based applications and social media), citizens are the *in situ* first sensors. However, this entire social media arena is unchartered territory to most public safety and security organisations.**

In this paper, we analyse crisis events to draw narratives on social media relevance and describe how public safety and security organisations are increasingly aware of social media's added value proposition in times of crisis. A set of critical success indicators to address the process of adopting social media is identified, so that social media information is rapidly transformed into actionable intelligence, thus enhancing the effectiveness of public safety and security organisations - saving time, money and lives.

Keywords-component; Social Media; Online Communications; Disaster Response; Security; Collaboration; Citizen.

I. INTRODUCTION

Broadband world is the term the International Telecommunication Union used in its May 2012 Report on Trends in Telecommunication Reform to address the growing adoption of mobile technology and social media across the Globe [1]. **Social media** refers to *"online technologies and practices to share content, opinions and information, promote discussion and build relationships. Social media services and tools involve a combination of technology, telecommunications and social interaction.*" [2] and, accordingly to Kaplan and Haenlein, there are six different types of social media: collaborative projects (e.g. Wikipedia), blogs and microblogs (e.g. Twitter), content communities (e.g. Youtube), social networking sites (e.g. Facebook), virtual game worlds (e.g. World of Warcraft) and virtual social worlds (e.g. Second Life). Applied technologies include blogs, picture sharing, vlogs, wall-postings, email, instant messaging, music sharing, crowdsourcing and voice over IP [3].

Today, social media play an important role in disaster and crisis events with significant national security implications, enabling citizens' involvement through the provision, seeking and brokering of information, connecting those within and outside the event's geographical space, with implications for both the informal and the formal response effort. In this context, often characterised by underdeveloped and degraded operational environments, public safety and security organisations are required to deal with the new trend of a digitally enabled social arena in disasters and crises. Social media indeed qualify as changing the rules of the game, forging a loudly silent transformation from a need-to-know to a need-to-share principle and from a command and control to a *connect and collaborate* paradigm[1].

This paper explores how the adoption of social media increasingly facilitate those tasks in crises, when connecting and collaboration are essential and public support a must.

II. DIGITAL AGE LESSONS IN UNDERDEVELOPED AND DEGRADED OPERATIONAL ENVIRONMENTS

Social media are ubiquitous, dramatically changing geopolitics, economic contexts and business competitiveness. They are also increasingly present in disaster and crisis response efforts. Several case studies of social media use in natural disasters, terrorist events and social upheavals demonstrate the growing presence of social media in these scenarios and the challenges it poses for disaster and crisis management systems, plans, processes and organisations [4]. The analyses of those case studies reveal that, in emergencies and crisis, amidst the collapse of all critical infrastructure, communications withstand extreme damage or destruction. Landline phone networks are unavailable or intermittently available, with the surviving stations of 112 or 911 emergency

[1] "Connect and collaborate" is a term used by Thomas L. Friedman in "The World Is Flat" (2005).

services rapidly becoming overwhelmed by the incoming volume of calls, as occurred in the 9/11 terrorist attacks [5], the Madrid train bombings [6] and the London tube explosions [7]. A different case was registered in Norway, where 112 operators dismissed all calls unrelated to the Oslo bombings, although they actually were reporting the shooting at Utøya, proving that the failure of official emergency systems is not only determined by technology [8]. Fibre-optic connectivity and mobile telephone networks are severely affected but, in most of the crisis studied, they exhibit a more resilient performance, especially concerning the capacity to establish SMS and text messaging communication [9]. Overall, the scarcity of communications' access hampers information availability and, consequently, disasters and crises' situational awareness and response efforts, in what was fairly evident both in the 2004 Indian Ocean Tsunami and the 2010 Haiti Earthquake.

In fact, ICT have proven their worth in providing both public protection and disaster relief (PPDR) organisations and the public the scarcest resource in crisis situations: **information**. In a society that has grown accustomed to immediacy and instantaneity, ICT and their strong real-time emphasis are fundamental to gather and deliver information, not only in terms of alert and emergency notifications but also respecting the attainment of the most complete situational awareness picture. And yet the large majority of official PPDR channels do not include online social media, instead choosing to practice a unidirectional information dissemination model towards the public, that is often scarce in availability, details and empathy and usually resorts to the traditional TV and radio broadcasts – in the Norwegian massacre and the Californian Wildfires, those media have been heavily criticised for being prone to sensationalism and irresponsive to the local communities' real needs [10] [11]. As a remarkable exception, the 2013 Boston Marathon bombing highlighted growing citizens' participation in the response effort, with the authorities enlisting the public's assistance to provide information and identify the suspects, namely using online and mobile technologies [12].

