Disaster 2.0

Emergency Management Agencies use and adoption of Web 2.0

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Disaster 2.0: Emergency Management Agencies use and adoption of Web 2.0

The Disaster 2.0 Project team

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Introduction

1.1 Introduction to the Disaster 2.0 Project

Government organisations, emergency managers and the public have used Web 2.0 applications (especially Twitter, Facebook, Ushahidi, but also others) in response to recent disasters such as the earthquakes in Haiti and Japan, the Brisbane floods in Australia, and Typhoon Haiyan. The objective of Disaster 2.0 is to establish how EU countries can use these Web 2.0 applications during emergencies, determine how successful these Web 2.0 platforms have been in enabling resilience in the public, and in mitigating damage to Critical Infrastructure (CI). The project also investigates to what extent Emergency Management Agencies (EMAs) have adopted these technologies to date and what problems have arisen in using them.

In July 2013, the Spanish (EMAs) were faced with a major catastrophic event when a high-speed train derailed in Santiago. The accident meant loss of lives, many injured people, an impact on critical infrastructure (CI) and a disruption to the everyday life of the local community. Other effects included economic disruption and damage to the image of the Spanish public services. Several EMAs, both governmental and non-governmental, participated in the emergency response. While writing this report, much of the information about this particular disaster is unclear and confused. Mainstream media coverage has been limited and slow (Tortosa, 2013), but several hypotheses regarding the causes of the incident have spread over Social Media (SM). There are also complaints about the biased news coverage on mainstream media, in particular that the state-owned RTVE is offering. The Facebook profile of the train driver, although deleted soon after the accident, was published on Facebook and Twitter. A YouTube video of the derailing was also published. Although the video was deleted quickly, The Guardian's online coverage of the catastrophe[1] still showed it on its front page for a while. Fake pictures, thousands of 'retweets' (RT) asking for blood dona-

[1] `http://www.guardian.co.uk/world/2013/jul/25/santiago-train-crash-spain-mourning`

tions, thousands more stating that no more blood is needed, people searching for their relatives and asking for help with the search — are just a few examples of the rush of SM activity immediately after the incident.

Spanish Civil Protection, Police Forces, Fire Fighters, Emergency Health Services, NGOs (such as Red Cross, local, regional and national authorities and other EMAs) were all online sharing information about the tragedy, as well as Virtual Operations Support Teams working online to counteract hoaxes and rumours, as well as supporting the EMAs.

When a disaster strikes, every minute counts. This is also true of information management. In order to save lives, quick, coordinated and preplanned response is critical, even more so as disasters are on the rise due to climate change, population growth, urbanisation, increased industrial activity and greater mobility of people and goods. The decisions involved and the methods required to adopt Web 2.0 technologies in disaster management, without increasing the uncertainty inherent in an emergency situation, are complex. Effective adoption and usage of Web 2.0 technology in disaster management is not a straightforward matter. Careless use of SM can increase the uncertainty in already challenging situations. When a disaster occurs, people need to be informed of : a) what they need to do; b) how they can check on their relatives; c) which roads and telecommunications they can use; where the shelters are; what information is reliable. This is just a small list of types of information communities need to have when a disaster, crisis or emergency strikes.

Since their rise in popularity Web 2.0 technologies and SM have worked as communication channels supporting information and communication activities during disasters. In recent years, the use of Web 2.0 technology during several overwhelming disasters have provided valuable lessons on how people and organisations can make the most of these new communication channels. The Disaster 2.0 project (D2.0) has analysed some of these examples, aiming to learn lessons and understand how EMAs can most effectively employ SM to support their work on the ground The investigation has enabled a greater understanding of the most recent developments and uses of these technologies in the field of emergency management.

The first part of the work concerning Social Media focuses on the role of Web 2.0 platforms in supporting disaster management and considers the strategies EMAs across Europe have adopted for public engagement. The second part of the work concerning Social Media concentrates on Web 2.0 service adoption in government organisations working in the field of emergency management, and the resulting changes arising from the introduction of these new information and communication technologies. It analyses the drivers and motivations for adoption as well as the barriers and difficulties. The broad adoption of SM by the public and the increasing effect it has on the work of EMAs, requires organisations across Europe to define and implement strategies for SM use.

1.2 The scope of the project with regard to Social Media

Disasters are unforeseen and highly dynamic situations, defined by high levels of information requirement, low levels of reliable information availability, a great need for quick information, and also information chaos. Government organisations can never be fully prepared for a disaster. They can only do their best to prevent them (regulations, public education, infrastructure maintenance), prepare for them (preparedness exercises, trainings, public preparedness education, working with data) or respond and act appropriately when they do strike, including adequate risk and crisis communication. This is why a pre-established management strategy and crisis communications plan are vital. The uniqueness of each disaster challenges the procedures of those working on the ground, the organisation's communication strategy, its standard operational procedures, its policies and the organisation itself.

A crisis communication plan ranks as a key strategic factor for effective action. EMAs need to have a crisis management plan, including a crisis communication plan. They must also use the time before a crisis to prepare the public for any emergency scenario that may occur. When an emergency does strike, they must provide information (1) quickly, (2) accurately, and (3) consistently. EMAs also should develop (4) strategies to establish authority. Finally, EMAs need (5) to coordinate internal and external communication. Internal communication protocols and those between the different organisations acting as first responders have to be updated and checked constantly as a failure in communication flow can have a devastating impact on the response efficacy. Poor internal communication is a prelude to a bad external coordination and communication. In brief, a good emergency management strategy must include a thorough communication plan.

Since the year 2000, information technology has changed radically particularly impacting the way people communicate, initially on personal computers but more recently on smartphones and tablets. A considerable number of "social media" companies have developed with names such as Facebook, Twitter, Orkut, Instagram, and Youtube. These companies offer technology of various types which greatly facilitate the communication of messages, images and videos, above all allowing for the sharing of these multimedia items with a wide range of "friends" or "followers". As the technologies have grown in ubiquity so have they developed an ever greater role in emergencies (which we survey in greater detail below). Prime examples discussed below include the use of social media in Haiti's earthquake or during the Queensland floods.

The advances in communication and information technologies have challenged organisations dealing with emergencies to develop new communication strategies for disasters and emergency situations. Web 2.0 tools have given people more ways to seek and share information. This can help peo-

ple cope with disaster situations and support subsequent recovery. But it has added another layer of complexity to the already complex situation of a disaster. Now, anybody with a mobile phone can broadcast information to friends, family and acquaintances. Anybody in a disaster situation can share the details instantly, and sources of information have multiplied dramatically, to such an extent that it can be difficult to make sense of the overwhelming amount of information. And for EMAs, in a matter of seconds following a disaster, they now have access to much more information than was ever available before the advent of SM. Mainstream media were quick to appreciate the power of Web 2.0 technology. Previously, before the advent of SM, when a flood affected an area, for example, residents would switch on their TVs and wait for the city council authority broadcast to tell them what to do. Now, victims are browsing their mobile phones, checking what friends and neighbours are sharing about the event. In a very short time, a huge amount of information is amassed from various sources, often containing contradictory stories. What to do then? Who can they trust? What advice should they follow?

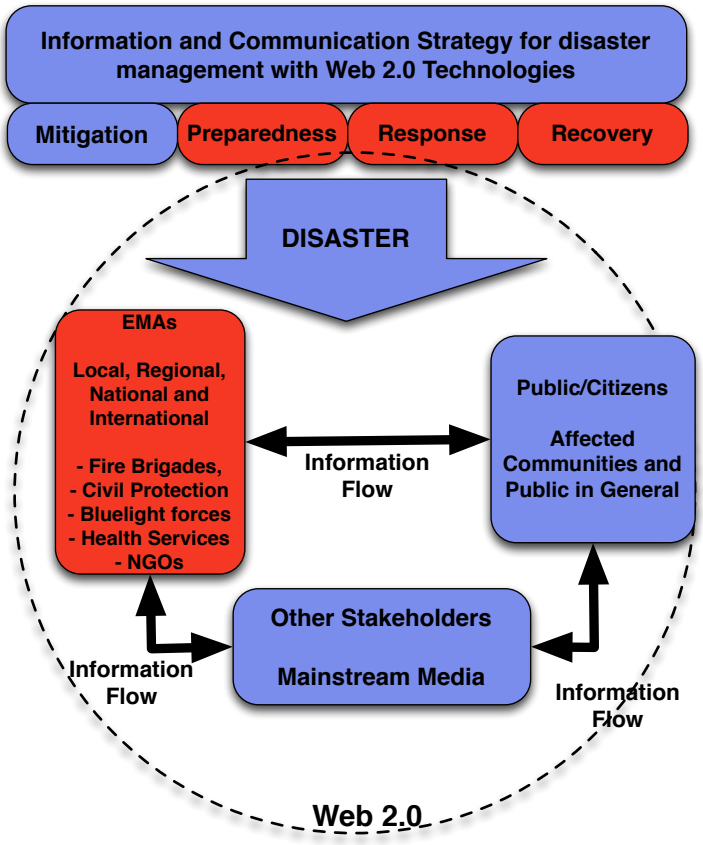

Figure 1.1: Framework of the Disaster 2.0 project

Figure 1.1 depicts the information flow during disasters. In this framework,

EMAs need to know how to use the information people are sharing and publishing online about a disaster, how to enhance their message during emergencies using Web 2.0 tools and how to use these technologies for disaster management. EMAs need to know how to give authority to their messages and how to make sense of the mass of information they can access. Furthermore, it is important to emphasise the potential to use Web 2.0 platforms as operational tools as well as communication tools.

1.3 Explaining the Disaster 2.0 project

1.3.1 Objectives of the Disaster 2.0 project, countries, data, findings

European EMAs have long planned for emergency tasks to prepare for the challenges associated with disasters, e.g. the nature of the threat, the people to be evacuated, the time available for response, the necessary supplies and the long-term effects of the incident. Web 2.0 technologies and SM are recent phenomena and there are as yet no solid guidelines and recommendations about how to use them effectively. Indeed, relatively few EMAs are using these powerful tools as part of their communication and emergency management toolbox. Because of this, the Disaster 2.0 project has explored how EMAs can use these technologies for risk and crisis communication and for disaster management in order to provide recommendations to guide their adoption by EMAs. The project has also examined several case studies in depth and has shared transferrable lessons through masterclasses, seminars, presentations, feedback sessions and an international conference, as well as this report and the case studies book. The project focused not only on helping EMAs to prepare, plan and execute the use of Web 2.0 technologies, but also in helping them to educate their organisations and increase widespread adoption of these new technologies.

Five European countries participated initially in the project: Italy, Greece, Belgium, Poland and Germany. Although these countries are the core partners of this project, the initial sample was widened as valuable examples of Web 2.0 and social media usage emerged in other European countries. Hence, the project also includes data from Spain, UK, Finland, Iceland and Netherlands. It also considered data from European organisations such as EUROCONTROL.

This report presents the final findings from a number of interviews with emergency managers, civil protection officials, first responders, researchers, journalists, weather forecasters, non-governmental organisations (NGOs) and voluntary organisations, involved in the emergency management in the Disaster 2.0 countries. Out of this work, a nine-stage model for Web 2.0 tools adoption was developed and is presented below, which identifies the steps that might be considered when adopting SM.

As each EMA faces unique circumstances and has differing requirements from the use of SM, this research has focused on creating a versatile model that can guide emergency services to consider the best approach to meet their own needs. To support this task the project includes a worksheet guiding this discussion and helping to take decisions based on the finding of this research.

One of the main objectives of the Disaster 2.0 project was to understand the benefits and drawbacks of using social media for disaster management and identify the barriers and drivers for its adoption by EMAs. The project's aims included:

a. Identify innovative uses of Web 2.0 platforms by emergency management agencies (EMAs).

b. Understand which Web 2.0 practices have worked and the procedures of its adoption within the organisation and in relation with other stakeholders.

c. Provide recommendations for improving information management during disasters and emergencies through improving EMAs' understanding of Web 2.0 platforms.

d. Establish how successful these Web 2.0 platforms have been in mitigating damage to Critical Infrastructure (CI) and building resilience in the public.

e. Identify problems that may arise in using these platforms.

f. Provide a road map of how Web 2.0 tools can help information and emergency management, specifically when communicating with the public.

g. Develop an illustrative list of case studies of EMAs currently using Web2.0 applications for disaster and emergency management.

h. Identify transferable lessons which can assist in future adoptions of Web 2.0 platforms.

1.3.2 Research methodology

The project's methodology has been divided into five phases: Phase 1: The exploratory stage included reviews of: the literature, communication plans, and approaches to risk and crisis communication and emergency response. It also included a review of previous uses of SM during disasters, such as the Haiti Earthquake of 2010. Phase 2: Visits to five countries where interviews and focus group were conducted to establish how EMAs work and either what their current practice was, or what plans they had to use SM

for disaster management. Phase 3: An analysis phase mapped current capabilities, identified innovative practices and generated recommendations for Web 2.0 usage. Phase 4: An impact phase followed with workshops and presentations held in each participating country and an interactive web portal established. Phase 5: Dissemination to publicise findings through conferences, journal articles, and other means.

1.3.3 Participating countries

Disaster 2.0 researchers visited five partner countries. These countries, their representatives on the project's International Advisory Board, and the threats those countries face, is given in table shown in Figure 1.2. In some countries the research team worked at the local and regional level because this is where most emergency management and crisis communication take place, and where more innovative uses of Web 2.0 tools have emerged. In other countries we worked at the national level – always positioning our work at the right level for that country (informed by the advisory board member for that country). Frequently we held interviews at national, regional and local levels in order to capture a complete picture of SM usage in that country.

1.3.4 Deliverables

During the two-year project, we worked with government organisations across five European countries, each with a differing level of experience of Web 2.0 technologies. In each country, we have interviewed a variety of government organisations and Web 2.0 developers to understand a range of perspectives on the potential of these technologies. The project has enabled participating organisations to identify how these applications can support their work and build resilience in CI and the public. The project's findings have delivered:

- A final report and case studies on how countries can use these technologies.
- Four events to share good practice.
- A workshop in each country where we shared key findings.
- Two masterclasses where government organisations in other EU countries share good practice case studies of how they use these technologies.
- An international conference in 2013 on using social media and Web 2.0 in disasters.
- A repository of lessons, resources and samples for good practice.

Country	Representative	Instituions involved in the research	Typical threats and disasters
Belgium	Koen De Budt	Belgian Crisis Centre, City of Antwerp, Fire Department Antwerp, Safety Centre Europe, Federal Agency for Nuclear Control, Province of East-Flanders, Province of Brabant Wallon, City of Herentals, Province of Liege	Flooding is a threat along rivers and in areas of reclaimed coastal land, protected from the sea by concrete dikes. Other threats are nuclear risks and terrorist threats
Greece	Eirini Krampi	Helenic Police, Civil Protection Directorate, Greek Civil Contingencies, Greek Fire Service, Greek Coast Guard, Ministry of Citizen Protection.	Earthquakes, forest fires, flash floods, landslides, CBRN (chemical, biological, radiological, nuclear), epidemics, and incidents in installations containing hazardous materials
Germany	Holger Poser	Behörde für Gesundheit und Verbraucherschutz (BGV) (Health, environment, consumer protection and radiology emergencies), Civil Protection and Disaster Rsponse Management (Ministry of Interior and Sport), Federal Agency for Technical Relief (THW), Behörde für Inneres (FHH, BGV) (Hospital planning and disaster control of health department), Behorde Fur Stadfeut (Department of Environment), Crisis Management Centre of Hamburg, Katastrophen Brand und Bevölkerungsschutz (Fire disasters and population protection, Ministry of Interior), Health and Consumerism Department	Terrorism, flooding, forest fires, storms and nuclear risk.
Italy	Elena Rapisardi	National Institute of Geophysics and Volcanology (INGV), Center for Internet & Society, Angeli con il fango sulle magliette (NGO), GeoSITLab UNITO(GIS and Geomatics laboratory), ARPA Piemonte (Agenzia Regionale per la Protezione Ambientale), Centro Funzionale Regionale Regione Autonoma Valle D'aosta, Consorzio LaMMa	Earthquakes, volcanic eruptions, landslides, mudflows, avalanches, flooding and extreme weather conditions.
Poland	Pawel Karnas	Krakow Crisis Management Center, Fire Department, Police	Floods, droughts, hurricanes, epidemics, forest fires, industrial catastrophes, blackouts, snow storms, landslides and earthquakes in the Silesian region

Figure 1.2: Countries visited, International Advisory Board members, institutions and threats.

Accompanying this report on Social Media, there is also an extensive online repository of Web 2.0 tools-related resources. This repository includes materials that have been prepared by the project team, materials from an international search of Web 2.0 adoption of emergency management related materials. This repository is available at `http://repository.disaster20.eu/`.

1.3.5 Structure of this report

This report is written for practitioners of emergency management. Academic readers will find interest in this report, but are also offered journal publications and conference papers that have been (and will continue to be) written as a result of the project. This report is divided into XX chapters which aim to explain the results, their underpinning and their potential impact on the theory and practice on leveraging Web 2.0 technologies for emergency management.

Chapter 2

Disaster Management and Crisis Communications

Over the last several decades, disasters and disaster management have become formal topics of study, and a sizeable community of researchers and practitioners (including emergency managers, spokesmen, policy makers, physical and social scientists, relief workers and civil servants) has grown around them. This has resulted in a vast body of literature on disaster management. This chapter uses this literature to define the concepts that will be used throughout this report and examine the practical approaches to disaster and crisis management. In addition, we provide a framework for communication during disasters and emergencies, and and show how Web 2.0 technologies can be applied to disaster and crisis management.

2.1 Key Concepts

2.1.1 Emergencies, Disasters and Catastrophes

"Various unwelcome situations can occur. . . which are based on natural phenomena (i.e., hurricane, flood, earthquake etc.), on socio-political conditions (i.e., war, political crisis, financial recession etc.)" (Anthopoulos et al., 2012:2) or on technical accidents or a failure that causes damages, fatalities and injuries (i.e. nuclear plant failure). These phenomena are called "disasters" (Blackhard, 2006), "emergencies" (Hadmer and Dovers, 2012), "catastrophes" (Quarantelli, 2006) or "crises" (Loosemore, 1999). Defining disasters succinctly is challenging. Some studies have defined the concept through its essential components (Quarantelli, 1998, 2000; Perry and Quarantelli, 2005). These publications illustrate the complexity of the term from both research and practical perspectives. Disasters vary according to their source, size and effects. The following widely accepted definition from the United Nations Office of Disaster Risk Reduction (UNISDR) is the one that will be used in this report:

> A disaster is "a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. . . Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation." UNISDR, 2007

The terms "disaster" and "emergency" are often used interchangeably. However, disasters are distinguished from emergencies—events which require urgent action and which might involve destruction or injury and extra resources or operational procedures— by their scale. For Alexander, (2002) "an emergency is defined as an exceptional event that exceeds the capacity of normal resources and organisations to cope with it" (p.1). Alexander (2002) distinguishes between four levels of emergency. The first and lowest level deals with routine events (such as a car accident, or a stroke in a public space). Quarantelli (2000) refers to these as everyday emergencies. The second level concerns those events that can be dealt with within the municipality or local level without requiring significant resources from outside areas (such as severe flooding or power outage). A major incident or disaster requiring regional or "inter-jurisdictional" resources and higher levels of coordination is distinguished as the third level of emergency (e.g. a train accident as the reported in the introduction chapter) (p.2). The fourth and final level refers to "that of the national or (international) disaster, an event of such magnitude and seriousness that it can be managed only with the full participation of the national government, and perhaps also international aid" (such as Haiti Earthquake) (Alexander, 2002, p.2). Using the definitions adopted here, all except the first level of emergency are within the scope of this report.

Scholars and emergency managers also generally recognise this distinction between disasters and everyday emergencies, seeing both a qualitative and a quantitative distinction between disasters and everyday accidents. Quarantelli (2000) points to four differences in terms of an organisation's behaviour. During disasters organisations have to:

1. Quickly relate to a higher number of unfamiliar groups. This refers to the amount of different actors and agencies involved in the emergency management process. Thus, in a disaster several agencies work together

(fire brigades, police, municipality government, NGOs, media groups, etc.).

2. Adjust to losing part of their autonomy and the freedom to act.

3. Apply different operational procedures. This refers to the performance standards of each organisation that often need to change during a disaster.

4. Operate cooperatively with public and private sector individuals and organisations. Private and public organisations need to use all their resources for the common good. It means a blurring of the public-private line.

Disasters are also distinguished from catastrophes, where a catastrophe means that the whole community has been severely impacted (Quarantelli, 2000, 2005). The affected population cannot rely on friends and family to help them, because friends and family are also affected. The emergency management organisations in the community are also affected, and so the normal mechanisms put in place to provide assistance have themselves broken down. Some scholars define catastrophes as exceptionally large-scale disasters. Differences can be seen especially at the organisational, community and societal levels (Quarantelli, 2006):

1. Most or all of the community-built structures (i.e. homes) are heavily impacted. Moreover, during catastrophes the emergency management organisations and their structures are damaged as well.

2. Local emergency managers and personal are not able to undertake their usual work roles. There are two main consequences of this: first, leadership roles have to be taken by outsiders of the community affected. Second, problems can arise between local and outside organisations.

3. Everyday community functions are severely interrupted and infrastructure such as electricity and water will be disrupted.

4. Catastrophes tend to affect multiple communities, and often have a regional impact.

5. The role of the media is different as they cover catastrophes more intensively than disasters; there is much more and longer coverage by national and international media.

6. Finally, the relevance of the political arena is greater as national and senior officials are involved.

In the time period immediately after the incident, at the individual level, the reaction to disasters and catastrophes is extremely similar. For example, citizens seldom panic, family or household units mostly undertake evacuation, and neighbours help one another. However, as highlighted by Quarantelli (2006), the difference is at the organisational level and generally they will face a more difficult and complex response. Difficulties are cultural – each culture responds differently to a disaster.

2.1.2 Crisis, hazards and risks

Crises concern unexpected and extreme events which require a quick response (Loosemore, 1999). It is suggested by Anthopoulos et al. (2012) "that a crisis can generate a disaster and vice-versa, while a crisis can be a long-term phenomenon (i.e., financial recession, war etc.). Crises are the results of mismanaged risks... and require proper planning" (p.4). Crises occur when the core values or life-sustaining systems of a community fail. "Although a crisis calls into question the survival of a system, it can lead to either positive or negative organisational outcomes" (Mishra, 1996: 262). Such outcomes depend on the behaviours determining how resources are allocated, used, and acquired during the crisis (Mishra, 1996). For dealing with a crisis, a response plan needs to be put in place.

A **hazard** can be defined as the probability of a disaster to occur or a potential unwelcome situation. "A hazard, in the broadest term, is a threat to people and the things they value. Hazards have a potentiality to them (they could happen), but they also include the actual impact of an event on people or places." (Cutter, 2001: 2).

Risk is associated with uncertainty over a situation. "Risk is the probability of an event occurring, or the likelihood of a hazard happening [...] Risk emphasises the estimation and quantification of probability in order to determine appropriate levels of safety or the acceptability of a technology or course of action. Risk is a component of hazard." (Cutter, 2001: 3). Other definitions suggest that: Risk = Likelihood x Consequence (Ansell and Wharton, 1992: 100).

2.1.3 Classes of disasters and hazards

Disasters may be classified by the types of hazards that cause them, where a hazard (such as a storm or earthquake) is simply an event or phenomenon that has the potential to cause harm. For example, the EM-DAT (CRED, 2009) database of disasters –a repository maintained for over 30 years by the Centre for Research on the Epidemiology of Disasters (CRED) – provides a broad taxonomy. Disasters are classified as either natural or technological (man-made). The former is in turn divided into disasters caused by the following varieties of hazard: geophysical (e.g., earth- quakes, volcanic

CLASS OF HAZARD	EXAMPLES
Natural (Geophysical)	
Geological	Earthquake, volcanic eruption, landslide, accelerated erosion, subsidence
Meteorological	Hurricane, tornado, ice-storm, blizzard, lightning, rainstorm, hailstorm, fog, drought, snow avalanche,
Oceanographic	Tsunami (geological cause), sea storms (meteorological cause)
Hydrological	Flood, flash flood
Biological	Wild fire (forest or range fire. It can be man-made), disease outbreaks, insects infestation, crop blight, epizootic.
Technological	
Hazardous materials and processes	Carcinogens, mutagens, heavy metals and other toxins
Dangerous processes	Structural failures, radiation emissions, manipulating and transporting hazardous materials
Devices and machines	Explosives, unexploded ordnance, vehicles, trains, aircrafts
Installations and plans or critical infrastructure	Bridges, mines, refineries, other industries, power plans, storage plans, power lines, pipelines, communication networks, high-rise buildings
Social	
Terrorist incidents	Bombings, shooting, hostage taking, hijacking
Crowd incidents	Riots, demonstrations, crowd crushes and stampedes

Figure 2.1: Disasters and classes of hazards (Source: Alexander, 2002)

eruption, landslides); meteorological (hurricanes, tornadoes); hydrological (floods, flash floods); climatological (drought, wildfires); and biological (e.g., epidemics). Industrial accidents, such as oil spills or nuclear accidents, are examples of technological hazards, as are deforestation and exhaustion of other natural resources. Other classification schemes are of course possible. For instance, another useful category comes from social hazards, such as terrorist acts, or war—that is, wilful acts (NRC, 2006) as other causes of disasters (Haddow et al., 2011). The Table in Figure 2.1 summarises the disasters in relation to the classes of hazard that cause them.

To sum up, the project deals with emergencies and disasters at several levels and caused by different classes of hazards (both natural and man-made), and some can be considered to be catastrophes, but the project does not cover everyday emergencies. Although we have recognised several conceptual distinctions between disaster, emergency and catastrophe,

we will mainly use the terms disaster and emergency as synonyms for the remainder of this report. Following this review of concepts, we shift focus to before and beyond the event and consider them as long-term processes which include issues such as resilience, preparedness and recovery.

2.1.4 Disaster resilience

As with the term *disaster*, so also have been many attempts to define **resilience**. This report defines resilience as the ability to prepare and plan for, absorb, recover from, and successfully adapt to adverse events (Cutter et al., 2013). Resilience is of relevance to any type of disaster. This concept of resilience is applied to hazards and disasters, whether natural or human-induced, and provides a framework for being able to anticipate, withstand, and recover from such events with minimal human and economic losses. In defining resilience Klein et al. (2008) noted two distinctive elements; "the amount of disturbance a system can absorb and still remain within the same state or domain of attraction" (p.42); and the degree to which the system is capable of self-organisation (OECD, 2006). This includes the pressures placed on the socio-economic and socio-environmental system during a disaster (Adger, 2006: 269). Specifically resilience can be divided into the areas of ecology, society, economic, institutional, infrastructure and community competence (Cutter et al., 2008).

Summarising scholarly definitions and for operational purposes, system or community resilience can be understood as the:

- Ability to absorb stress or destructive forces through resistance or adaptation,
- Capacity to manage, or maintain certain basic functions and structures during a disaster or an emergency,
- Ability to recover.

The concept of resilience goes beyond specific behaviour strategies. It means emphasising and reinforcing what communities can do for themselves and how to strengthen their capacities, rather than focusing on their needs during disasters. Therefore, disaster resilience concerns EMAs and it is a shared responsibility amongst citizens, communities, the private sector and governments. In other words, it includes all the stakeholders involved in disaster management. Increasing resilience to disasters requires decisions and actions both in the short and long term.

2.2 Disaster Management

Disaster management is the organisation and management of resources and responsibilities for addressing all aspects of emergencies, in particu-

lar preparedness, response and initial recovery steps. As defined before a crisis or emergency is a threatening condition that requires urgent action. Effective emergency action can avoid the escalation of an incident into a disaster. Emergency management involves plans and institutional arrangements to engage and guide the efforts of government, non-government, voluntary and private agencies in comprehensive and coordinated ways to respond to the entire spectrum of emergency needs. The expression "disaster management" is sometimes used instead of emergency management (UNSDR, 2007). Hence, disaster management is the set of activities related to both the preparation for and response to disastrous events. A so-called disaster cycle (or disaster management cycle) consisting of distinct phases or stages is frequently discussed in the literature (e.g., Adam and Wisner, 2003; Alexander, 2006; NRC, 2007; Hadow et. al. 2011; Neal, 1997).

2.2.1 Disaster management cycle

The belief is that, while disasters are disruptive and chaotic in nature, the management process for each one can be viewed as having a common life cycle. Though different variations of the cycle are discussed (a description of the evolution of the idea is given in Neal, 1997), a 1979 report by the National Governor's Association (1979) seems to have been very influential in describing the management process cycle in four stages. The stages are as follow:

1. **Mitigation:** Mitigation activities are those undertaken (independent of any particular event) to either eliminate the possibility of a disaster, reduce the probability of one, or else reduce its harmful effects. Examples of mitigation activities include: building dams and levees; creating building codes for earthquake or tornado resistant buildings; passing zoning laws (e.g., prohibiting construction in flood-prone areas).

2. **Preparedness:** Preparedness activities are those designed to maximise the effectiveness of the response to a disaster when one occurs. Examples include the drafting of disaster plans and evacuation routes; the development of hazard monitors and early warning systems; stockpiling resources; setting up interagency mutual aid agreements; engaging in training exercises. While both mitigation and preparation take place before a disaster ever occurs, the two are distinct. Mitigation activities are geared toward the prevention of a disaster, while preparation activities are geared toward effective response. In a literal sense, preparation activities assume mitigation will fail.

3. **Response:** Response activities immediately follow a disaster and are "devoted to reducing life-threatening conditions, providing life-sustaining aid, and stopping additional damage to property" (NRC, 2006). Securing affected areas, assessing damage, performing search-and-rescue

missions and providing immediate medical aid are all examples of response. This phase of disaster management requires urgent action by emergency management agencies and other organisations.

4. **Recovery:** Recovery activities are those intended to help return society to normality after a disaster. These can be divided into short-term efforts, e.g., providing temporary shelter to those displaced, and long-term efforts, e.g., providing financial assistance to local governments and private individuals to rebuild.

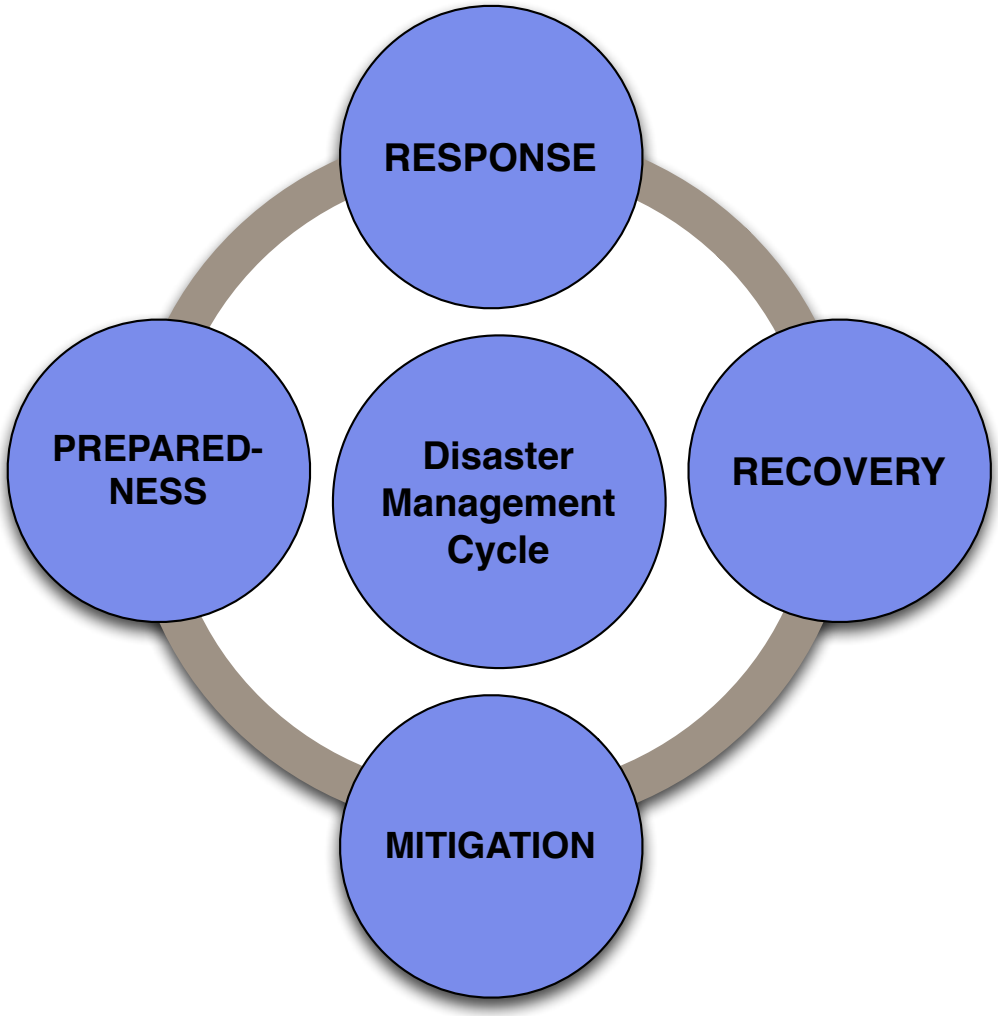

Figure 2.2: The Disaster management cycle

Disaster or emergency management refers to the work of emergency managers (EM), including public authorities (government), emergency management agencies (EMAs) (such as civil protection, police, fire brigades,

emergency services) and other public or private organisations (such as NGOs, the media or private corporations). Usually, the procedures that need to be taken are captured in a contingency plan. The definition used by the United Nations (UN) describes a contingency plan as "a forward planning process, in a state of uncertainty, in which scenarios and objectives are agreed, managerial and technical actions defined, preparedness measures undertaken to mitigate the effects and response systems put in place in order to prevent, or better respond to, an emergency" (UNDR, 2007).

The trend for legislation and policies has been to focus on the recovery stage. Recently, there have been several attempts to broaden the scope of emergency management addressing each stage of the disaster management cycle, not only focusing on the response phase. These efforts bring opportunities to broaden the scope and develop more strategic approaches and introduce new capabilities. It is important for disaster management institutions to consider the potential benefits that Web 2.0 technologies can provide, and how citizens' use of these technologies can add to the disaster management process (Handmer and Dover, 2012).

2.2.2 Characteristics of Disasters and Disaster Management

This section will review the different characteristics of disasters. Although disasters caused by different hazards are in many ways quite different –e.g., the damage caused by oil spills is typically very different to that caused by tornadoes— there are certain characteristics and issues that commonly arise. It is important to be aware of the characteristics of emergencies and disasters in order to activate the process to prepare, respond, recover and mitigate the impacts of emergencies and disasters.

The following list of characteristics regarding disasters, disaster management and information processes during disasters, has been compiled from several accounts found in the literature (Der Heide, 1989; NRC, 2006; Harvard Humanitarian Initiative, 2011; Quarantelli, 2005), and is especially relevant to this project:

1) **Disasters are infrequent:** Although there is data suggesting that the frequency of disasters is increasing (GRID-Arendal, 2012), disasters are, by definition, abnormal events. One result of this is that it is common for communities to insufficiently invest in mitigation or preparation activities (NRC, 2006), as several recent disasters, such as Hurricane Katrina, have illustrated. One of the major problems during Katrina was that preparedness activities, training and inter-organisation exercises were neglected. What this means is that when disasters occur, responders will be forced to act in ways that are relatively unfamiliar to them, and groups having little experience working with each other will have difficulty coor-

dinating efforts. Similarly, technology when used only in disaster management will be relatively unfamiliar to the EM.

2) **Disasters disrupt normal organisational functions:** All disasters affect a given community to some extent or other. In a catastrophe, all aspects of life are affected, including the official structures and organisations designed to provide assistance during emergencies. Local relief organisations, to the extent that they can function, must work differently than they were designed to. Normal operating procedures must be altered and responsibilities reallocated (Der Heide, 1989). Furthermore, the organisations effectively involved in the response and recovery efforts will come in part from outside of the local communities (Quarantelli, 2005) and so will not be as familiar with their surroundings.

3) **Disasters are unpredictable:** Even when it is known that a disaster will occur (due to the use of monitoring networks, etc.), its precise nature, extent, and evolution often cannot be predicted. It is often not known—at any point during the response—which organisations, or individuals within the organisations will be available. The same holds for the equipment and facilities used during the response. Often, groups and resources must be assembled in an ad hoc fashion, based upon whoever and whatever is at hand.

4) **Disasters require the combined efforts of many actors:** During the disaster management process several stakeholders (public or private, governmental or non-government, etc.) are involved. In general, many groups and actors will be involved during a response. This poses severe problems, from the standpoint of information and communication, organisation and cooperation.

5) **Effective action requires timely, accurate, and verifiable information:** In order to act effectively, responders must be in possession of all relevant information, and they must be assured that the information available to them is trustworthy and current. Because of the unpredictable nature of a disaster, even accurate reports become out-of-date very soon. In a report on the use of the Ushahidi crowd-sourcing platform[1] after the 2010 Haiti earthquake (Morrow et al., 2011), it is noted that Ushahidi was of value in large part because it was one of the few sources of map-based information actually coming from individuals in the affected areas. It provided data from the area before larger organisations could mobilise. The same report, however, indicates that the crowd-sourced information—and its source—often could not be verified.

6) **Information overload is common:** Disaster response requires responders to process multi-modal data: text, satellite imagery, photographs,

[1] `http://ushahidi.com`

sensor data, etc., which might all be used in a response effort. Due to the time constraints under which responders must make decisions and due to the diversity of information they must process, responders are often overwhelmed with information. The informational pressures placed on responders will only become more acute as technology advances, at least in the near term. Advances in technology allow more information to be generated—by more people, including disaster victims and volunteer communities—and delivered to responders without increasing in the responders' ability to successfully cope (HHI, 2011).

7) **Information "siloing" occurs frequently:** The HHI Haiti report (2011) noted earlier indicates that responders typically focused only on the immediate informational needs of their own group and could spend little if any time on the informational needs of others. That is, they did not spend much effort making their data available to other organisations. This was in part due to technological barriers to integration (e.g., caused by heterogeneous data formats) and the extreme time constraints under which organisations operated, but it was also in part due to organisational resistance to making data available to others. Interviews with multiple EM managers and field staff indicate that the politics of opening their internal data to other UN agencies is itself an issue, let alone opening the data to the hundreds of organisations that partnered with the IASC-led cluster system in Haiti. Barriers such as cyber-security, humanitarian protection, and distrust loom as large as the technical interoperability of proprietary systems (HHI, 2011).

8) **Media has a relevant role:** It is also important to recognise that the media also have a role in characterising a 'disaster' and its magnitude (Hadmer and Dovers, 2012).

To conclude, disasters are complex phenomena, and the activities involved in disaster management are themselves quite diverse. Even within a particular phase of the management cycle, many actors will take part, fulfilling many different roles.

2.2.3 Emergency management stakeholders

The emergency management stakeholders are all the actors involved or affected by a disaster, including citizens, emergency managers and policy makers. Emergency managers need to involve every actor in each phase of the management process. According to Haddow et al. stakeholders can be divided into three groups (2011):

1. Social groups:

a) Individuals are the basic unit in social groups. They try to prevent emergencies, prepare for disasters, evacuate and suffer their impact. They take action and decisions. Individuals control a substantial amount of resources and information when an emergency happens. Moreover, they have a big influence on relatives' and friends' actions. Recent disasters have demonstrated how individuals using social media (SM) and Web 2.0 tools have been able to spread huge amounts of information more quickly than other stakeholders (such as media or government agencies).

b) Volunteer groups. They work closely with EMAs. Volunteer groups organise themselves or work in cooperation with EMAs in order to prevent emergencies and to provide support during such events. Web 2.0 technologies have allowed the emergence of "virtual volunteers".

c) Other private sector groups such as non-government organisations (NGOs), non-profit organisations (NPOs) or charities.

d) Private commercial companies.

2. Economic groups: There are several economic groups involved in the disaster management process such as businesses.

a) Business can suffer a huge impact when a disaster hits. They also need to prepare plans and strategies. They can suffer economic losses and have a role in organising the flow of goods and services. Examples of relevant businesses in disaster management are pharmaceutical companies or insurance companies.

b) Critical businesses are those in charge of public utilities: electricity, water, gas, telecommunications, etc. These can be considered part of the critical infrastructure (CI). Such businesses are active in disaster management as they are responsible for restoring services as quick as possible. Depending on the country such organisations may be private businesses or may form part o government.

c) Media, both traditional media and new media, have an important role in disaster management as they can manage and control the flow of information. Due to its central relevance to this project, the relationship between media and emergency management will be reviewed later in greater detail.

3. Governmental groups: Government emergency management agencies can be divided into several levels. This group of stakeholders includes emergency managers, policy makers and politicians. Also included are; civil protection agencies, police forces, fire brigades, emergency services, scientists, etc. when they are staff of a public service.

These governmental groups can operate at several levels: international (such as EuroControl), national (e.g.. Ministries), regional or local (e.g.. Civil Protection, City Councils). The governmental groups also include research centres which are usually attached to Universities or Ministries.

2.3 Disaster and emergency communication

Meeting the information needs of the public and offering timely support are vital in crisis situations (Keselman, Slaughter and Vimla, 2005). Additionally, timely, appropriate and efficient information is vital to enable decision makers to deal with the crisis. When dealing with emergencies and disasters, communication planning becomes a complex task. It involves the collection, organisation, production, and dissemination of information that makes it possible to make informed decisions and mobilise necessary resources. EMAs need to control the information flow. Sources of information and key stakeholders need to be identified. It is important to create messages and content that will make EMAs visible and relevant to the affected population, the community, communications media, and other organisations involved in the disaster or emergency response. This planning is usually carried out in a complex political and social environment.

An important task of EMAs, then, is the dissemination of information when a disaster happens. This information is commonly called crisis information. EMAs, government and other authorities distribute crisis information in many ways, including spreading information through media such as television, newspapers and radio. Recently the Internet has become a prominent way of communicating crisis information (Vandenbosh and Higgings, 1995). Effective crisis communication allows people to take action that saves lives, reduces damage, reduces suffering and speeds up recovery. Rapidly reporting disasters and their impact can be very effective in helping affected communities and improving response.

2.3.1 From crisis communication to risk communication: CERC

While crisis communication focuses on sharing information with affected citizens during an actual crisis or disaster, risk communication is concerned with promoting preparedness behaviours to the public in advance (Seeger, 2006). Hence, we can say that the risk communication model follows the trend, stated above, of broadening the scope of emergency management and includes preparedness. Risk communication is related to health communication and efforts to make the public aware about the risks attached to particular behaviours. Risk communication has largely been conceptualised as a problem of reaching the public or specific audiences, raising awareness

of risk and changing their behaviour accordingly (see Witte, 1995). Crisis communication, in contrast, is more typically associated with public relations (PR) and the need for organisations to repair damaged images after a crisis or disaster (Coombs, 1999). Besides, warning and risk communication have also been part of the broader emergency management tradition (Mileti and Sorensen, 1990).