Notwithstanding, communicating with the public has proven to always be a challenge for PPDRs, a difficulty further highlighted in the 2005 London Tube attacks, for the United Kingdom's Data Protection Act prohibits sharing personal data without the consent of those concerned, thus limiting what information officials could give agencies and families on the identity and status of victims [13]. Indeed, disasters and crises often question the balance between individual privacy and public security.

As a result of the repetitive lack of official information, and because it is rare the high-levels of preparedness of some societies, such as the Chilean people[2], citizens choose the rich contents provided through mobile and online social media technologies, requesting assistance, looking for information and trying to locate missing relatives and friends. This is why, over the long span of the Chinese SARS outbreak crisis, 120 million text messages were exchanged [15] and, immediately after the 2010 Great Japan Earthquake, Twitter became the emergency service with 1200 tweets per minute [16] or even why Mission 4636 [3] received 1000 SMSs per day [17]. Moreover, the growing global phenomenon of citizens' journalism through the online social media has been instrumental in providing eye-witness accounts and first reports from the affected areas, thus contributing to the enhancement of the general public's situational awareness in crisis situations and search and rescue actions – it was so in natural catastrophes like the 2004 Indian Ocean Tsunami, the 2005 Hurricane Katrina and the 2010 Haiti Earthquake, but also in the US, London, Madrid and Boston terrorist attacks. Still, one might understand the use of social media in the 2013 London terrorist incident as two suspects killed a serving soldier and encouraged passers to take pictures and record his words, using social media as a propaganda tool. Also volunteering across the Globe and the use of ICT tools have prompted citizens' initiatives like the South East Asia Earthquake and Tsunami Blog[4], the *Digitales por Chile*[5] or the Ushahidi platform[6] to became useful sources of information on the crisis' evolving situation, the relief assistance and the tracking of missing persons.

Notwithstanding the benefits of Facebook, Twitter, flickr, YouTube, instant messaging, SMS, MMS and emails, it is also relevant to bear in mind its misuses and abuses. Not only they are extremely efficient instruments for defamation, slander, rumour and misguidance, but also social networking platforms have proven to serve as tools of change, in the 2011 Middle East and the 2013 Turkish upheavals to organise political and social protests and in the 2011 UK riots to coordinate looting activities. Today, there is an ongoing debate whether these tools should be further monitored or controlled, a matter that the Chinese government promptly resolved during the 2003 SARS Epidemic, when it used Operation Golden Shield to prevent public unrest [18].

III. CONDITIONS NECESSARY FOR CONNECT AND COLLABORATE SUCCESS

Ranging from natural disasters to terrorist activities and to social turmoil, the above-mentioned crisis events are well-documented accounts of the current state-of-the-art in the use and impact of social media technology in disaster and crisis situations and associated response efforts throughout the World. As we study these illustrative examples, the significant influence social media are exerting on traditional response systems and models in degraded environments becomes evident. Social media presence is prompting those systems to

[2] The high level of knowledge about earthquakes and tsunamis of the Chilean citizens have determined their adequate response to the 2010 Great Chilean earthquake and tsunami [14].

[3] "4636" was the number of the free aid SMS service established in Haiti.

[4] Built by more than fifty worldwide contributors, this blog aggregated news and included a tracker for missing persons' reports and humanitarian efforts concerning the 2004 Indian Ocean Tsunami.

[5] *Digitales por Chile* is a 300-volunteer organisation that, in just 12 hours, created the www.chileayuda.com portal, with disaster-related information, including Twitter, Facebook, Ushahidi and Google's Person Finder, multi-layered geo-referenced mapping, official communications and donations. The information was constantly updated on rescue centres, medical assistance and police warnings.

[6] http://ushahidi.com

adopt need-to-share principles and *connect and collaborate* approaches.

It is useful to identify the conditions that must be in place to enable and encourage the successful use of social media technology as a privileged instrument for connecting and collaborating, for improving traditional disaster and crisis response systems and models so that they involve citizens and inter-agency participation and, ultimately, contribute to enhanced situational awareness and effectiveness.