Recent efforts have been directed toward merging these traditions into a more comprehensive approach. The merged approach is called the "crisis and emergency risk communication" model or CERC model[2] (Reynolds, Galdo and Sokler, 2004). This approach is, in part, an acknowledgment of the developmental features of risk and crisis, and recognition that effective communication must be an integrated and on-going process. The CERC model examines crisis and risk communication in terms of a cycle. The process starts in the pre-crisis period during which the main task for a government organisation (GO) or EMA is to communicate risk information to the public. The cycle then moves into the initial event stage where priorities change from preparedness and behaviour change to reassurance and specific messages. As the initial crisis stabilises the cycle moves on to a stage where EMAs offer more detailed responses to the public, and deal with specific rumours related to the disaster. During the resolution stage the focus switches to encouraging the clean-up and starting a public discussion on issues related to why the crisis first emerged and what could be done to prevent similar events occurring again. The final stage represents a consolidation and examination of the steps that can be taken to better prepare the public for similar future events. CERC is an important model for EMs which would like to engage in Web 2.0 technologies because it merges a communication approach and an operational approach taking into account the four stages of the disaster management cycle. It is worth noting that this cycle mirrors and matches the 4 stage management cycle described before in Section 2.2.1.

2.3.2 Disaster communication and the mass-media

It is generally acknowledged that the media play a key role in many aspects of crisis and disasters. When thinking about the role of the media, it is assumed that they are crucial disaster management tools just because of their ability to efficiently and quickly transmit official information about the hazard, preparedness, and recovery stages to a wide and heterogeneous population. Passing on warnings is "without doubt, the clearest and most consistent role [of mass media] in a disaster" (Quarantelli, 1991, 23). Another important media role is keeping people informed after the disaster strikes (McEntire, 2007). Further importance lies in the media's capacity to participate in preparedness and to facilitate recovery by changing peo-

[2] http://emergency.cdc.gov/cerc/

ple's attitudes to natural hazards (Wenger and Quarantelli, 1989; Wenger and Friedman, 1986). According to the approach considering the capacity of media to participate in each stage of the disaster management cycle, the public receives, processes, interprets, and personalises the information and then acts accordingly in each stage of the management cycle. The assumption is that this informing function of the media varies only in content but not in form across the various disaster phases. In the "preparedness" stage, the media (mainly TV, radio and now the Internet) provide factual information about the approaching hazard and tips to help the populace prepare for its impact. During the "response" and "recovery" phases, the media focus their attention on the areas most affected, providing estimates of the damages and losses, helping the recovery of the community. During the long-term "mitigation" phase, the media are considered a disaster information provider through coverage of non-local disasters (via movies, news, and special programmes), which are viewed as helping the community to raise disaster awareness and prepare for future events (Rodriguez 1997; Quarantelli 1996). Therefore, even when the content of the transmission changes, the media are still perceived to serve an informing function because it is assumed that people keep watching, reading, and listening to obtain information on hazard preparedness, response, and recovery (Quarantelli, 1996).

The media role has traditionally been to function as a link between the public and EMAs. The controversy surrounding the media role is whether the media are effective in increasing preparedness and response to natural hazards, or if they present a distorted and sensationalist picture of the disaster situation. Nevertheless, nobody questions that the fundamental role of the media in natural disaster situations is as transmitters of official information and every EM is aware of the necessity of taking journalists into account in the disaster management process. From a communication perspective, the important elements of disaster management are not only the content of the communication, the information, but also the channels of communication and the source of the communication (Pennings and Grossman, 2008). Hence, the message distribution and delivery strategy matter. A reminder here is that the aim of this report is not to provide recommendations about which media to use, when to use them or what information to communicate. Rather the Disaster 2.0 project aims to illustrate how Web 2.0 can be part of the communication toolbox used by EM for emergency and disaster management.

2.4 Web 2.0 for disaster management

Advances in information and communication technologies have provided all stakeholders with more ways to seek information during disaster situations and to look for support in the emergency management process. Recent disasters and emergencies have highlighted the role that information and com-

munication technologies (ICT) play in disaster management. With a century-old history of investigation, the sociological study of crises is aware that ICT has expanded the reach of disaster sociology, adding new challenges to this area (Palen et al., 2007). Studies are now focused on the emerging trend of citizen participation through social media and mobile communications technologies - providing, seeking and sharing information. However, this advance in social computing is challenging disaster management organisations and their traditional command and control models do not easily adapt to this new trend of a global, digitally-enabled social arena.

Before examining some recent examples of how Web 2.0 was used in disasters, we are going to define Web 2.0, Social Media (SM) and Social Networking Sites (SNS) and provide examples of their use for emergency management. The definition of Web 2.0 technologies offers to the practitioners an understanding of the functions these tools can support and their potential applications.

2.4.1 The domains of usage of web 2.0 in disaster management

Defining SM and Web 2.0 clarifies the potential value these technologies have for Emergency Management Agencies (EMA). This section of this report defines and describes the characteristics of SM in general and outlines, with examples, some functions these tools offer to the everyday routines and needs of disaster management, based in a first hand observation. The functions and purposes for using Web 2.0 will be expanded upon later in the results chapter and analysed in depth.

Sometimes Web 2.0 and Social Media are used indistinctly. However, although the terms overlap, they are different concepts. Web 2.0 is an elusive concept that is often used without a clear definition. There have been several attempts to define it, nevertheless each definition depends on the approach: technologists and programmers consider web 2.0 to be about language, web designers think it concerns tools, and companies and start-ups believe it is all about business models. However it also has a social component, which needs to be considered in its application to the disaster management area. Thus, the term sits in an intersection between technology, society, and business.

Web 2.0 services that foster mass collaboration are often referred to as Social Media. These include blogs, wikis, social network sites like *Facebook* and *Twitter*, communal bookmarking and tagging sites like *Del.icio.us* or *Pinboard* , media sharing sites like *YouTube* and *Flickr*, and a host of supporting technologies. Here we are going to broadly define Web 2.0 and Social Media and, in doing this, we will go through other concepts related to both of these terms, such as User Generated Content (UGC) or Social Network Sites (SNS). In addition to providing an extensive review of current

Web 2.0 and Social Media tools we want to underline their features, capabilities and potential to enable EMAs to conceptually understand Web 2.0 in order to use these tools. Thus, the focus is not on particular services but offering examples of usage within the disaster management context.

2.4.2 Definitions

Web 2.0: Web 2.0 is a stage of development of the Web, a step forward from Web 1.0 that was characterised by top-down communication and communication from one-to-many. Web 2.0 as a set of technologies have enabled effective communication for both improving human knowledge and fostering collaboration. The technology tries to sort out the inherent information problem – that there is a huge amount of information on the Internet that is sometimes difficult to find, retrieve and make sense of - and it proposes a changing model of communication – communication is now many-to-many. Web 2.0 tools and services – such as Folksonomies, RSS feeds, blogs, wikis and social networking applications – create an environment tackling the information problem. Web 2.0 aims to connect users in a meaningful way and connect millions of people in the same place. However, the literature revealed several uses of the word. Web 2.0 is often used synonymously with social media, social software or social networking sites, and this lack of clarity makes research on the area difficult.

The term Web 2.0 is primary associated with O'Reilly (O'Reilly, 2005, 2009). Since its inception as a term in 2005, the term has been used to cover several concepts, technologies and, overall, describes an attitude towards those technologies and web applications, a set of principles and practices that ties them together. In other words, it has depicted a new way in which technologists and users started to use and design the World Wide Web (WWW) as a platform (Kaplan and Haenlein, 2010). This upgraded version of the web was more open, collaborative and participatory than Web 1.0. Going back to the origins of the term, in O'Reilly's words, "Web 2.0 is the network as platform, spanning all connected devices; Web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as a continually-updated service that gets better the more people use it, consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating network effects through an 'architecture of participation,' and going beyond the page metaphor of Web 1.0 to deliver rich user experiences." (2005). Hence, in this early attempt to define Web 2.0, O'Reilly discusses seven of its characteristics: (1) the web as platform, (2) harnessing collective intelligence, (3) data as the next 'Intel Inside', (4) end of the software cycle, (5) lightweight programming models, (6) software above the level of a single device, and (7) rich user experience.

From these seven characteristics we want to highlight the properties that

underscore the value of SM to the area of disaster management. Firstly, the easy access to updated technology with a set of protocols allowing open and flexible use, which fosters its application in the area of emergency management. The basic functioning is the same for any EMA wherever is located. Moreover, when technology changes it changes for everybody simultaneously and the service changes as users find new uses for it. The second characteristic, participation and harnessing collective intelligence refers to the ways in which websites have come to depend on their users for content (Beers and Burrows, 2007). This approach is built on two attitudes: the 'wisdom of crowds' (Surowiecki, 2004) and the idea that systems should be open to change from the users. The 'wisdom of crowds' holds that aggregate contributions can be used to achieve objectives not possible alone (Kittur and Kraut, 2008). It is the process of taking into account the collective opinion of a group of individuals rather than a single expert to answer a question. This approach is key to the emergency area, as we will see later in examples of use. It has allowed for a new collaboration paradigm between the people and the EMAs. An early observation noted that a crowd's average estimate for a bull's weight at a country fair would be more accurate than an individual expert's opinion (Galton, 1907). This concept has been widely used in disaster and emergency management area. The technological developments promote user participation with a low barrier to entry into the specific sites. Third, data as the next 'Intel Inside' refers to the key question that surrounds database ownership, and the degree to which companies can profit from and protect their databases in a situation where users can generate data on a large scale. A further aspect can be found in concerns over privacy in user-generated databases. These aspects are a concern for EMAs, as they are not the owners of the data shared over Web 2.0 technologies. The fourth feature relevant to the emergency area is the idea that software should reside in the 'cloud', a metaphorical term for the web (Katzan and Dowling, 2010). It allows data to be stored in geographically distributed servers. This is an advantage over storage in a single central server, which is highly vulnerable to damage during a disaster. Furthermore, 'cloud' data can be accessed from any device. The fifth characteristic is web-sites simple enough to allow programming mashups and combination with other data sources. It provides EMA with the ability to adapt the services to their needs with relatively low technological skills (Kroski, 2008). The sixth feature identified, software above the level of a single device, again stems from leveraging the power of the web platform. It means that software and services are no longer limited to a particular device or operating system. In other words, Twitter as an emergency tool can be used on almost any device - from a desktop PC running Windows to an iPhone. And the last characteristic refers to the capacity to produce and share multimedia data (pictures, videos and sound), increasing the capabilities of getting images from the disaster easily.

After nearly a decade we can confidently say that Web 2.0 is not just a new version of Web 1.0, it is a new way of understanding the web. The Disaster 2.0 project has focused on the strong social component of Web 2.0, studying how Web 2.0 is being constructed by its use (Beer and Burrows, 2007), specifically, how Web 2.0 is being constructed, adapted and used for emergency and disaster management.

Social Media: As with Web 2.0, the fundamental feature of SM is the cultural shift that changes one-way or "linear give and take" communication into two-way communication or "collaborative discussion" (Mergel and Greeve, 2012). Social media is again an elusive term to define. The number of definitions is so big that to agree a clear definition has proven an impossible task (Tomassi, 2011). Again, the definitions differ depending on the researcher's perspective, from business (Kietzmann et al, 2011; Scot and Jacka, 2011), technology and communication (Allan and Thorse, 2009; Howard and Parks, 2012). Social media has also been defined from the perspective of EMAs (Crowe, 2012; White, 2012) through the functions it supports for emergency management. Despite the different definitions, there is a general consensus that social media is changing the way people relate and communicate with one another, as well as with companies, organisations and institutions –including traditional media outlets.

The general definition outlines how, "'Social Media' is the term used for 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. They can use a variety of formats, including text, pictures, audio and video." (Social Media Guidelines, EU)[3].

Social media is closely related to user-generated content (UGC) (Agichtein, 2008). From the beginning of this decade, UGC has become very common on the web: users participate actively in content creation through Web 2.0 services. Furthermore, Social Media promotes user interaction and the sharing of opinions and content, encouraging participation and engagement. It involves building communities or social networks of people "connected by a set of socially-meaningful relationships" (Wellman, 1996: 1). The explicit support for social interactions between users, such as posting comments, rating content or products, and responding to questions and comments is what makes Social Media different from traditional media. Social Media services include blogs and web forums, social bookmarking sites, photo and video sharing communities, and the popular social networking platforms such as *Facebook* and *Twitter*, which offer a combination of all of these with an emphasis on the relationships among the users forming a community.

The popularity of SM rapidly expanded in 2002 with the launching of, Friendster (`http://www.friendster.com/`) the first Social Media site with

[3] `http://ec.europa.eu/ipg/go_live/web2_0/`

wide adoption. Soon after, MySpace (2003)(https://myspace.com), LinkedIn (2003)(http://www.linkedin.com/) and Facebook (2004)(http://www.facebook.com/) were introduced. Another important platform launched in 2003 was Wordpress (http://wordpress.com/), it allowed users to install and publish a blog with no programming skills. Wordpress, together with Blogger (http://wordpress.com/), ignited "citizen journalism." This year also brought the advent of social bookmarking[4] with Del.li.cious (http://delicious.com/). Twitter was launched in 2006. Currently, Twitter and Facebook are the most popular Social Media services according to SocialBakers statistics[5].

Following the idea that Web 2.0 is a stage in the development of the Web, we go on to review some Web 2.0 tools examining the relationship between networked communication and information organisation online. These tools – folksonomies, RSS feeds, blogging, wikis and social networking applications – will be classified according to how they do both tasks: organising information and connecting users. On the one side, we find a range of applications such as Google Pagerank and RSS feeds which facilitates the retrieval of and search for information. These kinds of applications contribute to our understanding of the web as a common site, harnessing collective intelligence. Although these applications are nurtured by individual experiences, for instance tagging a video on YouTube, they are contributing to organising the web. On the other side, connecting users, we have the Web 2.0 networked communication tools, such as Facebook or LinkedIn. In this case, social aspects are the main reason for users being online. The social network the Web creates and sustains constitutes the data an individual is looking for and the data an individual wants to share. However, we have to keep in mind that the line is not as clearly drawn and applications and services can fall on one side or another more or less clearly, and even on both. Moreover, several functionalities can be added to these services making them more complex and interrelated, such as geographical data added to social networking sites. Users are also able to find uses for the technology that developers never thought. For example, recently the Amazon wedding gift registry facility became a humanitarian tool for fundraising in the aftermath of Hurricane Sandy (Fox, 2012).

RSS: power to retrieve information

This technology is used to publish frequently updated content –such as

[4]A social bookmarking service is a centralised online service which enables users to add, annotate, edit, and share bookmarks of web documents. Many online bookmark management services have launched since 1996; Delicious, founded in 2003, popularised the terms "social bookmarking" and "tagging". Tagging is a significant feature of social bookmarking systems, enabling users to organise their bookmarks in flexible ways and develop shared vocabularies known as folksonomies.

[5]http://www.socialbakers.com/facebook-statistics/

blogs, news, audio and video. It helps EMs to organise this updated information and keep it as a link, so they can decide whether to follow a link and when (King, 2003). To allow this, a website makes a feed, or channel, available which computers regularly contact to get the most recent items on the list, and this is done by an aggregator or RSS reader –a program that manages a number of feeds, such as FeedReader, Straw or NetNewsWire. In brief, RSS allows practitioners to review all of the websites they are interested in, subscribe to them and read all the new content on their RSS readers or browsers when it is published. It allows users to define their own categories and organise the content according to their own system. For instance, an emergency manager could categorise feeds as “tools”, “SMEM news”, “cases”, etc.

Folksonomies		Emergency Management Examples
Main goal	Inform	Vimeo Consorcio Lamma, http://vimeo.com/20878866 Greece Police Coast Guard YouTube channel: http://www.youtube.com/user/helleniccoastguard West Midlands Police's Flickr photostream (UK) http://www.flickr.com/photos/westmidlandspolice/ Search for SMEM in Delicious, https://delicious.com/search?p=SMEM Flickr during London Bombings http://www-us.flickr.com/groups/bomb/pool/
	Promote the institution (image)	
	Education	INGV http://www.youtube.com/user/INGVterremoti
	Get help of citizens	Some police brigades have used flicker to get citizens help in identifying perpetrators
Examples of services	Delicious, Flicker, Youtube, Vimeo, etc.	
Advantages	Easy retrieval of information, classification of information, help to situational awareness	
Disadvantages	EMAs cannot control how citizens are tagging the information. Sometimes citizens can spread information of EMs (ie. masterclass 1 presentation of the West Midland Police Spokesman, Amanda Coleman).	

Figure 2.3: Folksonomies in the EM field

Folksonomies: power to search information

A 'folksonomy' –folk taxonomy– is a kind of distributed classification system. It is created by a group of people who use labels or 'tags' to categorise and bookmark online content (Web pages, links, photographs, images, videos and so forth) (Guy and Tonkin, 2006). Although scientific taxonomies are classifications applied in a methodological and systematic manner, far from individual choices, folksonomies are based on the subjective categorisation of the user who tags something. A folksonomy then can be used on a web-site so as to allow users to upload data and tag it, and facilitate their later retrieval.

The folksonomies became relevant with the advent of Del.icio.us, the web service (mentioned above) for storing, sharing and searching bookmarks, and Flickr, a popular website for users to store, share and embed personal photographs. As Del.icio.us and other folksonomies gained users, they benefited from collective action and the network effect. As more people used the service, the more widespread the tags became, and the better they described what they link to. They contain certain types of metadata, such as titles and authors. The tags potentially provide two types of metadata about a link or a specific content: firstly, it describes the content, and secondly, the number of people who have tagged a link suggests the quality of its content (Golder and Huberman, 2005). The tagging possibility is fundamental for EM as it facilitates access to the relevant information and organising.

Blogs: sharing information and communication

A blog, or weblog, is a 'personal online journal'. It consists of discrete entries, commonly named posts, usually displayed in reverse chronological order with the most recent post appearing first. Technically, a blog is a web page where the owner regularly adds new entries which tend to be short and include hyperlinks to other blogs or websites. They often also feature other media, such as pictures, videos and podcasts. Originally, blogs were personal websites where single authors published content about their interests and received comments from readers. Since 2009, more and more blogs are updated and managed by multiple users. The number of company, institutional or organisational blogs has also grown. It is an easy way for an averagely technical skilled person to publish content on any topic they like for discussion on a web site. A Weblog usually provides a feed to its content by producing an RSS document.

As we have seen with other Web 2.0 tools, blogs are proficient at fostering the collective intelligence of the Web. They do so by building communities amongst their users and in combination with other Web 2.0 technologies, such as RSS and folksonomies. Its social aspect is what differ-

entiates them from previous websites (Marlow, 2004). They are supported by Content Management Systems (CMS) such as WordPress (2003)(`http://www.wordpress.org`). There are three specific features of blogs which help to create a community: permalinks[6], the comments facilities and the "trackback" function (it alerts the blogger when the blog has been referenced in other blogs). One example of the impact a disaster can have on blogging activity was seen after the terrorist attacks in the US on September 11th, 2001, when blogging sites saw a period of elevated activity as authors posted reactions, information and emotional support.

Blogs meet Web 2.0 functions of EMAs by helping them to organise and expand their knowledge and thoughts via creative interactions; they are particularly good at creating conversations, dialogue and opinion. Blogs are a way of creating content and a networking space, and this is the feature mainly used by EMA.

Recently, there has been an explosion in the use of micro-blogging tools. This service became widespread in 2007 when Twitter (2006)(`http://www.twitter.com`) grew in usage and popularity. A micro-blog differs from a blog in that its content is shorter and usually limited (e.g. the famous 140 characters in Twitter). They "allow users to exchange small elements of content such as short sentences, individual images, or video links" (Kaplan and Haenlin, 2011), in other words, Micro-blogging services let subscribers post short updates online or broadcast them. The advantage of micro-blogging is its suitability for mobile-devices and it fulfils the need for an even faster mode of communication (Java et al., 2007).

As we will see below, Social Networking Sites usually include the micro-blogging tool in the form of status updates. We can clearly place micro-blogging in the social network category as they promote the creation of social networks around topics of interest. Although competitors exist such as Identi.ca, the most notable micro-blog service remains Twitter. Examples of Twitter used by EMAs will be included below.

[6]The URL that points to a specific blog entry after it has passed from the front page to the archives.

<table>
<tr><th colspan="2">RSS and blogs</th><th>Disaster Management Examples</th></tr>
<tr><td>Main goal</td><td>RSS used in EMA webpages can facilitate other stakeholders to keep the information organised and be updated.

EMAs also can use aggregators to be updated and monitor the information other agencies/ stakeholders provide.

Validate information</td><td>Red Cross UK http://www.redcross.org.uk/
Consorzio Lamma
http://www.lamma.rete.toscana.it/consorzio/news
FEMA: http://www.fema.gov/data-feeds
West-Midland Police:
http://www.west-midlands.police.uk/feeds/
INGV: http://ingvterremoti.wordpress.com/feed
ARPA Piemonte:
http://www.arpa.piemonte.it/news/aggregator/RSS
London Fire Brigade:
- http://www.london-fire.gov.uk/NewsRSS.xml
- http://www.london-fire.gov.uk/IncidentsRSS.xml
BELGIUM CRISIS & EMERGENCY MANAGEMENT CENTRE: www.cemac.org/cbe
ACAP: http://acaps.org/inthepress/flux.rss
LONDON BLOGGERS:
http://londonbloggers.iamcal.com/weblogs/2715/
LONDON BOMB BLAST COMMUNITY:
http://www-us.flickr.com/groups/bomb/
iRescate: http://irescate.es
IRevolution: http://irevolution.net/
CrisisCommons: http://crisiscommons.org</td></tr>
<tr><td colspan="2">Virtual Emergency Centre</td><td>“Sala operative 2.0” Centro Intercomunale di Protezione Civile Colline Marittime e Bassa Val di Ceccina:
http://valdicecina.salaoperativaprociv.org/</td></tr>
<tr><td rowspan="2">Examples of services</td><td>Feed readers</td><td>Feedly: http://www.feedly.com/
NetVibes: http://www.netvibes.com/en
NewsBlur: http://www.newsblur.com/
TheOldReader: http://theoldreader.com/</td></tr>
<tr><td>Blog publishing tools</td><td>Blogger: http://www.blogger.com/
WordPress: http://wordpress.com/
Drupal: https://drupal.org/</td></tr>
<tr><td>Advantages</td><td colspan="2">It allows EMAs to browse, organise and share the daily content regarding emergency management, with notes and comments. For example, as an emergency manager it would be very valuable to read the updated weather information, seismic activity, new tools for EM in the same browser window.
It allows EMAs to provide updated information to the other interested stakeholders with an easy to use technology.</td></tr>
<tr><td>Disadvantages</td><td colspan="2">It is necessary to provide timely and updated information on a regular basis.</td></tr>
</table>

Figure 2.4: Blogs and RSS in the EM area

Wikis: knowledge sharing and collaboration

Wikis allow EMs to log in and edit content via a web browser usually using a simplified markup language or a rich-text editor (Lamb, 2004). Wikis are powered by wiki software, such as MediaWiki (`http://www.mediawiki.org`), SocialText (`http://www.socialtext.com/`), EditMe (`http://www.editme.com/`), OpenWiki (`http://www.openwiki.com`), etc. They can be helpful in sharing, exchanging and editing information within EMAs and between different EMAs. Due to their openness – at least within the group of people who are registered and have permission to edit them – they are inherently collaborative, which means that they are good at organising and creating knowledge in specific ways. Hence, they offer a cheap and easy way for EMAs to collaborate and share information. In contrast to blogs, they promote collaboration over individual authorship and relevance of information above chronological order. Wikis are good example of the collective intelligence of the Web at performing one task: it has the potential to focus many minds on the completion of one unique task. However, debate and dialogue is also possible in a wiki, although this is often hidden in the discussion pages. The more relevant example of Wiki is the Wikipedia (2001), the well-known collaboratively edited, multilingual,free Internet encyclopaedia (`http://en.wikipedia.org/wiki/Wikipedia`).

Social Network Sites

The use of social network sites (SNS) has been one of the most innovative applications of Web 2.0 tools in disaster and emergency management. Again this is a controversial term as it is often used synonymously with social network – a network of social interactions and personal relationships including off-line exchanges , and with SM. We define social network services or sites (SNS) as a websites or applications which enable users to communicate with each other by posting information, comments, messages, images, links, etc. Boyd and Ellison (2008) outline how SNS are “web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site” (p.2). SNSs also vary in the extent to which they incorporate Web 2.0 tools and services, such as mobile connectivity, micro-blogging, and photo/video-sharing. Essentially, SNSs provide the possibility to exchange information, manage relationships and communicate in a social context.

Originally the personal profile was the main feature that articulated the list of contacts, friends or acquaintances. EMAs build an organisation profile and they organise the content around this profile. Currently it could

Wikis		Emergency Management Examples
Main goal	User generated content Share information Collaborate between inviduals, groups or open	http://wiki.openstreetmap.org/wiki/WikiProject_Haiti/News http://www.wikimapaid.org/a/wikimapaid http://wikiwarnings.com/ http://wiki.crisiscommons.eu/wiki/Haiti_Hospital_Capacity_Finder
Examples of services	MediaWiki: http://www.mediawiki.org/wiki/MediaWiki SocialText: http://www.socialtext.com/ OpenWiki: http://www.openwiki.com/ EditMe: http://www.editme.com/	
Advantages	Improve the disaster management process Create an open platform for individuals and groups to share emergency or disaster related information Improve the knowledge sharing and the information registry to emergency preparedness The technology is open-source	
Disadvantages	Need of technical skills to manage a Wiki, the technology is not intuitive for everybody Need of customize the capabilities of wiki technology There must be a sharing culture behorehand or develop strategies to achieve it	

Figure 2.5: Wikis in the EM area

be said that in many SNSs it is also the sharing of interests that organises the social network and creates the community. These sites are mainly organised around a timeline showing status updates, thus SNSs include micro-blogging. Users also can leave messages on their contacts' profiles or pages. SNSs combine "public" messaging and private messaging tools, such as email or instant messaging. *Facebook* and *Twitter* are the most popular SNSs, the number of worldwide users of Facebook in January 2013 is estimated to be 1 billion and 500 million people use *Twitter*. Other relevant SNSs are *Google+*, *LinkedIn*, *MySpace*, etc. These are the more popular tools among EMAs as well.

SNSs were created with a specific audience in mind; today they are so popular that they compete with mainstream media in informing the public. Organisations and companies prepare their public communications with

Social Network Sites		Emergency Management Examples
Main goal	Diffuse information	Examples of use of Twitter, FB, LinkedIn, etc. TWITTER: @policia, @coivaldicecina, @flash_meteo, @INGVterremoti, @ArpaPiemonte, @hellenicpolice, @HCoastGuard, @pyrosvestiki, @CrisiscenterBE, @LPAntwerpen, @WMPolice, @emergenciescat FACEBOOK: https://www.facebook.com/westmidlandspolice http://www.facebook.com/FEMA https://www.facebook.com/LondonFireBrigade https://www.facebook.com/wwwKrakowPL Virtual Support Groups: http://vosg.us/
	Community building	
	To support team work	
Examples of services	Facebook, Twitter, LinkedIn, etc..	
Advantages	The people use them frequently Very easy to use Free	
Disadvantages	Problems with the personal and professional use of SNSs They are mainly private companies, thus the companies such as Facebook or Twitter own the data	

Figure 2.6: Social network Sites and their use in EM

SNSs as well. SNSs include photo, video and audio sharing; micro-blogging, blogging, location-based-data, instant messaging and text, video or audio based chat. Some SNSs can also work together and are interrelated through other applications called aggregators, such as HootSuite (`http://hootsuite.com/`) or TweetDeck (`http://www.tweetdeck.com/`). These applications are very useful for EM as they can monitor and publish information through several SNS profiles at the same time. Rather than giving an exhaustive review of the current SNSs we have highlighted their interrelated features and their changing nature. We believe that it is critical for EMAs to have a thorough conceptual understanding of social networks in general, rather than a deep knowledge of the specific capabilities of a few services. This is preferable as, SNSs change continuously and users also constantly change the services they prefer. The important aspect is that SNSs are about strengthening and creating social networks and having a social network can be very useful in disaster management, as this report will illustrate later.

Mashups and geo-location tools

In the area of Emergency Management the use of mapping services,

Mashups / Geolocation tools		Emergency Management Examples
Main goal	To consolidate data in one unique interface	Examples of use of Google Maps, Ushaidi, Sahana,... USHAHIDI DURING SANDY: https://hpsandy.crowdmap.com/ USHAHIDI DURING JAPAN EARTHQUAKE: http://www.sinsai.info/ HAITI OPEN STREET MAP: http://haiti.openstreetmap.nl/ GOOGLE TOOLS: https://groups.google.com/forum/#!forum/crisismappers SAHAHA: http://sahanafoundation.org/deployments/disaster-risk-reduction-drr-portal/
	Locate people	
	Managing resources	
	Situational awareness	
Examples of services	GOOGLE TOOLS: • PERSON FINDER http://google.org/personfinder/global/home.html • GOOGLE CRISIS RESPONSE http://www.google.org/crisisresponse/ • GOOGLE MAPS: https://maps.google.com/ SAHANA: http://sahanafoundation.org/ USHAHIDI: http://www.ushahidi.com/ OPEN STREET MAP: http://www.openstreetmap.org/#map=5/51.500/-0.100 GEOCOMMONS: http://geocommons.com/	
Advantages	These tools take advantage of the crowd-sources capabilities of Web 2.0 and the geo-location tools. They are mainly open and free tools. There is a strong community involved in the deployment of these tools.	
Disadvantages	They required some technical skills. They are not very popular among the wider population.	

Figure 2.7: The use of mashups and geographical sites in EM

such as Google Maps, and OpenStreetMap are especially relevant as geographical data is very important during the initial stages of a disaster. OpenStreetMap was used especially successfully during the Haiti disaster has been used repeatedly since especially in humanitarian disasters occurring in locations where publicly available mapping is poor. These mapping applications and tools can be used collaboratively, highlighting again how Web 2.0 can enable EMs to access collective intelligence. Also, geo-location applications can be very useful in locating people and managing resources, especially in combination with mobile technologies.

For the purposes of this report, we will define aMashup as a web page or web service that uses data, appearance and applications from other sources to create a new service. It is usually completed through open application programming interfaces (API) and data sources to produce different results

to the original reason for producing the data source. In other words, it is to take two or more web pages or services and combine them to make one unique service with a different goal.

The main characteristics of a Mashup are: combination, visualisation, and aggregation. It is important to make the data more useful, for personal and professional use. Mashups have an active role in the evolution of Social Media and Web 2.0.

2.5 Conclusions

From the literature review, we can be concluded that disasters are multi-faceted and complicated events. When a disaster strikes many diverse activities need to be carried out simultaneously by various agencies and other stakeholders. The Disaster 2.0 project studies the use of Web 2.0 tools for the management of emergencies and disasters at several levels and caused by different classes of hazard (both natural and man-made). From now, the Disaster 2.0 report uses the terms disaster and emergency as synonyms.

The focus of the project is not on the disaster or emergency itself. We take a disaster management approach which considers disasters as long-term processes which require strategies for resilience, preparedness and recovery. The project also merges a communication approach and an operational approach. It considers risk and crisis communication as part of the disaster management process. When studying the role of Web 2.0 in the disaster management process the project explores its roles both as a communication channel and as an operational tool. The team has also researched case studies looking at several stakeholders involved in the disaster management process.

Chapter 3

The use of Web 2.0 in disasters

In recent years, several high profile disasters have provided valuable lessons in crisis management, planning and organisation. This chapter explores the state-of-the art approaches to Web 2.0 technologies for disaster management. It also analyses some worldwide examples of Web 2.0 tools usage during recent major disasters to understand how current crisis response efforts are carried out by EMAs and how citizens are involved in those efforts, focusing mostly on the use of mobile technology and Social Media (SM) The chapter also pays attention to the relationship between mainstream media (such as press and TV) and SM in crisis and risk communication.

3.1 The value of Web 2.0 technologies

Disasters, emergencies and crises disturb routines and raise significant public and media attention. Today, mobile and online SM technologies are changing politics, social interactions and business. Society is increasingly using Web 2.0 tools and adapting those tools to its needs, and this offers the potential for improved management of and response to disasters, as shown in Chapter 2 of this report.

Web 2.0 and SM have already proved extremely valuable in providing information to stakeholders (citizens, government and non-government Emergency Management Agencies(EMAs) and traditional media) in crisis situations. The immediacy of real-time information that SM provides is a key factor during emergencies for a society that has grown accustomed to instant information and constant access to communication. In addition, to the benefits in terms of communication, there is also the opportunity to attain a more complete situational awareness. As yet the majority of EMAs do not fully utilise SM, opting to implement a one-way information dissemination communication model. This is often limited in accessibility, details and empathy and usually consists of traditional TV and radio broadcasts through the press-office departments or authorities in charge. The mainstream media have also often been criticised for sensationalism and not

being aware of the specific and real needs of affected communities – the ones that truly need the information. Communicating with the public during crises and emergencies has remained a challenge for EMAs (Sutton et al., 2008).

In terms of the opportunities for situational awareness, the growing phenomenon of citizen journalism (Allan, 2009) through SM has been paramount in offering eye-witness accounts and first reports from the affected areas. Examples include the 2004 Indian Ocean tsunami, in 2005 during Hurricane Katrina and in the 2010 Haiti earthquake. It has also been observed in major terrorist attacks such as those that took place in Madrid in 2004 and London in 2005. In Chile the population have an unusual level of preparedness for earthquakes. During the 2010 Chilean earthquake , the public used SM technologies to request assistance, look for information and try to locate missing relatives and friends (Büscher et al., 2008; Mendoza et al., 2010). During the Japan Earthquake (2011), or Tohoku earthquake, Twitter became the most used emergency service with 1200 tweets per minute coming from Tokyo (Taylor, 2011).

Another distinct feature offered by Web 2.0 tools and SM is digital volunteering across the world. Web 2.0 services have driven citizen initiatives over specific platforms (such as Google's Crisis Response, Ushahidi, Sahana, or OpenStreetMaps), to become useful resources of information and relief assistance. Illustrations of this include the portals and websites created by volunteers in the aftermath of major crises to coordinate assistance and help relief efforts. Specific examples include the 2007 Virginia Tech shooting Wikipedia page composed by 1500 individuals (Hughes et al., 2008: Palen et al. 2009); the wide collection of tweets posted by citizens to assist fire-fighters and citizens during the 2007 Californian wildfires (Sutton et al., 2008).

Although most European emergency plans take into account the need to properly inform the general public and the media, they have only recently introduced some references to SM (e.g., Facebook or Twitter) as additional means for informing and contacting citizens. However, few emergency plans cover SM usage (such as CERC which introduced references to SM in its 2012 edition). The main current strategies and procedures of SM usage are reinforcing the communication model's underlying uni-directionality rather than capitalising on the easy two–way communications facilitated by SM.

3.2 Lessons from Web 2.0 disaster response efforts

In recent years, several natural disasters and human-induced actions have created challenging situations for disaster managers. These events provided lessons on how to use Web 2.0 technologies and drove organisa-

tional changes. In times of crisis, communities need information on the incident such as where they can find help and how they can contact relatives (Longstaff, 2009). In recent years we have observed how Web 2.0 tools have been used to provide this information during several major disasters, from the early examples of the terrorist attacks in the USA on September 11, 2001, or the London bombings in 2005, to Hurricane Sandy in October 2012. To speed up the recovery from disasters and promote resilience, governments need to engage with the public in an interactive information sharing system. Lack of effective communication can decrease public trust in institutions (Covello, 2009; Heath and Palenchar, 2002).

Social Media is one emerging technology with the potential to allow for the flexibility, adaptability, and boundary spanning functionality demanded by response organisations for their information systems. Sutton, Palen, and Shklovski (2008) demonstrated the ability of SM to not only coordinate widespread communication and strengthen information flows, but to also be flexible to the changing needs of the responders. This project analysed some of the previous occasions when Social Media was used, aiming to understand how recent disaster response efforts were carried out by EMAs and how citizens were involved in those efforts.

3.2.1 The Indian Ocean Tsunami, 2005: distributed and decentralised global efforts

The 2004 Indian Ocean Earthquake was devastating, recording 9.3 on the Richter scale. Soon after the earthquake a huge tsunami devastated the coastline of the island of Sumatra and hit twelve other countries in the Indian Ocean, killing over 280,000 people[1]. It is considered the first internet-mediated natural disaster.

Tourists were the first group of people reporting the disaster as they were using phones and digital cameras to take photos and videos of the devastation and uploaded them onto the Internet (Mason et al., 2013). Tourists became “accidental” “incidental” or “unintentional” citizen journalists (Meraz, 2006). Flickr was used to share the pictures. Wiki technology allowed information to be shared and published online and blogs had a central role in spreading the information. This disaster highlighted that technology and blogs can be created and used to aid individuals in framing response management independently of mass-media and government (Murthy, 2011).

The BBC News website showed how people are able to adapt the technologies to their needs. At the end of articles published about the event, readers of the online BBC News began to add comments about missing persons and grief over the disaster. They kept conversations over multiple

[1] `http://earthquake.usgs.gov/earthquakes/eqinthenews/2004/us2004slav/#summary`

BBC site pages that were certainly very difficult to follow[2]. This difficulty of managing the information regarding missing people was also observed in the Red Cross/Crescent websites, where the data duplication were huge and citizens could add, edit or share any content (Potts, 2009).

3.2.2 London Bombings, 2005: Mobile technologies and social media empowering citizens

On 7th July 2005, London was shaken by several coordinated suicide terrorist attacks affecting civilians and the public transportation system. Fifty-two civilians and four bombers were killed, and over 700 people were injured[3]. This disaster prompted coordination and information problems for EMAs. Initial information was limited and there was confusion about the number of places affected. The City of London Police, responsible for the banking and financial district of London, restricted cell phone network access to specific users to reduce network traffic and improve first responders' access. However, this action had the unintended consequence of cutting off access for many responding agencies, including the London Ambulance Service (Strom and Eyerman, 2008). Legal issues also complicated the agencies' response, as 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 (Strom and Eyerman, 2008). One of the biggest challenges faced by the London agencies was how to communicate with the victims' families. Mobile phone networks reported failures and the BBC speculated that the telephone system had been shut down by security services to prevent the possibility of mobile phones being used to trigger bombs. It became clear later that the intermittent unavailability of both mobile and landline telephone systems was due only to excessive usage (Manso and Manso, 2013).

London commuters affected by the incident were carrying laptops and mobile phones enabling intense and rapid use of Social Media. They took pictures with their mobile phones and uploaded the information to Social Media. Over blogs, they posted information and discussed the disaster. The public, whether directly affected by the incident or not, used multiple systems to coordinate information, from broad systems such as blogs and wikis to more specialised systems such as cellphone video, Google Maps, Flickr communities, and Internet Relay Chat (IRC). Survivors uploaded images and videos and blogged about the event while blog commenters shared links to further spread information, and maps were created to visualise the disaster. Some participants sharing images on Flickr provided geographical information in the form of geo-tags. This pinpointed the location in which the photos were taken, helping to verify their authenticity, and providing valuable

[2] http://news.bbc.co.uk/1/hi/talking_point/4130299.stm

[3] http://news.bbc.co.uk/2/hi/in_depth/uk/2005/london_explosions

information for situational awareness. However, the lack of mobile phone network in the underground system and a failure of the telecommunication infrastructure meant that this information would only be later forwarded to police and broadcasted through the mass-media.

This incident highlights the creative use of mobile and blogging technology by citizens to tell their own stories and share their own information. It was identified as a turning point for news-gathering and news production by many traditional media (radio, TV and newspapers), which until this moment had been the major source of information. Moreover, traditional media used social media information as a source for their reports. According to the Guardian (2005), "Mobile phone video clips and stills were posted on the Internet sites alongside first-hand accounts of people's experiences, building up a vast catalogue of DIY coverage more comprehensive and wide-ranging than anything available through the mainstream media." This disaster emphasised the relevance of camera and video equipped mobile phones as an empowering device for citizens, enabling them to provide first-hand reports of events through social media - side-stepping traditional media and government agencies.

A major issue arising from this disaster was the use of language when tagging the information in Flickr or other folksonomies. The tags used by the people lacked consistency across communities, making it difficult for EMAs to access and retrieve the information they required (Potts, 2007).

3.2.3 Hurricane Katrina, 2005: easy use of web services and social media for emotional support

During August 29, 2005, Hurricane Katrina broke into the Gulf Coast of the United States. It devastated New Orleans and flooded 80% of the region for weeks, forcing 1.2 million residents to evacuate and killing 1,833 people (Knabb et al. 2011). The government response illustrated how unprepared it was to deal with this kind of disaster. The criticism of the government's crisis response was focused on mismanagement and lack of leadership in relief efforts, leading to the lack of basic coordination and a delayed reaction to the disaster. The communication problems were huge, as the telecommunications network was affected, as was other critical infrastructure. 911 lines were down for several days and EMAs could not communicate with the governor or the competent authority. There was a "near total failure" (Manso and Manso, 2013) which hindered situational awareness and obstructed relief coordination.

Given the lack of official information there were several attempts from citizens and traditional-media to inform victims and organise information. For example, the use news channel CNN, through its news website CNN.com, attempted to aid the community by publishing content and creating lists of missing people. But, the CNN attempt was unsuccessful due to difficulties

in managing the website. They received a huge amount of posts which became difficult to manage and organise. Another illustration was NOLA.com, the website of New Orleans' Times-Picayune tri-weekly newspaper, whose blog became a fundamental resource for rescue operations and for reuniting dispersed residents, as it accepted and posted thousands of individual requests for help (Niles, 2005). Again, this initiative had some problems due to the amount of disorganised data that made difficult to find relevant information. One of the spontaneous and successful attempts took place on the *Lost & Found* section of Craigslist (`http://www.craigslist.org`), a popular advertisements website. While its primary use was to sell and buy, or publish offers, in the aftermath of Katrina it was used to track down missing friends and family, and other participants posted offers of housing and assistance to the victims. Later, internet fora specific to neighbourhoods allowed New Orleans communities, now spread geographically due to the hurricane, to keep in touch with friends and family (Procopio and Procopio, 2007; Shklovski et al., 2010). This highlighted the potential of SM for emotional support.

However, a bi-product of all these lists and websites providing information, in the absence of authoritative and credible information from public officials, was a climate of rumour, misinformation and speculation. In this disaster, traditional media and journalist were already prepared to use SM, but not the authorities. However, they faced information management problems. This case illustrates how during emergencies the citizens use the technology that they already know, are familiar with and that relatives are also using. To sum up, this case confirms that people turn to the internet and social media when they need information and that is even more true in situations with high levels of uncertainty and a lack of official information (Stephens and Malone, 2009).

3.2.4 Mumbai terrorist attacks, 2008: collaboration between citizens and traditional media

From November 26th to the 29th 2008 there were twelve coordinated shootings and bombing attacks across Mumbai: 166 people were killed and more than 300 were injured (Bhandarwar et al., 2012). Critical infrastructure (CI), including telecommunications infrastructures, was damaged. The internet connection however throughout the emergency remained relatively stable.

Once again, faster than traditional media, the first information about the Mumbai terrorist attack in 2008 was posted on Twitter along with a stream of pictures on Flickr taken by citizens (Beaumont, 2008). Reactions from the Indian blogosphere to the terrorist attacks in Mumbai were posted as events unfolded, with first-hand witness accounts and real-time citizen journalism efforts (Potts, 2007). People used collaborative tools and Web 2.0 technologies to spread information around the world about what was happening during the attacks. Flickr was again the SM service preferred by citi-

zens to publish photos. During this disaster Twitter became the best source for real-time citizen news on the attacks (Kiewit, 2008) and it became the most active and effective Web 2.0 tool for spreading information. The hashtag #mumbai became the major means through which participants shared and organised the information. During this event the connection between citizens and journalists was much stronger than in earlier disasters, for instance the BBC News website integrated relevant Twitter feeds in its pieces (BBC, 2007). Besides the success of Twitter usage, during this disaster, the organisation of virtual volunteers helping to organise the information could also be observed[4].