The Network Enabled Capability tenets [19] have proven to be robust over time and across social media applications. A network connection is an absolute requirement, allowing the sharing of information and enabling the community to improve the content of the information, by correcting errors, exchanging alternative views and perceptions, and (often) identifying the sources of information, enabling others to judge motive and intent. Information sharing also allows collaboration or discussion of what the information means, as well as improving awareness and empowering the development of a shared situational awareness. Given shared situational awareness, participants in social media have yet another opportunity to collaborate in discussing what may and should be done, both individually and as a social group. This appears to allow them to act in concert. The cases reviewed illustrate that these actions, whether supporting PPDRs, first responders or relief workers or deciding when and where to carry out protests, impact the ability of a group to achieve its desired goals.

The flat and open nature of social media is one of the authorities' major concerns as they lose information control and fear potential negative consequences, including the further endangerment of citizens' safety. Information, being it correct, incorrect or in form of rumours, affect the public's behaviour and perception of the situation. Therefore, actions such as FEMA's rumour control policies (albeit the label rumour management would be better suited) and FDNY's monitoring of social media to detect and correct misinformation are of paramount importance [20].

However, social media are not a panacea. Because they essentially occur in the information, cognitive and social domains, they have limits in the physical domain, for network reach may be affected due to damages or disruption in communications infrastructure and systems, thus delaying or impeding information sharing. Hence, based on the case studies' analysis, we identify the following conditions for success: **Interoperability**, **Reach**, **Richness**, **Quality of Interaction**, **Trust** and **Privacy Data Protection**.

INTEROPERABILITY

Effective social media require technical, semantic and social interoperability. Technical interoperability refers to the simple ability of the devices in use to connect directly. For example, a mobile phone can *Tweet* if it has Internet access and accesses the Twitter webpage. Semantic interoperability refers to the ability to understand the message received. In Haiti, pleas for help in the Kreyol language were not understood by the English or French-speaking responders and volunteers and required translation. Groups of volunteers emerged to process translations and expedite rescue services. Social interoperability means a willingness to exchange information and work together. In Egypt, blogs proved to be linkages that cut across the political and religious divides that prevented recognition of common interests and the potential for mutually supporting actions.

REACH

The Information Age, characterised by the ubiquity of the Internet and online technologies, resulted in always-connected individuals with active consumer/producer behaviours. The May 2012 *Latest Social Media Statistics* [21] clearly state the overwhelming numbers that corroborate the growing trend on the adoption and use of social media platforms.

In developed societies, where there is heavy internet penetration and broad access to smartphones, social media provide citizens and organisations important services in situations of disaster or crisis. These services accommodate warning broadcast, alert services and coordination of operations to generate essential information when traditional communications systems fail, as proven by the Japanese Earthquake case study. Even in developing countries, there are significant social media dynamics, as observed in the Haiti Earthquake and the Indian Ocean Tsunami case studies (*ad hoc* communications networks were rapidly deployed to enable local connectivity and assist rescue operations), but also in Turkey and Middle East countries (social media platforms enabled social mobilisation and active informed citizenship).

Reach, however, does not mean that media are always readily available. Capacity may be limited by failures, system overload or deliberate prioritisation and restrictions by authorities or service providers. Limits can also arise from risk assessments. The Madrid bombing decision to shut down cell phone services fearing they might be used to trigger explosive devices is an example, as is the initial refusal of the Norwegian emergency call centre operators to put through emergency calls from the island because the downtown bombing was perceived

TABLE I. THE LATEST SOCIAL MEDIA STATISTICS

Twitter	Facebook	Google+	YouTube	Mobile
500 Million accounts 40+ Billion tweets 175 Million tweets a day 11 new topics (*hashtag*) created every second	850+ million members 31% check in once a day Avg of 20 min per day 2.7 billion likes per day 100 billion connections 20 million apps installed daily 250 million photos daily 425 million access via mobile	90+ million users g+ button is served 5 billion times a day g+ users: 44% of users are single 29% female / 71% male 20% are students Average of 6 minutes on site	4 billion videos viewed every day - 1 trillion in 2011 24 hours of video uploaded, every 24 secs 2.9 billion hours a month on the site, 326,294 years 800 million users per month Auto speech recognition translates video and captions in 43 languages	5.9 Billion subscribers 8 Trillion SMS messages sent in 2011 11+ Billion apps downloaded, 1 in 4 never used again The number of mobile searches quadrupled in the last year 8.49% of global web site hits come from mobile

as the crucial event. Albeit the Internet and communications sectors have successfully achieved interoperability across disparate devices, technologies and location, more conservative sectors (e.g., PPDR communities) are still limited by non-interoperable, proprietary technologies and/or stringent security requirements. In many of the case studies, the private sector and open source communities provided key platforms to assist response efforts in underdeveloped and degraded operational environments: Haiti's DigiCel provided a free SMS service to anyone with a mobile phone (a fee would have restricted participation and negatively impact reach) and Ushahidi's information was used by US deployed forces.