These terrorist attacks caused chaos on the ground, and had a similar impact online, as people attempted to locate their families and friends. Nevertheless, the SM response to this disaster is acknowledged as an excellent example of some of the most robust uses of the internet as a place to both build community and distribute information during times of disaster (Potts, 2007). A huge amount of situational information was spread and shared through SM and this also highlighted the benefits of these situational awareness capabilities for the perpetrators or terrorist groups. "Situational information which was broadcast through live media and Twitter contributed to the terrorists' decision making process and, as a result, increased the effectiveness of hand-held weapons to accomplish their terrorist goal" (Oh et al., 2011).

3.2.5 Haiti earthquake: volunteered geographic information and crowd-sourced maps

The Haiti Earthquake of 2010 killed an estimated 230,000 people and left the nation's capital, Port-au-Prince, in ruins, destroying 300,000 houses and leaving 1,600,000 people homeless[5]. With the collapse of all critical infrastructure (CI), communications suffered heavy damage as well: the public telephone system was not available, mobile telephone companies reported affected services and fibre-optic connectivity was disrupted. Still, a few hours after the earthquake most of Haiti's cell phone towers were still operational and text messages were getting through.

Several interesting events happened on social media during the Haiti disaster response. Due to the weakness of local organisation and infrastructure, many facilities and resources usually taken for granted in a rescue operation were absent. The lack of detailed, up-to-date maps resulted in digital volunteers from Crisis Commons (`http://crisiscommons.org/`) – an organisation devoted to improving data-sharing during disasters – undertaking the task of updating the Port-au-Prince map over OpenStreetMap, sup-

[4] Volunteers organised through Twitter were able to build this list on Google Spreadsheets: `https://spreadsheets.google.com/pub?key=p_esnE-+3Z3p-HehX1YOZIaw`

[5] `http://www.usgs.gov/newsroom/article.asp?ID=2679`

ported by wiki technologies (Gray, 2010)[6]. As international EMAs worked to gain information about damage, needs, locations, and road and security conditions, Ushahidi — an open-source crisis-mapping platform that was developed following Kenya's 2007–08 post-election violence — came online in Haiti. The system draws on mobile phone communications and SM to map crowdsourced[7] information about situations on the ground. This new source of intelligence pulled information from Twitter, Facebook, and blogs and received more data via text message to create reports that were placed on a Web-based, interactive map available to anyone with an Internet connection. Within four days of the earthquake, some first-responder teams began to use the Ushahidi map and information stream (Liu et al., 2010). The affected people used the 4636 emergency number to send their requests for help and with the Ushahidi map volunteers around the world who speak French and Creole translated thousands of messages, mapped where the calls came from and directed the most urgent pleas to the U.S. Coast Guard, the Red Cross and other relief and rescue agencies (Meier, 2010). Twitter also had a major role in coordinating, communicating with and requesting volunteers.

During this incident government organisations also used Social Media for disaster management, including the crowdsourced maps. A wiki was also used by several organisations and it proved to be a valuable resource for awareness and knowledge sharing (Yates and Paquette, 2010). This wiki included photos, commentaries and information published in social media. The most significant challenge was the extent to which the wikis grew unchecked as more and more users added knowledge. This problem pointed to the double-edge sword of wiki technologies: its strength is that anyone can add and edit the information; its biggest weakness is that anyone can add and edit the information.

In Haiti, there was an unprecedented use of the Internet and social networking applications to facilitate rescues and coordination on the ground, situational awareness, geographical information, crowdsourced information and more. It is the first disaster in which academic literature has identified the use of Web 2.0 tools by government agencies.

3.2.6 The Chilean earthquake, 2010: Social Media as a citizens' coordination tool for relief

On January 27th 2010 an earthquake of 8.8-magnitude shook Chile. The earthquake killed 525 people; left 12,000 injured and displaced one mil-

[6] `http://wiki.openstreetmap.org/wiki/WikiProject_Haiti/News`

[7] "Crowdsourcing" is a term coined by technology writer Jeff Howe. He defines crowdsourcing as "the act of taking a job traditionally performed by a designated agent and outsourcing it to an undefined, generally large group of people in the form of an open call." Howe (2008), p99.

lion and half people (Grossi et al., 2011). The earthquake caused tsunami waves that flooded the Valparaiso-Concepcion-Temuco area and nearby islands, before moving across the Pacific, where fifty-three countries, including Japan and the Philippines, were on alert and ordered evacuations. Chilean infrastructure was very badly damaged. A blackout left 93% of Chilean territory without other means of communication other than emergency radio. Electricity, telecommunications and water supplies were disrupted and mobile phone and Internet services were sporadic, but 3G continued to work intermittently so many smart phone users in Chile were able to tweet about the earthquake.

In the aftermath of the Chilean earthquake, SM tools were mostly used as a coordinating mechanism for relief and aid by NGOs (such as @CruzRojainforma) and private social initiatives. The literature does not report any SM use by governments in this disaster. Google mobilised several teams to help with the disaster response, with Google Map Maker (`http://www.google.com/mapmaker`) made available in Chile, as well as the Person Finder tool to submit or search for information about individuals who may have been affected. Twitter and other web-based resources were a key source of information about the disaster, helping families to state their difficulties and know their loved ones' whereabouts. "Twitter was used to tweet time-critical information about tsunami alerts, missing people, deceased people, available services, interrupted services, road conditions, functioning gas stations, among other emerging topics related to the catastrophe" (Mendoza et al., 2010). Hash-tags were created, such as #quake and #terremotochile, to compile information about the earthquake, and others such as #buscapersonas were used to search for missing people.

One successful action was the emergence of *Digitales por Chile* (`http://www.digitalesporchile.org/`), a volunteer organisation that used Twitter to gather the highly skilled IT professionals and technicians in order to help citizens affected by the disaster. In just twelve hours, the 300 volunteers of Digitales por Chile created the web site `http://www.chileayuda.com`, which supported the systematisation and integration of the disaster-related information, including Google's Person Finder, geo-referenced mapping, official communications and donations. *Digitales por Chile* intensively used Twitter, Facebook and Ushahidi, with its maps being constantly updated with information on rescue centres, medical assistance and police warnings. During this incident there was also a live video feed from Chilean TV in Livestream[8]. The proliferation of live video streams was amazing (Axon, 2010).

Traditional media followed this embracing of SM. The New York Times elaborated and published a list of Twitter accounts with information about what was going on in Chile. The Huffingtonpost also collected pictures from

[8] `http://www.cyberjournalist.net/live-video-coverage-of-chili-earthquake/#sthash.4HwyydJz.dpb`

Twitpic and published them in their live blog and online newspaper[9]. Again, problems arose as false information was spread though Twitter, such as the rumour of non-existent tsunami warnings or fake death tolls, but other Twitter users quickly declared these rumours as false, proving that social media is self-moderating (Mendoza et al., 2010).

3.2.7 Queensland floods, Australia, 2010-11: an Emergency management Agency in charge of social media disaster response

Queensland, Australia suffered severe flooding throughout late 2010 and early 2011. These floods resulted in the loss of 33 lives and caused an estimated AU$30 billion in damages (Zhong et al. 2013). The flood waters inundated the city of Brisbane and forced thousands of people to evacuate their homes to seek shelter. Hundreds of roads were closed, train services were disrupted and electricity was down. However, the communication infrastructure remained functional. In contrast to Haiti and other previous disasters, the Social Media response came from the state rather than from volunteer organisations. In particular, the Queensland Police Service (QPS) took the initiative in organising a Social Media presence across three popular platforms: Twitter, YouTube, and Facebook.

The police force in Australia is the lead agency in responding to disasters. Their chief motivations in using Social Media were the need to inform the public about the extreme weather situation and also updating members of the traditional media. During the disaster the police saw an increase in the number of people following their SM accounts. Numbers doubled within two weeks. During the disaster the police simplified their usual process for dealing with the press and released information at a much faster rate than usual. This streamlined process was based on existing systems for releasing information to the public and press (Queensland Police, 2011). The decision to use social media was not grounded in one policy decision, but represented the consensus among the staff in the police. The uptake was high and information from the police's social media account circulated on traditional media as well as through the online social networks (Queensland Police, 2011).

The police undertook the following activities:

- acting as a centralised clearing house for disaster-related information through Facebook and Twitter as soon as it became available, including details on behalf of other departments and authorities,

[9] http://www.huffingtonpost.com/2010/02/27/chile-earthquake-pictures_n_479535.html#s71405

- live video streaming of the Brisbane-based disaster-related media conferences on the QPS Facebook page with the video subsequently posted on the QPS YouTube channel,
- live Tweeting key points as they were made in briefings and in these media conferences,
- uploading dot point summaries of the media conferences to the QPS Facebook page shortly after their conclusion,
- uploading at least daily audio updates to Facebook from local disaster coordinators around the state
- ”myth busting“ of misinformation and rumours in the media and community
- Tweeting most QPS Facebook posts generally using the #qldfloods, #TCYasi or #mythbusters hashtags
- providing 24/7 moderation of the QPS social media accounts, responding to inquiries from the public where possible,
- coordinating Auslan sign language interpreters to assist with most media conferences,
- coordinating the translation of media conference.

(Queensland Police, 2011)

Notably the communication undertaken by the police focussed on pushing messages to the public rather than using social media to gather information about the disaster. In this case social media is an addition to traditional media, a new way of doing what had been done before, and often a way of doing it with more detail. For example, the police could post their news bulletins on YouTube. This allowed them to update the pubic in their own time without having to adjust their schedules to the requirements of traditional broadcast media. The police set the pace and the public followed on. In addition, the Australia public broadcaster had a dedicated digital radio channel providing interactive mapping of the flooded region and Twitter and Facebook provided updates and messages of support.

As in other recent disasters, actual intervention occurred in the form of squashing rumours transmitted over Facebook and Twitter. Anecdotal accounts often highlight the problems associated with false information being transmitted over social networks. Some emergency services have been deployed in response to deliberate false information posted on social media sites. In the Queensland case the police took an active role in directing the public's activity on social media, but were not attempting to use social media to coordinate a response or arrange a rescue from a perilous situation.

3.2.8 Japan Earthquake, 2011: the need for monitoring the information on Social Media

On March 11th 2011, a 9.0 magnitude earthquake struck off the east coast of Japan, causing a severe tsunami reported to be 40.5 meters high and traveling 10 km inland. At least 15,647 people were killed, 4,643 missing, 5,924 injured, 130,927 displaced and more than 332,395 buildings, 2,126 roads, 56 bridges and 26 railways destroyed or damagedhttp://www.bbc.co.uk/news/world-asia-17219008. Electricity, gas and water supplies, telecommunications and railway service were disrupted and several reactors were severely damaged at the Fukushima nuclear power plant.

Mobile and landline phone services suffered major disruptions in the affected area but Internet services were largely unaffected. Over an hour after the earthquake Twitter became the preferred means of communication, with nearly 1,200 tweets per minute coming from Tokyo, accordingly to Tweet-o-Meter[10]. Twitter users even shared the tsunami's estimated times of arrival on U.S. shores, long before an official government tsunami warning went into effect. Even the traditional media reported that Twitter was the only functioning communication tool immediately after the earthquake. Several Wi-Fi hotspot providers reacted by providing free access to their networks, and some American and German telecommunications and VoIP companies offered free calls to (and in some cases, from) Japan for a limited time (Manso and Manso, 2013).

As in other recent disasters, the use of social media grew and confirms that, people primarily used it to determine where their family and friends were and establish their well-being (Jacobson, 2011). At this stage, social media has been proven to be a reliable resource to do this. In Japan, besides Facebook and Twitter, there is Mixi (http://mixi.jp/), which is the largest social network site in Japan. Social Media are useful tools for EMAs to get situational awareness from the people in the affected area. The Social Media coverage was huge and it was possible to follow events in real-time. Users could also participate in disaster management by sharing information, links, maps and other information through SNS such as Twitter, Facebook, Mixi, Flickr. –, live video and blogs –CNN live blog, Al Jazeera, NHK CrisisCamps, Google Maps, Ushahidi or Person Finder. (Peters, 2011). YouTube in particular was widely used during this disaster (Pew Research Center, 2012). A survey undertaken by IMJ Mobile (2011) examined the usage of social media as an emergency communication tool. Twitter was mainly used for information gathering (84%) and information sharing (48%). Facebook was used for confirming the safety of loved ones (56%) and information gathering (47%).

Once again emergency managers faced the challenges of monitoring the vast amount of information spreading over social media and tackling

[10] http://www.casa.ucl.ac.uk/tom/

hoaxes, rumours and false information. Cabinet Secretary, Yukio Edano, calmed public fears and avoided media speculation by taking part in regular live press conferences. After the earthquake, the crisis at the Fukushima power plant soon became the main concern. Within a few days, 64% of blog links and 32% of Twitter news links concerned the power plant, according to a research conducted by the Pew Research Center's Project for Excellence in Journalism (2012). Public criticism of both the government and TEPCO, the operator of the plant, started to rise. Cabinet Secretary Edano was praised on Twitter for his clear, articulate speech, his leadership qualities and his willingness to answer difficult questions. While local governments sent updates via Twitter when their servers went down and their web sites became inaccessible, TEPCO, the operator of the quake-damaged atomic power plant, did not issue any tweets after the disaster, although it did have a Twitter profile.

Another issue emerging during the nuclear crisis that followed the earthquake was the communication of scientific information to the public. Specialised vocabulary became common in SM, used not only by officials but by the general public. In this sense, the disaster brought the opportunity to communicate scientific information to the public and educate them through SM. Introducing SM into these debates, which have been occurring among scientists, and letting the public begin to participate is an extremely interesting development.

3.3 Lessons learnt from the literature review and previous disasters

With every disaster the importance of social media and its potential power seems to grow. Social media services (such as Twitter and Facebook) and smart phones are changing the patterns of creating, distributing, and sharing emergency information during emergencies and crisis (Palen et al. 2010; Palen et al. 2009; Shklovski et al. 2010; Shklovski et al. 2008; Starbird et al. 2010). Reviewing these recent disasters highlights how it has become a norm that the initial event is shared by eyewitnesses, and then is quickly spread through social media, before being broadcast through traditional media (Oh et al. 2010). Collective incident reporting and crowdsourcing of information can be considered an integral part of modern disaster management. The online community has now the status of first responders who support emergency response by leveraging their local knowledge, typically not available to professional emergency responders who may be less familiar with the local area.

From the cases reviewed concerning the use of social media in emergencies and disasters we have identified a number of "lessons learnt" when using Social Media for emergency management. These include:

- The need to provide accurate information.
- The value of Social Media for situational awareness.
- The need to stop malicious uses of Social Media during disasters.
- The technological limitations; new tools are needed to monitor social media for situational awareness.

These cases also highlighted the need for governmental EMAs to embrace Social Media to further integrate it into their disaster management processes. Enabled by social media services and mobile phones, collective and participatory responses to community crisis situations are demanding changes to the institutional and organisational arrangements of disaster response. The main challenge in disaster management is to effectively leverage the collective power of citizens connected through Web 2.0 tools (Palen et al. 2010; Sutton et al. 2008). SM has proven its potential in the response to major disasters, through providing a flexible and innovative structure that could be utilised by many individuals, departments and external organisations for the effective acquisition, sharing, use, and maintenance of information and knowledge (Yates and Paquette, 2011).

From the EMAs point of view that means a systematic usage that could include:

- using Social Media in each phase of the disaster management cycle preparedness, response, recovery and mitigation;
- monitoring public activities and postings to establish situational awareness;
- using uploaded audio-visual content to estimate the extent of damage to CI;
- engage in a two-way conversation with the public;
- receive victim requests for assistance;

As illustrated in this literature review, recent research has studied the use of SM for emergency management with two main areas of focus: One stream of research is guided by the aim of providing emergency managers with an adequate strategy to use social media to coordinate responses (White, 2011; Crowe, 2012), while another surveys how people affected by disasters use SM to access and share information, relief and support (Büscher, Mogensen et al., 2008; Starbird et al., 2010; Hughes and Palen, 2009; Sutton, 2010; Sutton et al., 2008, Yan Qu, Zhang et al., 2010). Other research studies the problems in SM usage (Castillo, et al, 2011: Waters, 2010; Oh et al., 2011).

SM adoption within government agencies in general and EMAs in particular is slow and limited, although it is gradually growing. As observed in this chapter, the use of SM for emergency management emerged in public settings outside any authority or government context. In fact, organisations have only recently begun using SM for risk and crisis communication (Booz Allen Hamilton, 2009). In the organisational sense, non-profit organisations led the way in adopting SM tools (Barnes and Mattson, 2008; Liu et al, 2012; Waters, 2010). An early governmental example, subsequent to the successful reports on Twitter usage during recent disasters, is US-based Federal Emergency Management Agency (FEMA), who added Twitter to the national emergency response network in 2007 (Tynan, 2009). Hence, research has paid less attention to how governmental organisations utilise SM both for risk and crisis communication and disaster management. The number of studies is even smaller when focusing on SM in terms of technology adoption (Latonero and Shklovski, 2011; Taylor and Kent, 2007; Taylor and Perry, 2005).

3.4 Conclusions

A review of past crisis events has shown that Web 2.0 and SM offer a resilient and efficient way for citizens to communicate and for EMAs to collect information and communicate during disasters. The examples provided in this chapter are true accounts of the current state-of-the-art in the use of Web 2.0 platforms in crisis situations. However, EMAs in Europe are low in adoption. Still, it is worth noting the exceptions that demonstrate its potential use. The next chapter will provide practical examples of Web 2.0 technologies and SM in Europe that could be used to prepare, respond and recover from disasters.

The Disaster 2.0 project has chosen to focus on Emergency Management Agencies in Europe, as much of the existing literature is based on the USA. Another issue is that previous research investigated just the disaster response usage of Web 2.0 (White, Plotnick, Kushman, Hiltz, and Turoff, 2009; Bharosa, Appelman and de Bruin, 2007; van de Ven, van Rijk, Essens, and Frinking, 2008). Other streams of research observe how the public, including volunteers, and those affected by a disaster use SM (Liu, Iacucci, and Meier, 2010; Hughes and Palen, 2009; Starbird and Palen, 2011; Sutton, Palen, and Shklovski, 2008).

Consequently, few studies have investigated how EMAs utilise Web 2.0 technologies both to communicate with stakeholders before and during emergencies and to manage operations (Latonero and Shklovski, 2011). Hence, this project is focused on the perspective of practitioners and emergency managers, as well as the organisational perspective.

Chapter 4

Disaster 2.0 Project methodology

This Chapter describes out methodology in collecting and analysing the data for the project. As noted in the Introduction, the team collected data from five European countries. The aim was to understand how different emergency management agencies, both governmental and independent, were using and could potentially use Web 2.0 in disaster and emergency management. This chapter provides details concerning the qualitative research methodology used in this project to develop an understanding of the "social world" (Robson, 2002) of using these technologies through interviews, focus groups, and observations, both online and face-to-face. The project also used quantitative data to provide an adequate framework to interpret the qualitative data and to provide insights that help to answer the research questions. Overall, the emphasis was on:

- a participatory methodology which engages stakeholders in the project and makes the results available to all actors interested in emergency response and disaster management;
- a comprehensive methodology, which covers individually all 5 countries; and
- a multidimensional methodology which makes use of both primary and secondary data as well as qualitative and quantitative data.

4.1 Objective and aims

The primary objective of this study on Social Media (SM) usage by public sector emergency management agencies (EMAs) was to understand the benefits and drawbacks of using SM for disaster management. That allowed the formulation of the principles for adopting and using Web 2.0 platforms clearly explaining their degree of transferability and usefulness in other settings. The study of SM adoption is complemented with non-usage cases,

as they provide practical understanding about the barriers and difficulties in adopting SM.

More concretely, this research project aimed to:

a) Identify innovative uses of Web 2.0 platforms by emergency management agencies (EMA).

b) Understand which Web 2.0 practices have worked and the procedures of its adoption within the organisation and in relation with other stakeholders.

c) Improve information management during disasters and emergencies through improving EMAs' understanding of Web 2.0 platforms.

d) Establish how successful these Web 2.0 platforms have been in mitigating damage to Critical Infrastructure (CI) and building resilience in the public

e) Determine what problems arise in using these platforms.

f) Provide a road map of how Web 2.0 tools can help information and emergency management, specifically when communicating with the public.

g) Develop an illustrative list of case studies of EMAs currently using Web2.0 applications for disaster and emergency management.

h) Identify transferable lessons which can assist in future adoptions of Web 2.0 platforms.

To meet these aims, this report has provided in the previous chapter the lessons learnt from past disasters. The following chapters provide more detailed information about innovative applications of Web 2.0 tools by EMAs in Europe. It also delivers practical recommendations and advice on how to further use Web 2.0 tools for disaster and emergency management. In order to achieve this objective, (1) the team worked with a range of countries and disaster scenarios; (2) the team collected data from these countries in several forms (such as interviews, focus group, case studies); (3) the data was analysed, and finally, (4) the team reported results and drew recommendations about how to adopt SM for emergency management.

The next table summarises all the key stages of the Disaster 2.0 research project:

Activity	Description	Month
1. Inception	Formation of the D2.0 team and start of the project	1
2. Country sample	Although the countries were already selected in the proposal the D2.0 assessed their suitability and made some changes in order to better capture diversity.	1
3. Formation of International Advisory Board (IAB)	The D2.0 project created an IAB to support and guide the research process. The board comprised one expert in each core country and was chaired by an expert from UK.	2-3
4. Review of the available material • Academic publications • Grey literature and reports • Blogs, News and online publications • Policies and legal approaches	Review of the academic and practitioner literature on the use and application of Web 2.0 in disaster and emergency scenarios. The D2.0 team continued to review the literature constantly given the fast-moving nature of the topic and the rapid advances in Web 2.0 and its usage. The review also examined policies and regulations regarding the use of Web 2.0 technologies.	1-24
5. Setting up of the project web-site, SM accounts and repository	A website was created to inform emergency management and research communities about the activities undertaken under the D2.0 research project: www.disaster20.eu A Twitter account was set up: @d2h4 As was an online repository containing literature, reports and case studies of the application of Web 2.0 technologies: http://repository.disaster20.eu/	1-24
6. Meeting with the IAB	Inception of the project with the IAB. Collected feedback from board members. Agenda: • Project Objectives • Project Progress to date • Constitution of the Advisory Board and its role • Planning for country visits • Planning for masterclasses and hackathons	3
7. Initial methodology for the data collection and country visits planning	Development of the interview questionnaire, structure of the focus groups, etc.	4-7
8. Observation online	The D2.0 team collected data and participated on Web 2.0 tools observing how EMAs are using SM.	4-22
9. Selection of the Interviewees and participants in focus groups	Selection of the interviewees in each country with the IAB	7-9

10. Data collection visit to Italy	Interviews	The team conducted 8 interviews with EMs, including geologists working in the area of earthquake hazards, meteorologists and civil protection staff.	9
	Presentations	Members of different organisations with a role in EM during a disaster presented examples of SM usage for different stakeholders (i.e. LaMMa, ARPA, INGV, Civil Protection, traditional media and NGOs)	
	Focus groups	Several focus groups and information group discussions. For instance a discussion about the usefulness of geographical crowd-sourced information took place. In total there were 3 focus group and 6 informal discussions.	
	Institution visits	The team visited a Civil Protection Centre, LaMMa and a research centre, as well as several other institutions.	
11. Data collection visit to Greece	Interviews	Interviews conducted with various emergency responders including members of the Police Force, Fire Brigade, Coast Guard and Civil Protection Service. In total 12 interviews were conducted.	9
	Presentations	The visit included 6 presentations from agencies that described their Web 2.0 usage and also explained their organisational structure.	
	Institution visits	Several EMCs were visited (e.g. the Civil Protection Operation Centre and Hellenic Police Headquarters). The emergency services gave a demonstration of how they organise their response during emergencies.	
12. Data collection visit to Belgium	Interviews	During country visit in Belgium the team undertook 12 interviews with emergency managers from several agencies, including Crisis Centre of Brussels, Fire Department of Antwerp and Safety Centre Europe.	11
	Presentations	There was a presentation from the City of Herentals	
13. Hackathon 1	Software developers and EM experts from around the world came together for h4d2, a hackathon for disaster response. The two day event saw participants working together to develop software and solutions to real-world problems faced by emergency management experts. This event provided -insightful data about new open processes for emergency management and tried to exchange and transfer knowledge among different stakeholders. More information: http://h4d2.eu/h4d2-september-2012/		13
14. Data collection visit to Poland	Interviews	In Poland the D2.0 team conducted interviews with several government agencies, such as Fire Brigade, Police and authorities at local level.	14
	Institutions visit	The team visited the Municipality EMC and had the chance to observe the information management systems used in case of emergency.	

15. Masterclass 1: Protecting the public and building resilience through SM**.**	The aim of this masterclass was (1) to publicise best practice and important lessons for effective SM usage drawn from across Europe. With five countries involved in the D2.0 project, this masterclass drew together the best from each country, aiming for the line-up of presentations to be a representative sample of activity; (2) to encourage networking and to build lasting connections, and (3) to provide examples and case studies to include in the final report. Masterclasses were led by emergency practitioners and policy makers from around Europe and speakers also included humanitarian activists and heads of communication of EM agencies. More information: http://www.disaster20.eu/masterclass1/ These masterclasses provided insightful practical data about different strategies EU EMAs adopted to leverage Web 2.0 tools. They also provided valuable lessons about the drivers and barriers EMAs faced in adopting SM for disaster management.		15
16. Data collection visit to Germany	Interviews	In Germany the D2.0 team had the opportunity to interview a wide range of stakeholders involved in the emergency management: including a head of press office, a nuclear risk expert, a health emergency manager, etc. Members of non-government agencies were also interviewed.	15
	Institutions visit	The team visited an EMC and observed its information management systems in operation.	
17. Masterclass 2: Disaster information: the use of SM and semantic technologies	This masterclass followed the same aims as the first one. During masterclass 2 several emergency managers, policy makers and researchers shared experiences on the use of SM. As in masterclass 1, these interactions provided applied case studies about SM usage in disaster management in the EU.		17
18. Analysis of primary and secondary data	After data collection visits , data analysis took place.		12-22
19. Hackathon 2	Disaster management experts, humanitarian hackers and other interested parties proposed challenges which could further the development of existing software projects, start new projects or develop resources. These challenges were addressed over the hackathon weekend. This event provided us insightful data about new open processes for EM and aimed to exchange and transfer knowledge between different stakeholders. More information: http://h4d2.eu/blog/		20
20. SMERST Conference	This conference aimed to bring together researchers and practitioners in emergency response and humanitarian disasters who shared an interest in SM and/or Semantic Technologies. The conference enabled discussion of research findings and provided insight into different approaches and practices. The conference gave new breadth to the SM usage case studies, as the team learned about new strategies of usage, as well as the latest academic research in the area. See more at: http://www.disaster20.eu/smerst-2013/#sthash.I81ewO3x.dpuf		20

21. International Advisory Board meeting	The team met with the advisory board in order to: (1) Organise feedback visits (2) Provide a first presentation of the workshop that will take place in each country and receive feedback in order to adjust the workshop to the specific needs of each country. The team was able to check the validity of the results with each advisory board member and to include some topics of interest that were not covered earlier.	20
21. Feedback collected from country visits.	Feedback visits to the core partner countries allowed to the team present the results of the project and knowledge transfer. It also permitted to get feedback and check whether EMs agree the way we have reflected and report their practices (according to the ethics of the project).	22-23
22. Final Report	The final report collecting the case studies and exploring the benefits of using Web 2.0 tools, drivers and barriers of adoption and recommendations to use, or expand usage of, SM.	20-24

Figure 4.1: Key stages of the research project

4.2 The countries visited and their disaster scenarios

The project involved the participation of five European countries initially: Italy, Greece, Belgium, Poland and Germany to ensure that multiple perspectives were considered. Although these five European countries are the core partners of this project, early research uncovered valuable examples of Web 2.0 and SM usage in other European countries. Hence, the project also included data from Spain, UK, Finland, Iceland and Netherlands. This international approach is important, as each country has its own approach to using Web 2.0 platforms during disaster response. Also the various countries each had their own emergency management systems, organisational structures and societies. However, it is important to remember that all the countries share a common feature: they are at risk of major disasters, such as tsunamis, earthquakes, floods, etc.

Purposive sampling was used to select the government organisations and the non-government organisations participating in this research project. A purposive sampling strategy is where “members of a sample are chosen with a ‘purpose’ to represent a location or type in relation to a key criterion” (Lewis, 2003, p.79). Our overall purpose was to identify a variety of country types (richer/poorer) with a variety of different disaster types (floods, forest fires, earthquakes, public events/disorders, nuclear, etc.). Thus we excluded some countries based on an informal assessment that their disasters did not provide sufficiently rich potential material (e.g. the Irish Republic, Norway). This approach largely served the purpose of limiting the scope and size of the project for practical reasons.

Before beginning the research project an advisory board was formed by

representatives of each of the five core countries. The role of the International Advisory Board (IAB) was to guide the research and ensure that the project reflected the various national priorities for emergency management. The IAB members in each respective country helped the project team in recruiting both governmental and non-governmental organisations – at national, regional and local level – to participate in the research. The team worked jointly with the IAB to create a list of the types of emergency managers to interview. Each advisory board member was provided with information on the types of emergency managers and other subjects (such as journalists, scientists, researchers) that the team was interested in interviewing. This helped to capture a comprehensive picture of Web 2.0 tools usage and analysis in each country.

Researchers from the Disaster 2.0 project visited each of the partner countries. The countries, the names of their representatives on the IAB, and examples of the hazards they face, are given in Figure 1.2. The table also lists the various agencies in each country that took part in the study. Many Disaster 2.0 countries were preparing for one or several key hazards which were high on their risk register. These high risk hazards are included in the figure, but note that these are some hazard examples among a number of threats for these countries.

4.3 The Data collection

A broad range of data collection techniques were used in the project. While it was possible to gain insights into the problems posed by the use of SM for disaster management (through the literature review and other abstractions such as analysis of previous disasters) from the perspective of the public, comprehensions from the public sector agencies are limited, especially where the focus is on Europe. In this scenario, then, it is essential to understand how EMAs and other experts, working with government agencies, are currently using SM, what problems and benefits they perceive and how and why they adopted, or failed to adopt, SM.

Qualitative research, a method concerned with understanding a research participant's social world, was deemed the most appropriate means to achieve the project goal for the following reasons:

- Its focus on viewing "events...through the eyes of the people... (studied)" (Bryman, 2004 279); in this case the views of the experts already using Web 2.0 technologies and those not using them.

- Its focus on the understanding, explanation and "rich descriptions" that interviewees provide of the area under study (Miles and Huberman, 1994).

- Its provision of flexibility, allowing the researcher to change direction during the research and follow up emerging themes (Bryman, 2004).

4.3.1 Country visits

The countries were each visited twice - once to collect data and once to provide feedback to the participants:

Visit 1 data collection: During each country visit the Disaster 2.0 team collected data in several ways as shown in figure 4.1. Interviews were carried out with experts, practitioners and/or focus groups in emergency management. Emergency managers or other experts also gave presentations about their work. Experts were chosen on the recommendation of the relevant IAB member. Site visits were conducted e.g. an emergency response agency headquarters in Greece and an emergency operations centre in Belgium. The interviewees, focus group and site visits were chosen and organised in collaboration with the IAB member of each country. Hence, participants were chosen with advice from the International Advisory Board (IAB) and selected for their leadership perspective and position in the disaster and emergency management process. (Months 9-15).

Visit 2 Feedback sessions: The second visit aimed to explain the project findings and outline opportunities to further strengthen countries' use of SM for emergency response and risk communication. Feedback visits were also an opportunity to report to the EMAs the recommendations drawn from the project and receive insights about how each agency could see itself applying those recommendations. (Months 22-24).

All data collection and analysis followed the standards required by Aston University's Ethics Committee. First, the team undertook an anticipated risk/benefit analysis of the research project. Members of the research team have experience of conducting research in the emergency management field and discussing potentially sensitive topics. The team minimised this potential risk by paying close attention to any signs of respondents showing discomfort (Lewis, 2003). Second, informed consent was gained from participants. Interviewees were provided will detailed information about the project and the research process before they agreed to participate. And finally, with the respondent's consent, all interviews were audio recorded. The data for each therefore comprised: the audio recording, researcher's handwritten notes, transcripts and any documents provided by the respondents. In this report, all information and interviewee responses are anonymised so that individual participants cannot be identified. All publications and public data that make use of the data will omit information that could lead to individual respondents being identified.

The next section will explain the use of qualitative methodology and how qualitative research methods were used to collect the data outlined above.

4.3.2 Data collection techniques

Practitioner interviews: These voice-recorded, semi-structured discussions (Mann and Stewart, 2000) were used to collect data from as wide a range of people as possible as they are "a very good way of accessing people's perceptions, meanings, definitions of situations and constructions of reality" (Punch, 2005). The interviews undertaken, although necessarily limited, covered the main emergency managers and other experts involved in the communication processes before, during and after a disaster or emergency. Choosing participants with a range of experiences (policemen, firefighters, volunteers, communications staff, journalists, researchers, etc.) increased the possibility of shedding light on the research questions from a variety of aspects (Patton, 1987; Adler and Adler, 1988). These interviews enabled triangulation of results with the literature review (as recommended by Hammersley and Atkinson 1995). The interviews also enabled the team to fill information gaps detected in the literature and secondary data review.

Handwritten notes were taken by the researchers to back up the recordings, and the interviews were transcribed verbatim to allow for easier analysis. The purposes of these interviews were:

- to obtain a practical assessment of the initiatives EMAs took regarding the use of Web 2.0 platforms for emergency and disaster management,
- to obtain practical information about ways of adopting these technologies, taking into account the incentives and barriers within the organisation and regarding other stakeholders who are formally or informally involved in the emergency management process,
- to learn about the benefits and disadvantages of using SM for emergency management,
- to obtain an up to date picture of innovative practices at national, regional and local levels, beyond the literature currently available,
- to obtain information about future plans for using Web 2.0 platforms.

Focus groups: Conducting group interviews with several subjects on a specific topic or issue (Bryman, 2004: 345) was an appropriate method to collect data from the IAB. Individual IAB members had their own perspectives of the different applications, advantages and barriers of Web 2.0 tools for disaster management and the focus group was an opportunity to share and collect these. The group situation also allowed members of the IAB to respond to each other's views and build knowledge and agreement collectively as they discussed the issues (Shaw et al, 2006). The focus groups were also valuable as they gave stakeholders the opportunity to discuss the implications of using SM for their respective EMAs and for communication

with other stakeholders. Focus groups also helped to identify general policy and regulation issues facilitating or impeding further adoption. Thus, the purposes of the focus groups were:

- to get practical insights of the difficulties and benefits of using Web 2.0 to maintain relationships with other stakeholders,
- to engage several stakeholders in a common discussion about the benefits of using SM and the barriers against its adoption,
- to understand whether Web 2.0 tools can sustain inter-organisational communication and management.

Masterclasses: Examples of practice were selected from the participating countries and presented to emergency managers and practitioners during two masterclass sessions. The masterclass sessions provided another means to understand practical examples of Web 2.0 usage for emergency management. Participants of the masterclasses included emergency managers, press-officers of emergency agencies, researchers, policy-makers (from government organisations such as FEMA), and other professionals. The data collected through the master classes informed the narratives about how specific organisations are using Web 2.0 tools. The main objectives of the masterclasses were as follow:

- to learn from examples of SM usage,
- to share different strategies and procedures in emergency management using Web 2.0 tools,
- to provide emergency managers with a range of transferable practices,
- to promote knowledge exchange and sharing,
- to obtain a practical insight about the transferability of the case studies,
- to promote social networking.

Visits to public sector agencies: During the data collection visits, some countries gave tours of their emergency operations centres, emergency rooms in government agencies (such as the fire brigade), institutes or centres of research (into subjects like volcanology or weather forecasting), city councils and other government organisations. Visits to these centres, headquarters and labs provided opportunities to view how operations are managed on a daily basis and how Web 2.0 tools are used, or not, in practice. The team was also able to observe which technological equipment and resources were available to each organisation. The goals of these visits were:

- to observe emergency managers at different levels in practice,

- to learn about the standard operational procedures during emergencies,
- to obtain practical knowledge about information flow during crisis and emergency situations,
- to understand what types of equipment, hardware, software and other resources the organisations have.

Observation and participation: The internet has been a productive place for research (Markham, 2004). Online observation of the EMAs' SM accounts gave the team insights of the kind of content published, as well as the interactions that took place in Web 2.0 platforms, such as Facebook, Twitter or YouTube. In order to understand online practices it is important to take part in them, consequently the Disaster 2.0 team participated in these conversations through a Twitter account (@h4d2).

The participant observation (Hine, 2005) allowed triangulation of the data, as the team was able to compare actual online practices to those described in earlier interviews. It also allowed detection of additional practices not discovered in the initial sample. For instance, one occasion the team conducted an additional interview in order to ask about something they observed online. Additionally, participation gave a deeper understanding of the cultural practices emerging (Denzin and Lincoln, 2000) through the use of Web 2.0 tools by EMAs. The objectives were:

- to learn about strategies and actions in SM communication,
- to acquire knowledge about the impact of the SM accounts (number of followers, likes, re-tweets, etc.).
- to triangulate the data,
- to engage with EMAs in order to promote knowledge transfer.
- To establish a social network of experts around the project.

Other data sources: The project also employed other available data to inform the results and provide validation. The sources used during this piece of research included:

- Review of the literature produced by international organisations e.g. European Commission, U.S. Department of Health and Human Services, UNICEF, Digital Humanitarian Network.
- Review of national sources of literature and web-resources (from national ministries, regional and local government, sectorial bodies, foundations and research institutes)

- Review of academic literature (including proceedings of the ISCRAM conference, Journal of Homeland Security and Emergency Management.).
- Review of relevant blogs and online news (such as iRevolution, iRescate).
- Review of quantitative databases (Eurostat, comScore, SocialBakers).

While there are a number of helpful general studies and reports on the use of SM and Web 2.0 technologies for emergency management by different international organisations, these alone did not address our research aims directly and in sufficient depth. The literature review was therefore complemented with interviews of national, regional and local stakeholders and emergency managers in all countries covered by the study. This provided the research team with information about the latest developments in this area and future initiatives - information not available in public reports or other literature.

4.4 Analysis

This section outlines the techniques used to generate the findings on how the participating countries are currently using Web 2.0 technologies for emergency management, and how this usage could potentially change in the future. In doing this it provides the analytical framework for the project, according to the theoretical section presented previously. The actual results of the analysis will be presented in Chapter 5. This section explains the techniques used to analyse the data.

To understand how countries and emergency agencies are using Web 2.0 tools and which drivers and barriers they face to their adoption, the whole set of data has been analysed through thematic analysis following three steps: “data reduction, data display, and conclusion drawing/ verification” (Miles and Huberman, 1994, p10). Information on how this data was analysed is presented below, starting with how the data was reduced, displayed and drawn/verified.

Thematic analysis allowed for scrutinising all the data gathered together under the same focus, with no need of distinguishing their source, while maintaining consideration of the context in which the data is embedded (e.g. case studies, interviews, focus groups, observations, masterclasses, SM data). Thus, the main advantages for Disaster 2.0 of this technique are:

- Fitting the data into their context: e.g. who was the interviewee -what was his/her role, his/her experiences, opinions - and the socio-cultural background to the content itself.
- Rules of analysis: follow a process of analysis.

- Themes at the centre of analysis] both based in the theoretical framework (Technology Adoption Theories) and in themes that repeatedly emerge from the data (such as trust and reliability on SM information).
- Criteria of reliability and validity.

4.4.1 Data coding, reduction and themes

This section of the report details the data analyses process followed. Data reduction is the process of analysing raw data and understanding the general messages it contains – attempting to reduce it to a more manageable set. Data can be reduced through "the process of selecting, focusing, simplifying, abstracting, and transforming the data that appears in written-up field notes or transcriptions" (Miles and Huberman, 1994, p10). Thus, all the data (handwritten notes, transcripts and other documents) were analysed in this way.

The first task for data reduction was to develop a "provisional 'start list' of codes" (Miles and Huberman, 1994) covering the topics to analyse. The "start list" of codes was developed by reviewing the Disaster 2.0 project proposal, the areas of literature identified in Chapter 2 and any notes/documents that had been collected during the research (e.g. from negotiation visits and the IAB).

Table 4.1: Example of theme, category and codes.

Theme	Web 2.0 platforms impact on Critical Infrastructure	
Category	Positive	Negative
Codes	a) Report of damage in infrastructure b) Information available for everybody to act accordingly (e.g. Avoiding a damaged route).	i) Unreliable information ii) Lack of trust iii) Information available for everybody, including individuals who could be a threat.

Table 4.2 outlines some examples from the "start list" of themes and categories that were developed to analyse the transcripts and identify how countries are using SM. Additional themes and categories emerged from the data during analysis.

The 'start list' of codes was revised during the process of applying them to the transcripts. The team used a process of check-coding to ensure there was a consensus on the meaning of codes (Miles and Huberman, 1994). After coding, the team was able to develop a comprehensive list of themes regarding the use of Web 2.0 tools for emergency management, paying attention to the drivers and barriers to its adoption.

Table 4.2: Example of themes and categories in the start list.

Theme, Categories and Sub-Categories			**Definition**
Web 2.0 platforms impact on Critical Infrastructure			CI
	Positive		CI-P
	Negative		CI-N
Strategy and actions on SM usage			SA
	Situational awareness		SA-SA
	Community engagement		SA-CE
	One-way communication (pull strategy)		SA-PULL
	Two-way communication (push strategy)		SA-PUSH
Web 2.0 tools adoption			TA
	Social factors		TA-SF
		Drivers	TA-SF-D
		Barriers	TA-SF-B
	Technological factors		TA-TF
		Drivers	TA-TF-D
		Barriers	TA-TF-B
	Economic factors		TA-EF
		Drivers	TA-EF-D
		Barriers	TA-EF-B
	Standard Procedure Factors		TA-SPF
		Drivers	TA-SPF-D
		Barriers	TA-SPF-B

4.4.2 Data displays

With the objective of identifying relationships across the themes, the team developed “data displays”. This is an analytical technique that helps to draw descriptive conclusions about a research topic and to identify relationships. A display is “a visual format that presents information systematically, so the user can draw valid conclusions and take needed actions” (Miles and Huberman, 1994, p91). Creating a display for coded data enabled the team to: (1) identify how each country is using Web 2.0 platforms; (2) draw general patterns on the use that can be transferable to other countries. It also allowed selection and reporting of case studies, avoiding repetition but providing useful recommendations.

One data display was produced to analyse the coded data. It was a “conceptually ordered display” where the data were ordered by themes generated through the coding process (Miles and Huberman, 1994: 127). One display was produced for each country. Each row of information on the

display provided the name of the theme (e.g. situational awareness), the reference to a source (e.g. an interviewee), and the data describing what had been said (e.g. a quotation). Table 4.3 provides an example of data display created.

Table 4.3: Example taken from the data display

Theme	Interviewee	Data
Situational awareness	Country 1, interviewee 11	"It is very valuable (talking about the use of SM) to get direct information from the place where the disaster is happening, as pictures, media does this to some extend"

Displaying the data as above for each country allowed the team to understand the interview data relating to each of the different themes and to observe emerging themes and innovative uses. This analysis resulted in refined data and a deeper understanding of how countries use and adopt SM.