RICHNESS

Richness (the quality of content) is also a pertinent condition for success. The evolution of social media from text and chat to voice, imagery and video has made a big difference in social media utility and impact. Services have become routinised in responding to disasters – people finders, photo posting and digital mapping updated with the most recent information all emerged as a consequence of improving technology and creative use of emerging capabilities. The power of social media has expanded as its users learn to create memes – verbal and visual images that take on a life of their own and come to epitomise a social group, cause or pattern of action. Improved richness is attained as new social media tools (Facebook, Twitter, YouTube, Flickr) become more and more popular and enhance their own potential impact. The selection of which communication channel is best often depends on the actual situation. In circumstances where connectivity is sparse or unreliable, or where making sounds is unadvised, basic text messaging may be the best, most effective choice[7]: it was the choice for Haitians trapped in rubble and for the youngsters in the Utøya island that wanted to alert relatives and authorities but did not want to give away their hiding place. Another issue is to know how to best get your message across to the audience. Different cultural backgrounds influence how citizens understand messages and deal with their content. Institutional messages are often disregarded: the email sent to students by the Virgina Tech management on the shootings day was not seen by all students and most of the students who read it did not grasp its urgency.

QUALITY OF INTERACTION

The quality of interaction in social media has also grown over time. Texts and voice chat remain vital, but the improved dialogue empowered by online *fora* and blogs allow rich bi-directional participation by interested citizens across the globe. Today, it is relatively trivial to set up near real-time one-to-one, one-to-many and many-to-many online communications and collaboration platforms, allowing the formation of highly focused *communities of interest*, exchanging *rich* content in the *right* format with very high *signal-to-noise* ratio. As a result, participants are engaged in high quality interactions, retrieving a real added value that encourages them to explore further these new online information avenues.

[7] SMS requires less infrastructure capacity than a voice call and can be processed asynchronously. Therefore, SMS are effective communication means even in conditions of great demand.

TRUST

Perhaps the most crucial condition required for the success of social media in supporting disaster response and recovery, trust is also among the most subtle and difficult to attain. In order for individuals and groups to act in concert, they must trust the information they receive, the source(s) of that information and the integrity of the medium through which they have obtained it. Even the willingness to participate in online social media communities and networks requires trust that the act of participation will not be punished or misused, either from peers or from authorities tracking the activity.

Trust in social media and the information it contains is one of the major contributors to differences in perception and participation across generations. Some participants prefer to use pseudonyms rather than their true identities, both to avoid exposure to those who might disagree with them or, in some cases, to hide from the authorities either because their activities are criminal or because they fear censorship or punishment. Tools and techniques to *anonymise* activities have become commonplace and can render locating the origin of a post difficult and impractical for all but the most skilled technicians.

However, in case after case, the record is clear that large numbers of citizens have chosen to participate in activities mobilised and coordinated through social media platforms whether because they seek to belong, or because they value the opportunity to have a voice and be heard, or even because they appreciate the auto-corrective misinformation mechanisms that social media provide. Adopters of social networking are a growing worldwide community and organisations are increasingly aware that social media are adequate platforms to know rumours and correct them, as did FDNY during the NY Sandy Hurricane.

PRIVACY DATA PROTECTION

Since its inception, cyberspace remains a relatively unregulated space with respect to data protection and privacy rights - a situation only exacerbated by its global reach and the corresponding lack of certainty as to relevant applicable legal frameworks. The Internet, and social media in particular, are no exceptions. Many of the issues involve the handling and mining of personal information, illicit uses of private data, the perception of unaccountability, the unauthorised disclosure of data to third parties and data ownership rights. These concerns are the main factors obstructing the adoption of social media as part of governmental official tools to disseminate and exchange information with citizens in disasters and crises. In Western European countries, laws on personal data sharing are quite stringent: as observed in the London case study, agencies and families were not informed of victims' identities and statuses since, in the absence of the consent of those concerned, such data dissemination is prohibited by the UK's Data Protection Act.