4.4.3 Drawing conclusions

Finally, the team drew and verified conclusions. To reach conclusions from the coding and data displays, further analysis involved:

- Relationships across themes: By coding the data and developing data displays, the team identified recurring patterns, themes which pull together many separate pieces of data and established relationships across themes.

- Grouping themes: The existing theory and data analysis were used to group themes that had similar characteristics, with the aim of understanding particular themes better.

- Detect commonalities and differences: The coding of the data and the different data displays were used to compare and contrast the countries' approaches to using Web 2.0 tools. This highlighted the differences in approach the countries were taking to prepare their populations.

- Drawing general recommendations from findings: This data analysis activity is concerned with the generalisation of the particular findings and with the transferability of usage experiences between emergency management agencies

Once the team had drawn conclusions from the data analysis, they had to test and verify the findings. This process establishes the credibility and validity of the research. Credibility deals with the focus of the research and establishes confidence in how effectively the data and processes of analysis address this focus (Polit and Hungler, 1999). The first issue regarding credibility occurs when deciding on the focus of the study, selection of context, participants and approach to gathering data. Choosing emergency managers with various experiences, from different contexts and organisations increases the possibility of shedding light on the research question from a variety of aspects (Patton, 1987). In this study, interviewees' and participants' varied roles in the disaster management process contributed rich insights into the subject. Selecting the most appropriate method for data collection is also important in establishing credibility.

Credibility of research findings also deals with how well categories and themes cover the data, that is, ensuring no relevant data have been inadvertently or systematically excluded, or irrelevant data included. In order to avoid this, analysis combined inductive and deductive techniques appropriate to the exploratory nature of the research and the innovative features of the subject.

Another important issue for the project was the question of transferability, which refers to "the extent to which the findings can be transferred to other settings or groups" (Polit and Hungler, 1999: 717). This is important as one of the objectives was to provide transferable lessons which can assist in future adoptions of Web 2.0 platforms. To facilitate transferability it was important to give a clear and distinct description of culture and context. The careful selection of participants and consideration of their characteristics during data collection and analysis also contributed to the transferability of the findings.

This chapter has outlined and described the D2.0 project's methodologies and techniques, both qualitative and quantitative, and explained the particular advantages offered by the chosen approach. The project's methodologies were selected to ensure a high degree of credibility and validity while combining insights from participants in emergency and disaster management and secondary data. The next chapter will examine the research findings.

Chapter 5

Usage and adoption by European emergency management agencies

5.1 Introduction

This chapter builds upon the literature review and examples of Social Media (SM) use provided in chapters 2 and 3. It outlines the findings on risk and crisis communication practices across Europe to demonstrate how practitioners can use SM to better manage risk, crises and disasters. It also provides recommendations for emergency managers to incorporate SM tools in risk and crisis communication. This chapter reports on Web 2.0 technologies and SM usage by emergency managers and provides recommendations for the systematic use of these platforms and tools for emergency management. The challenge for Emergency Management Agencies (EMAs) today is to understand how Web 2.0 platforms can help them become more effective. While Web 2.0 provides an opportunity for emergency management, it also generates several questions: "how can they make sure that the information that is "out there" is accurate during an emergency event?" (Palen et al. 2010), "how can they make sure that all the stakeholders have the correct information when needed before, during and after a disaster and what benefits brings SM usage for EMAs?"

The chapter is structured as shown in Figure 5.1. The first part describes quantitative data of citizens' Internet usage and Government 2.0[1] (Mergel 2010; Chun et al 2010). Its aim is to show the impact these technologies have had on society, making online interaction an essential part of life today.

[1] E-government is broadly defined as digital interactions between a government and citizens and other stakeholders. Government 2.0 combines Web 2.0 fundamentals with e-government, although usually refers to citizen participation by using open-source platforms. EMAs are mainly governmental agencies, hence we can consider that their usage of SM is part of the e-government strategies of public administrations.

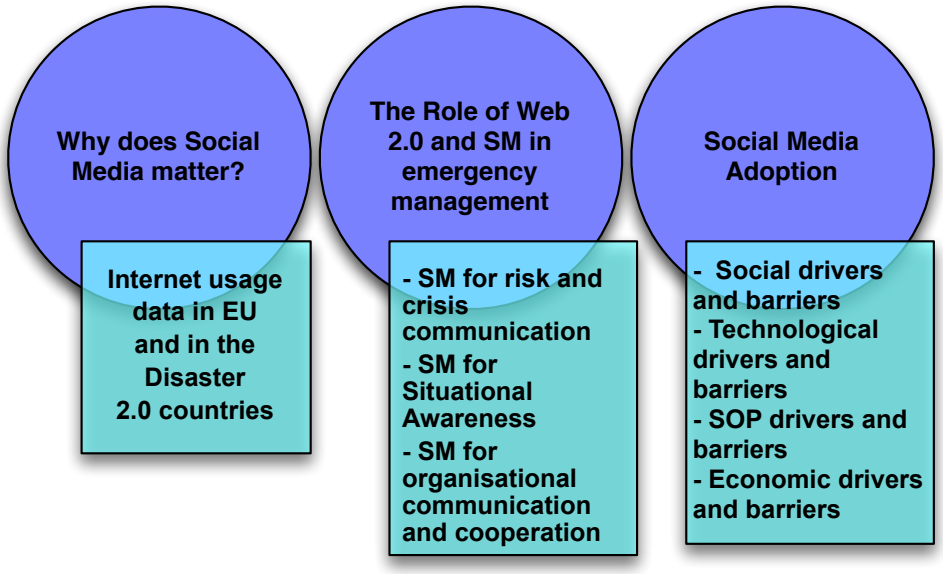

Figure 5.1: Structure of Chapter 5.

The second section offers empirical data collected from European EMAs illustrating the role of Web 2.0 technologies and SM for disaster management. This section is structured around three themes found in the data: the use of SM and Web 2.0 to support risk and crisis communication, the use of SM to improve situational awareness when an incident happens and the use of SM in inter-organisational and intra-organisational cooperation. The section provides examples of the strategies EMAs have applied when using SM from in both communications and operations Consequently, this section provides real practical cases of Web 2.0 usage that could be very helpful for practitioners wishing to improve their communication and operation strategies using SM.

The third and final section of this chapter focuses on the technology adoption process within European EMAs. In doing this, the team paid attention to the drivers and barriers for adoption. When an EMA decides to use SM all the organisation is affected and decision makers need to develop strategies not only in terms of usage but as well in terms of adoption. Thought must be given to how SM adoption impacts the organisation and how best to develop or adapt governance structures to facilitate the use of Web 2.0 technologies.

The Web 2.0 results in this chapter are complemented by the case studies included in the case studies book see “Disaster 2.0 Case Studies”.The following figure (Figure 5.2) summarises those case studies.

COUNTRY	EMA	TITLE
BELGIUM	City of Antwerp and Fire Brigade of Antwerp	Working together: from Emergency Managers' (EMs') personal social media profiles to official governmental accounts.
GREECE	Hellenic Police	A two-way communication with the citizens: Humanization of a public sector agency.
ITALY	Istituto Nazionale Geofisica e Vulcanologia, INGV (National Institute of Geophysics & Volcanology)	Communicating uncertainty on SM / Citizens as sensors / Researchers managing the SM profiles.
ITALY	Centro Intercomunale di Protezione Civile Colline Marittime e Bassa Val di Ceccina	The power of Crowd-Sourcing Maps / Operational Monitoring
SPAIN	Catalonian Civil Protection	Twitter as a key channel for risk and crisis communication
UK	London Fire Brigade	Spreading the message, community engagement and communication strategy

Figure 5.2: Summary of the Disaster 2.0 case studies. See Case Studies book.

5.2 Why does Social Media matter?

Social Media is redefining social life. Web 2.0 and SM have become essential communication and information media. Governments in general and EMAs in particular are realising that it is essential to use the communication tools that citizens and other stakeholders use. And the facts about social media are persuasive:

- Facebook has over 1.11 billion users (active March 2013) and more than 1 billion profiles,
- Twitter has over 200 million users (active February 2013),
- LinkedIn has over 225 million members,
- Every minute, 72 hours of video are uploaded to YouTube.

Over the last few years, Web 2.0 technologies have had a profound effect on the lives of European citizens, offering them an increasing number and range of opportunities to access information, communicate with others, gain and exchange information and build communities. The high rate of penetration of Web 2.0 technologies and SM (or social network sites) has clearly pushed governmental agencies to use these tools to engage with the citizens in all government areas. Emergency management agencies also have been increasingly using Web 2.0 services.

This section aims to examine Internet usage in general, and Web 2.0 tools in particular, in order to provide a context to understand the EMAs adoption in each country. This will improve emergency managers' understanding of the public's engagement with Web 2.0 tools and e-government services in order to make informed decisions about adopting and implementing SM.

We found that countries did not always have the clear argument for why to use SM. We also found incorrect assumptions about the use of SM in several countries. Countries also need solid reasons and clear benefits to begin using these technologies for EM. Below in table 5.2. we summarise the state of use in each project country. The data about the main online activities citizens in each country take part in is presented to help EMAs to decide which Web 2.0 platforms to adopt, and to better understand the online habits of the population. The project team has used the Eurostat database, years 2011 and 2012, unless indicated (Table 5.1).

Table 5.1: Eurostat Indicators used in this section - Source: Eurostat

EUROSTAT INDICATORS ABOUT INDIVIDUALS INTERNET USE
Interacting with public authorities
Obtaining information from public authorities from public authorities web sites (last 12 months)
Downloading official forms
Downloading official forms (last 12 months)
Sending filled (official) forms (last 12 months)
Participating in professional networks (creating user profile, posting messages or other contributions to LinkedIn, Xing, etc.)
Consulting wikis (to obtain knowledge on any subject)
Taking part in on-line consultations or voting to define civic or political issues (e.g. urban planning, signing a petition)
Reading and posting opinions on civic or political issues via websites
Participating in social networks (creating user profile, posting messages or other contributions to Facebook, Twitter, etc.)
Posting messages to social media sites or instant messaging
Uploading self-created content to any website to be shared
Reading/downloading online newspapers/news
Finding information about goods and services

5.2.1 Europe

In the Europe Union 70% of individuals accessed the Internet at least once per week during 2012 and this number has been growing during the last few years, as Figure 5.3 illustrates. Europeans go online at least once a day at a rate of 58.5%, and 24.4% of people have never used the Internet.

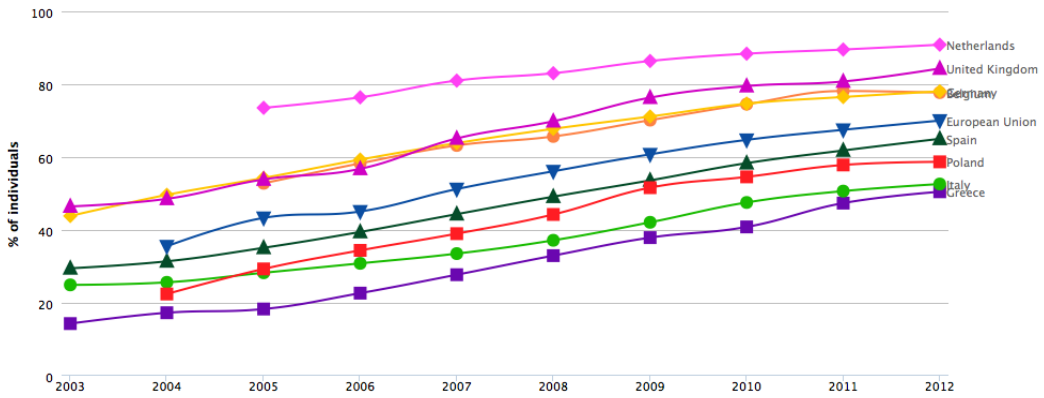

Figure 5.3: Individuals who are regular internet users (at least once a week), by all individuals (age 16-74) (Source: European Commission, Digital Agenda Scoreboard)

As illustrated in Figure 5.4, during 2012 44% of Europeans interacted with public authorities online, increasing from 41% in 2011. Individuals obtaining information from public authorities on the Internet also increased from a EU27 percentage of 35% in 2011 to 39% in 2012. As explained in the introduction of this chapter, we consider SM usage by EMAs as part of Government 2.0 services. Hence, it is important for EMs to know how often citizens interact with public authorities online as it can give an idea about the willingness to use other Government 2.0 services.

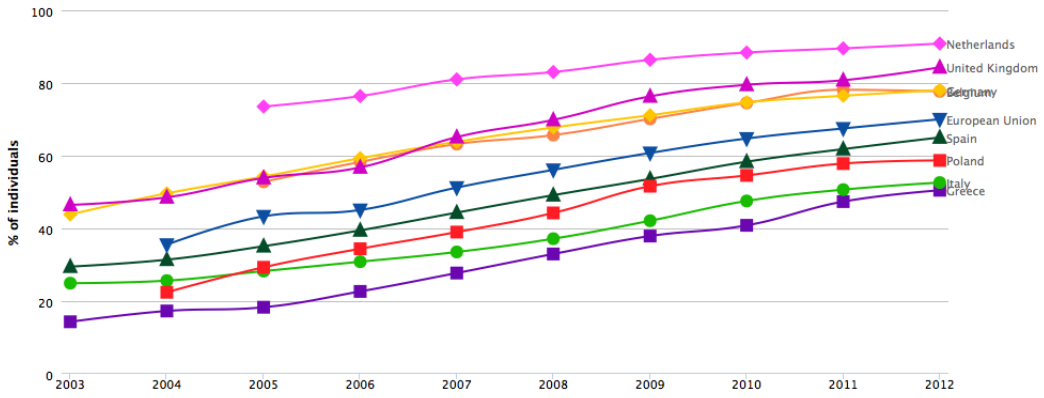

Figure 5.4: Individuals interacting with public authorities (last 12 months), by all individuals (aged 16-74) (Source: Eurostat 2012).

The core indicators for social networking sites (SNS) take up (such as Facebook, Twitter or LinkedIn) show that most Europeans are using them. According to Eurostat 2011 data, 38$ of EU27 individuals are participating in SNSs, ranging from 26% in Italy to 72% in Iceland, as shown in Figure 5.5.

Table 5.2 below, describes all the EU27 indicators reviewed for the Disaster 2.0 project during 2011 and 2012.

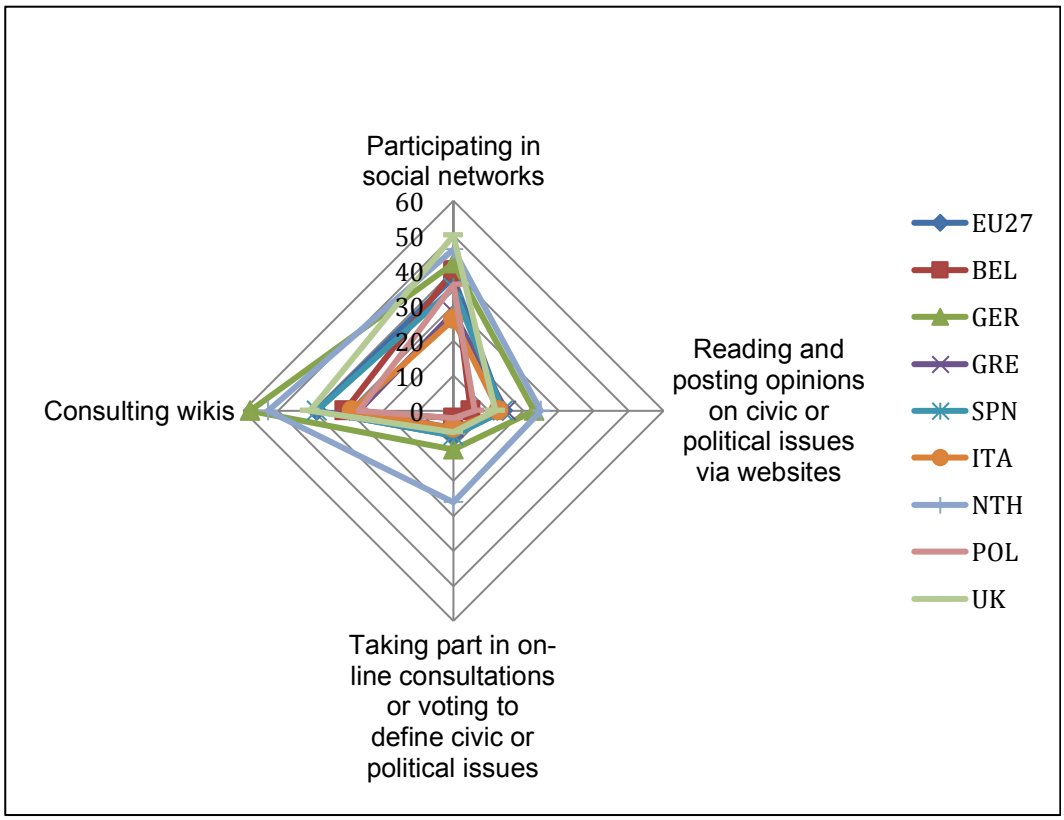

Figure 5.5: Percentage of individuals and activities online (aged 16 to 74) (Source: Eurostat (2011))

Europe has 223 million Facebook subscribers according to Internet World Stats (2012). Awareness of Facebook is close to 100% among European Internet users, although Facebook is not the only network they use. Citizens actively use Twitter, Google+ and LinkedIn among others (Ball, 2012). The Netherlands is the most active country on Twitter in the world – 33% of accounts located in the Netherlands posted at least one publicly visible tweet between 1st of September 2011 and 30th of November 2011 – Japan was second with 30% and Spain third with 29%. The European Union data (Eurostat) currently do not include any indicators regarding the adoption of SNSs or SM by government agencies.

Table 5.2: EU 27 Internet use in percentage of individuals (Source: Eurostat 2011, 2012 - data unavailable for 2013)

EU27 INDIVIDUALS INTERNET USE	**2011**	**2012**
Interacting with public authorities (last 12 months)	57	62
Obtaining information from public authorities from public authorities web sites (last 12 months)	35	39
Downloading official forms (last 12 months)	25	27
Sending filled (official) forms (last 12 months)	21	22
Participating in professional networks (creating user profile, posting messages or other contributions to LinkedIn, Xing, etc.)	7	:
Consulting wikis (to obtain knowledge on any subject)	39	:
Taking part in on-line consultations or voting to define civic or political issues (e.g. urban planning, signing a petition)	7	:
Reading and posting opinions on civic or political issues via websites	14	:
Participating in social networks (creating user profile, posting messages or other contributions to Facebook, twitter, etc.)	38	:
Posting messages to social media sites or instant messaging	:	40
Uploading self-created content to any website to be shared	:	26
Reading/downloading online newspapers/news	40	45
Finding information about goods and services	57	62

5.2.2 Italy

In 2012, 52.6% of the population used the Internet regularly at least once a week. This number has grown nearly 2 p.p. since 2011, but it is still below the European average. It is important to highlight that 37.2% of citizens in Italy have never used the Internet, which is above the EU average of 24.4%. In addition, 50.9% of Italians go online frequently, at least once a day, up from 48.9% in 2011.

Table 5.3: Italy Internet use in percentage of individuals (Eurostat 2011, 2012. Data not available for 2013)

ITALY INDIVIDUALS INTERNET USE	**2011**	**2012**
Interacting with public authorities (last 12 months)	22	19
Obtaining information from public authorities from public authorities web sites (last 12 months)	21	17
Downloading official forms (last 12 months)	15	13
Sending filled (official) forms (last 12 months)	8	8
Participating in professional networks (creating user profile, posting messages or other contributions to LinkedIn, Xing, etc.)	5	:
Consulting wikis (to obtain knowledge on any subject)	29	:
Taking part in on-line consultations or voting to define civic or political issues (e.g. urban planning, signing a petition)	5	:
Reading and posting opinions on civic or political issues via websites	13	:
Participating in social networks (creating user profile, posting messages or other contributions to Facebook, Twitter, etc.)	26	:
Posting messages to social media sites or instant messaging	:	29
Uploading self-created content to any website to be shared	:	18
Reading/downloading online newspapers/news	30	30
Finding information about goods and services	41	41

As Table 5.3 shows, the most popular activity in 2011 was finding information about goods and services with a rate of 41%, below the EU average of 57%. Italians are also using the Internet to a large extent to read and download online newspapers (30%), and to consult wikis (29%), although both indicators are below the EU average. Italians in 2011 largely used SNS (26%), and among frequent Internet users this rate increased to 48%. Among the least popular activities are; participating in professional networks (5%), and reading and posting opinions on civic and political issues (13%) but the latter is close to the EU27 average (14%) (Figure 5.8). (Eurostat, 2011).

In 2012, 19% of Italians interacted with public authorities online, increasing to 33% among the people who used the Internet within the last year. In contrast to the trend in the rest of Europe, this rate is lower than for previous years; in 2010 it was 23% and in 2011 22%. In 2012 64.81% of Italian Internet users were Facebook users, making it the most used SNS in Italy.

5.2.3 Greece

Greece is among the European countries with the lowest Internet usage. In 2011, 47% of the population was using the Internet regularly, at least once a week, well below the Europe average (68%). Frequent users, or daily users, account for only 37% of the population. Although this is up from 31% in 2010, it is still below the EU average of 56%. Greece has one the highest European proportions of people who have never used the Internet, at 45% in 2011, down from 52% in 2010 but still well above the EU average of 24.4%.