Citizens have tended to ignore or accept the risks involved in the exposure of their personal information through social media for, in crisis situations, such platforms offer tools addressing their problems (e.g. Google CrisisResponse includes a PeopleFinder database in which anyone can register missing persons and access existing records), apparently with

little concern for the UK's Data Protection Act or similar legal instruments. Nonetheless, recent legal disputes have arisen regarding the *right to be forgotten* or the right to rectify and erase one's own information online. The importance of this right – as well as the challenge of respecting it in crisis situations – has been emphasised by the EC Vice-President and Commissioner for Justice and Fundamental Rights, Viviane Reding [22]. In crisis situations, the balance between the greater public good and the respect for individual liberty, dignity and autonomy is open for discussion. Data protection legislation is evolving, with social media users demanding more transparency from social media providers regarding how their data is handled, stored and shared, and who retains ownership of, and responsibility for it. The legal and ethical implications of posting and sharing information online as well as the potential for the misuse of various online tools, including geolocation applications, techniques of information parsing and data mining, and the protection of civil rights and freedoms are fundamental issues to be debated as digital citizenship is increasingly fostered.

IV. CONCLUSIONS

The relevance of social media influence in the security context is acknowledged by nations and their institutions. This new, challenging arena poses significant questions and hurdles to public safety and security organisations, often characterised for the difficulty in handling decentralised, open and bi-directional flows of information. The US already presents a fielded emergency response system, whereas Europe is now starting to build a common crisis and emergency system, but both approaches highlight the strong emphasis and interest in adopting and using social media to the benefit of disaster and crises response efforts.

Case studies involving natural disasters, terrorist activities and political-social upheavals account for the current state-of-the-art in the use and impact of social media in emergency and crisis situations and their associated response efforts throughout the World. They corroborate the profound influence of social media in society, forcing traditional organisations to adapt to an Information Age reality. That reality includes an informed, active and digitally empowered audience demanding authorities to present enhanced network-enabled *connection and collaboration* capabilities, able to handle freedom of expression, source anonymity, decentralised flows of information, sharing of information and shared situation awareness, all of which enhance effectiveness, especially in crisis environments.

Specific success conditions have to be in place in order to enable and encourage the use of social media to improve disaster response models by involving citizens. Aware of the power and flexibility of social media, governments and citizens explore this new world and present their adoption mechanisms to the *Connect and Collaborate* paradigm.

Our effort in this paper to better understand the relevance, influence and role of social media in security-related events in disaster and crisis scenarios enables the emergence of particularly important conclusions:

- Social media have become ubiquitous in a wide variety of important security-related situations, including but not limited to disaster warning and response, social upheavals and responses to terrorist activity. Their impact is only limited by the reach of social media technology (when and where they are available) and the creativity of involved citizens and organisations.
- Over time, government institutions, international organisations and non-governmental organisations (NGOs) have become aware of and comfortable with the use of social media, framed in a relatively informal way to inform, conduct rumour management, develop situational awareness and collaborate in coordinated activities, from evacuations to volunteering. Increasingly, governments use social media as an integral part of crisis management operations, including prevention, preparation, response and recovery phases. Robert Ottenhoff, president and CEO of the Centre for Disaster Philanthropy, observed that since Hurricane Katrina social media has gotten better at alerting more people how to prepare for a storm of Sandy's magnitude [23].
- Social media providers, including major players such as Google, broadband providers like Digicel, and those controlling rich social media like Facebook and Twitter, have proven to be willing partners in security-related situations, pushing information and providing platforms for the coordination of information. Social media *intermodality* facilitates this sharing.
- As a consequence of the shared experience of governments, international organisations, NGOs, media and individuals, open source platforms have created and adopted templates and processes to generate rapid, flexible common responses as crisis situations evolve.
- Social media are tools, not panacea. They can be used for good, evil or mixed motives. However, in the reviewed case studies, they often proved to be an important reinforcement to community response. Social media utility and value have been enhanced as their reach, richness and quality of interaction have grown.
- Trust underlies all successful social media activity – trust in the information, in the information channel and in the source of the information. Efforts to earn and maintain trust are crucial to on-going success. Social media users are alert to the use of social media for misinformation and have been able to mount corrective campaigns.
- Data privacy aspects are still a concern in cyberspace, and social media in particular, for its international nature remains outside of country-specific legal framework.
- Information sharing is a trigger activity, enabling improved information quality, creating shared situational awareness, valuing collaboration and promoting a better disaster and crisis response.

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