Table 5.4: Greece Internet use in percentage of individuals. (Source: Eurostat 2011, 2012. Data not available for 2013)

GREECE INDIVIDUALS INTERNET USE	**2011**	**2012**
Interacting with public authorities (last 12 months)	27	34
Obtaining information from public authorities from public authorities web sites (last 12 months)	22	29
Downloading official forms (last 12 months)	15	17
Sending filled (official) forms (last 12 months)	13	18
Participating in professional networks (creating user profile, posting messages or other contributions to LinkedIn, Xing, etc.)	4	:
Consulting wikis (to obtain knowledge on any subject)	27	:
Taking part in on-line consultations or voting to define civic or political issues (e.g. urban planning, signing a petition)	5	:
Reading and posting opinions on civic or political issues via websites	15	:
Participating in social networks (creating user profile, posting messages or other contributions to Facebook, twitter, etc.)	28	:
Posting messages to social media sites or instant messaging	:	32
Uploading self-created content to any website to be shared	:	18
Reading/downloading online newspapers/news	38	43
Finding information about goods and services	39	45

Although their Internet usage is generally below the EU average, Greeks are active on SNSs, with 28% of the population using them during 2011. The success of SNSs has been related to the economic crisis, as Greeks have

used SM to criticise their government, debate policy decisions, express their frustration and even influence politics (Filippopoulou, 2011). Although SNS usage is widespread, only 4% are participating in professional networks. Outside SNS, the most popular activity online is finding information about goods and services with a rate of 39%, beneath the EU average of 57%. Greeks are also fond of reading and downloading online newspapers (38%, 2 p.p. below the EU average) and consulting wikis (27%).

The data about Greeks interactions with authorities are impressive (Figure 5.6 below). In 2012, 34% of Greece individuals interacted with public authorities online, up from 16% in 2010 and 27% in 2011. The percentage of Greeks interacting with authorities among the people who used the Internet within the last year is 61%.

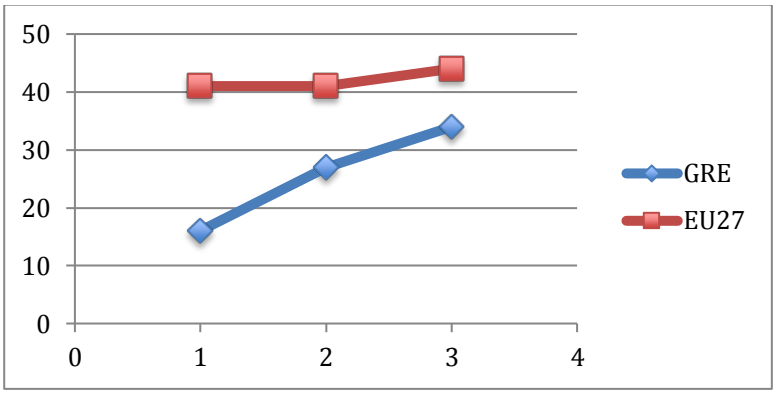

Figure 5.6: Greek individuals' interaction with public authorities (last 12 months)

In Greece, the first major explosion of the use of social media for political and civic purposes took place in December of 2008. The second major Social Media explosion happened after the first economic bailout, which was a major political event with major social implications. In 2012 67.39% of Greek internet users were Facebook users.

5.2.4 Belgium

Belgians are regular users of the Internet with 78% of individuals using the Internet at least once a week, up from 75% in 2010 and above the European average. 65% of the population are frequent users, up from 59% in 2010. 14% of Belgians have never used the Internet, down from 18% in 2010 and below the EU average of 24.4%

Regarding the activities Belgians undertake online, the most popular activity in 2011 was interacting with public authorities with a rate of 47% (EU27 57%). Among the least popular activities are those related to sharing opinions about civic and political issues (no more than 5% in 2011 compared

Table 5.5: Belgium Internet use in percentage of individuals (Source: Eurostat 2011, 2012.: Data not available for 2013)

BELGIUM INDIVIDUALS INTERNET USE	2011	2012
Interacting with public authorities (last 12 months)	47	50
Obtaining information from public authorities from public authorities web sites (last 12 months)	39	42
Downloading official forms (last 12 months)	24	26
Sending filled (official) forms (last 12 months)	26	29
Participating in professional networks (creating user profile, posting messages or other contributions to LinkedIn, Xing, etc.)	6	:
Consulting wikis (to obtain knowledge on any subject)	31	:
Taking part in on-line consultations or voting to define civic or political issues (e.g. urban planning, signing a petition)	2	:
Reading and posting opinions on civic or political issues via websites	5	:
Participating in social networks (creating user profile, posting messages or other contributions to Facebook, twitter, etc.)	40	:
Posting messages to social media sites or instant messaging	:	49
Uploading self-created content to any website to be shared	:	20
Reading/downloading online newspapers/news	37	43
Finding information about goods and services	:	65

with an EU average of up to 15%). In 2011 SNS participation was high at 40%, and 48% among those who used the Internet in the last 3 months (EU27 38%). Participation on professional SNSs is 6% (Table 5.5). In 2012, 50% of Belgians interacted with public authorities online, rising to 61% of individuals amongst those who had used the Internet within the last year. In 2010 and 2011 these rate were 45% and 47%; and 57% and 57% for those who used the Internet within the last year. Belgium's online population is older than the European average; with 19.5% of Internet users aged 45-54 (Europe 17.1%) and 22.3% aged older than 55. 57.98% of the Belgian Internet users are enrolled in Facebook. Facebook is also the most engaging site in Belgium, meaning that it is the website where people spend most time online (comScore, 2012).

5.2.5 Germany

In 2011, 77% of the German population used the Internet regularly (at least once per week including everyday), up 2% since 2010, and 9% above the

EU average of 68%. Frequent users (daily) account for 63% of the population, up from 60% in 2010 as well above the EU27 average (56%). 16% of Individuals have never used the Internet. Hence, in general terms connectivity for the German population is above the European average.

Table 5.6: Internet use in percentage of individuals in Germany (Source: Eurostat 2011, 2012. Data not available for 2013)

GERMANY INDIVIDUALS INTERNET USE	**2011**	**2012**
Interacting with public authorities (last 12 months)	50	51
Obtaining information from public authorities from public authorities web sites (last 12 months)	49	50
Downloading official forms (last 12 months)	30	31
Sending filled (official) forms (last 12 months)	15	15
Participating in professional networks (creating user profile, posting messages or other contributions to LinkedIn, Xing, etc.)	8	:
Consulting wikis (to obtain knowledge on any subject)	58	:
Taking part in on-line consultations or voting to define civic or political issues (e.g. urban planning, signing a petition)	11	:
Reading and posting opinions on civic or political issues via websites	23	:
Participating in social networks (creating user profile, posting messages or other contributions to Facebook, twitter, etc.)	42	:
Posting messages to social media sites or instant messaging	:	34
Uploading self-created content to any website to be shared	:	24
Reading/downloading online newspapers/news	52	55
Finding information about goods and services	70	75

During 2011, Germans performed various activities online. 70% of them went online in order to find information about goods and services compared to the EU average of 56%. 54% also used the internet to make travel and accommodation arrangements (15% more than the EU27 average), while 58% consulted wikis (9 p.p. above the EU average). There was SNS participation from 42% of the population, rising to 52% among those who had used the Internet in the last three months. Similar to the other reviewed countries, participation in professional networks online was quite low (8%) when compared to the SNSs participation as was subscription to news services or products (6%, same as the EU average).

However, Germans were very active in reading and posting opinions on civic or political issues, at a considerable rate of 23%, 14 p.p. above the EU average. The population's online interaction with public authorities during

2012 was 51%, a slight increase on 2010 and 2011 (both 50%). Among those who used the Internet during the last year this rate grows up to 61%. Only 11% have taken part in on-line consultations or voted to participate in civic or political issues (e.g. urban planning, signing a petition), 4 p.p. above the EU average.

Only 37.54% of German internet users have a Facebook profile. In December 2012, 46.4 million German internet users accessed a social networking site from a computer at least once during the month. Facebook accounts for the majority of users with an audience of 38.6 million unique visitors. Google Plus is in second position with 5.6 million unique visitors, Xing (`http://www.xing.com/`)is a close third with 4.2 million users and Stayfriends (`http://www.stayfriends.de/`) is fourth with 3.5 million unique users. Twitter is 5th in the rankings with 3.1 million German users and LinkedIn comes in 8th place with an audience of 2.7 million.

5.2.6 Poland

In 2011, 60% of the population in Poland regularly used the internet (at least once a week) which is below the EU average (69%), there has been a small increase (5 p.p.) in the rate of regular users since 2010. 45% of the population access the Internet every day, showing that the majority of Polish who go online (75%) are frequent users. Daily use of the Internet has increased somewhat in the last year, with an additional 3 percentage points increase in frequent users between 2010 and 2011. 33% of the population has never used the Internet, above the rate for the EU27 of 24.4%. However, there was a sizeable reduction (5 p.p.) in the number of non-users since the previous year, showing that Poland is making progress in getting its population connected. With regards to disadvantaged people, the rate was 40%, 11 percentage points below the EU27 average of 51%.

In Poland, the most popular activities online are finding information about goods and services (44%, up 5 p.p. over 2010), participating in social networks (36%) and consulting wikis (27%). Among those who used the Internet in the last 3 months this indicator goes up to 58%, over the EU27 average (53%). A minority of Polish users (6%) read and post opinions on civic or political issues. The same applies for taking part in online consultations or voting to participate in civic or political issues (2%) and participating in professional networks (4%).

Table 5.7 illustrates the data about Polish interactions with authorities. In 2012, 32% of Polish individuals interacted with public authorities online , up from 28% in both 2010 2011. 25% of the population used the internet to obtain information from public authorities during 2012, up from 21% in 2011.

Table 5.7: Poland Internet use in percentage of individuals (Source: Eurostat 2011, 2012. : Data not available for 2013)

POLAND INDIVIDUALS INTERNET USE	2011	2012
Interacting with public authorities (last 12 months)	28	32
Obtaining information from public authorities from public authorities web sites (last 12 months)	21	25
Downloading official forms (last 12 months)	14	15
Sending filled (official) forms (last 12 months)	9	11
Participating in professional networks (creating user profile, posting messages or other contributions to LinkedIn, Xing, etc.)	4	:
Consulting wikis (to obtain knowledge on any subject)	27	:
Taking part in on-line consultations or voting to define civic or political issues (e.g. urban planning, signing a petition)	2	:
Reading and posting opinions on civic or political issues via websites	6	:
Participating in social networks (creating user profile, posting messages or other contributions to Facebook, twitter, etc.)	36	:
Posting messages to social media sites or instant messaging	:	42
Uploading self-created content to any website to be shared	:	15
Reading/downloading online newspapers/news	18	30

5.3 The role of Social Media in emergency management

The statistics clearly show that European citizens are already online and using the Internet to engage with public services. The challenge that faces EMAs is how to leverage the power of Web 2.0 to work more effectively. Considering current European economic constraints, it is unrealistic to propose solutions that require significant resource demand. But there are two key factors that, properly exploited, would bring strong benefits to disaster and emergency management efforts, without significant added cost: (1) the high level of adoption and use of social media by citizens and (2) citizens pro-active behaviour of production and consumption of online information in crisis situations. In order to leverage Web 2.0 technologies the next sections offer practical examples of usage from EMAs which illustrates the functions these tools support in disaster management. Meanwhile, the examples also highlight the benefits and difficulties embedded in these practices.

The advent of SM has changed the way that people receive, produce and disseminate information, and how they communicate with one another. EMAs are in the beginning phases of refining their communication strategies to take advantage of the benefits of SM and to mitigate the risks associated with these platforms for disaster management. This research project has explored how EMAs can use, influence and shape SM and social networking for effective usage of Web 2.0 technologies.

5.4 Social Media for crisis communication

According to one EM interviewed, “when something happens there is somebody listening to our messages”, and during the so-called “Blackberry Riots”, those messages were read by thousands of residents looking for information and reassurance among the disorder and violence. On Thursday August 4th Mark Duggan was shot dead by police in Tottenham in the Greater London area, during an operation aimed to arrest him. Questions about whether or not Duggan shot first and whether this was an act of self-defence started a debate that put the police operation into question. The questions rapidly transformed into widespread public disorder, which started in London before moving on to other cities, including Birmingham and Manchester. Thousands of people were arrested. Five people died and over 200 people were injured during the unrest; 186 of them police officers (CBN, 2011). During the riots, several Police Forces, such as Greater Manchester Police (GMP), London Metropolitan Police (LMP) (Denef et al, 2013), and West Midlands Police (WMP) made use of SM.

An emergency manager (EM) in WMP made use of SM to provide updated information on the evolution of the riots in their city. “Just spoken to control room [. . .]. No disorders reported in all night” was a Tweet that was sent on 8 of August. They continued sending reassuring messages throughout the weekend, but as the rioting in London became more serious, WMP expected disturbances would spread to their area too. Eventually, the riots began in Wolverhampton.

One of the main challenges during the riots was to communicate successfully with a multitude of disparate groups and organisations, from the affected population to journalists. Managing this relational complexity embedded in disasters successfully is very challenging, especially in highly dynamic, fast-paced and dangerous situations. As Social Media are a very new means of communication—particularly for EMAs— there is currently little guidance on how to approach and use them. At present, they are required to experiment. Studying SM usage and examining the benefits it provides and problems it poses during emergencies adds new insight for EMAs. This subsection outlines the features of SM that can be beneficial for EMAs communicating with the public and will provide examples of usage strategies.

5.4.1 Enhance the outreach of the message

Incorporating SM in risk and crisis communication provides EMAs with the opportunity to enhance the message.

Offering timely information: All the emergency managers interviewed agreed that SM is more efficient in providing timely information than mainstream media and traditional press-releases, and this is the most widely adopted SM function. To continue with the case of an EM in WMP, they developed several strategies as soon as they began working at the organisation in order to adopt SM for risk and crisis communication. It is important to highlight this here as the success of the risk and crisis communication on SM during the UK Summer Riots is due in part to the strategies adopted before. As stated before, their goal was to enhance outreach of the message and provide timely information. Their strategy was based on using Twitter and achieving a high number of followers. Thus, the first action undertaken was meeting with influential SM users of the area –bloggers and local Twitter users with many followers–and made agreements with them in order to get their help, by retweeting[2] the police messages at the time of a crisis. Through these contacts the EM became a trusted and validated source of reliable information during crises and emergencies. Later, they developed several Twitter accounts (among other SM services such as YouTube and Facebook). They even have a Twitter account for a Police Dog and a Helicopter. In his words: "We have been accused of being a bit gimmicky putting dogs and helicopters on twitter. My answer to that is about to building a followership, it is about getting people to follow you, and although this looks gimmicky when you need to say something there is no good saying it if nobody is listening to you. ... So the people follow us and when something happen they are listening our message."

When the riots began, before the disturbances spread beyond London, WMP were listening to what people were saying on SM and sending reassuring messages out over Twitter and FB as well. People in the city were understandably apprehensive, given the magnitude of the disturbances in London, and police messages helped to keep people updated about the situation in their own city. Furthermore, they personally replied to people's queries about the situation. Once the riots started in the city and operational response began, it was more challenging to maintain their Twitter presence. The EM said: "it is difficult to be with an iPhone tweeting and reading while people are throwing bricks to your head". Police soon recognised to used Twitter while in a operation as a mistake and set up a control room dedicated purely to SM, monitoring of SM channels, as well as all outgoing communications were now performed in this communication room. After the riots they continued posting messages explaining that everything had gone back

[2]"Retweeting" means copying a tweet into the streams of tweets you publish so all your followers receive it as well.

Figure 5.7: Screenshots of the WMP police dog and helicopter accounts.

to normal (e.g. “In Wolverhampton city centre, great feeling, no problems at all”; “Just been for a walk around town on my lunch break – I have lots of photos to share with you – no problem anywhere that I could see and I walked from . . . ”.

The success of the information process undertaken during the riots was beyond doubt. Some of the EM’s Twitter messages were retweeted 300,000 times and the EMAs received feedback from the population. People recognised that they felt informed and updated about what was going on.

A similar strategy of SM usage was observed in another EMA in Greece, as reported in the case studies book (pp.7). Another example (also described in the case study book) of successfully keeping the public informed is the case of an EMA in Italy that provides timely earthquake information to the public. In fact, this EMA posts earthquake measurements every time the seismographic network detects any seismic activity over 2.0 on the Richter Scale. They post “objective information”, and they organise the Tweet as follows: (1) the hashtag #terremoti (earthquake in Italian), (2) Ml, the magnitude of the Earthquake on the Richter scale, (3) date and UCL time, (4) Lat, latitude, (5) Long, longitude, (6) Prof, depth in km, (7) Province (Italy), and finally (8) they include a link to a map showing the epicentre of the earthquake and extended information, as shown in Figure 5.8. This link also gives access to a web or mobile application for the public to report whether they have felt the earthquake, as outlined in the case studies book.

The project team has consistently observed that EMAs prefer to use Twitter to provide timely information more than any other SM service. Some organisations use Twitter and FB simultaneously to provide real-time updates with tools such as TweetDeck or Hootsuite that allow users to publish the same information in several SNSs at once.

Figure 5.8: Example of the map and tweets provided by the INGV, Italy

Providing extended information: When EMAs need to provide extended information they do it via blogs or websites and provide links to these longer articles via Twitter or Facebook when needed. Hence, blogs are another very popular means of distributing information. One advantage of this approach is the ease of use and set up offered by blogs. They provide a quick way to share information, publish longer articles and engage with communities of interest. The blogs went from a very informative style as journalistic outlets, such as the blog of the London Fire Brigade (`http://www.london-fire.gov.uk/`) to the innovative idea of using the blog as a web 2.0 operational room as developed by the *Centro Intercomunale di Protezione Civile Colline Marittime e Bassa Val di Ceccina* (`http://valdicecina.salaoperativaprociv.org/`). The blogs for emergency management usually share information about current events, provide safety information, and often encourage discussions about current disasters, preparedness or response efforts.

Working cooperatively to spread the message: The project team also observed how working collaboratively can enhance the message when an EMA has insufficient resources to keep the public engaged with a constant flow of information from SM services. The main strategy employed is to use the official channels to communicate messages to citizens during emergencies and to spread the information wider by re-sharing the information through other profiles - including those of other agencies and individual managers' professional profiles. These inter-related actions are based on a retweet tactic. The emergency managers use their personal/professional SM profiles, mainly Twitter, to publish the information and they have established agreements with other official accounts (such as Emergency Centres, Cities profiles, Fire Brigade or Police accounts) to retweet the information.

This approach is particularly useful when the EMA is small and operates on a local level. One EM highlighted the fact that the public is not

engaged with emergency SM services, as they are not interested in the information they provide until an emergency or crisis happens. In an interviewee's words: "We don't believe in a special account for crisis because people don't follow it". It is when something happens that the public turn to SM to get information, as was found during the 2010 train accident in Brussels and the 2011 incident in Pukkelpop Festival, in Belgium.

The main strategy is pushing information from the EM's profiles and getting the information retweeted by the official SM local authority profiles, Police and Fire Brigade profiles. The approach is not to publish lengthy updates via SM but to provide links to extended information.

Becoming the trusted voice: A recurrent topic appearing in the data as well as in the literature review (Castillo, et al, 2011; Oh et al, 2010; Spiro et al, 2012) is SM's capacity for quickly spreading rumours and fake information. SM is often used to distribute emergency-related content, which increases the importance of assessing the credibility of content, for both EMAs and the public. Although users increasingly access information via SM, they have little knowledge of how to judge which content is credible, beyond considering their trusted social network connections. In the next section we will address this issue from an EMA's point of view. First we will focus on the strategies EMAs have employed to avoid or stop rumours spreading through SM.

Our results are consistent with Morris et al (2012) who stated that users currently assess the credibility of tweets based on trust relationships with authors whose streams they elect to follow. And EMAs are the trusted source of information because their status in society. However, they have developed strategies to become trusted sources of information online and the most of the times this is related with their ability to spread their message. In order to do that, it is important, as stated before, to achieve a high number of followers or contacts, in order word, to be chosen by the followers. The next figures show the success of some SM streams in the emergency management area. The fact of having a huge amount of followers mean that people trust the information of these official accounts.

During the UK riots many rumours were spread and the active involvement and updating of information over SM was able to contain their spread to some extent, although one interviewee recognised how hard it is to change people's minds once a rumour has taken hold during uncertain times.

Our findings suggest that the information provided by authorities or EMAs is perceived as more reliable than information provided by other authors, thus, the people trust it. This result is consistent with previous research (Pal and Counts, 2012) which found that user names of organisations, rather than individuals, and those which were topically related to the tweet also were rated as more interesting than those which were not. Disaster 2.0 findings also highlight that everyday SM usage benefitted official SM accounts, helping them to establish their credentials and be seen as a

Figure 5.9: Social Media Streams of some EMAs

validated and trusted voice during disaster times.

Multi-lingual messages: Twitter usage during the 2012 summer forest fires in the north of Catalonia, Spain, demonstrated the platform's power to make arrive the message when targeting several stakeholders. Particularly noteworthy were the messages sent by Catalonian Civil Protection, a regional Civil Protection agency, over their Twitter service in several languages during the forest fires.

The area affected by the incident, the Alt Emporda, is situated in the North Coast of Catalonia, close to the border with France, and it is an international tourist area. Although it was quite a big incident – 120km^2 were burnt, 20 municipalities affected, three people killed and severe damage caused to critical infrastructure –media coverage was mainly delivered by national mainstream media (in Spanish) and regional media (in Catalan). The press office of Catalonian Civil Protection, aware that the Catalan region was at the time host to many thousands of international tourists, focussed their communication strategy on Twitter and sent emergency messages in several languages (Catalan, Spanish, English, French and German).

Relationship with traditional media: Following the case of the Catalonian forest fires, it is relevant to point out the relationship the Civil Protection's Press Office established with traditional media (newspapers, TV and radio) during the disaster. When this disaster started the press-office decided not to answer the telephone lines to provide information to the mainstream media as they were very busy. Instead, they decided to refer them to the Twitter stream where they posted real-time information on the disaster. The success was such that the web-sites of the mainstream media and the digital editions of the newspapers decided to insert the Twitter feed of Catalonian Civil protection (Figure 5.10).

Figure 5.10: The Catalonian TV webpage (Source: Presentation in Masterclass 1)

Mainstream media not only retweeted Civil Protection, they also used the stream to keep updated on how the event evolved and thanked the Press Office for the work done over Twitter.

It soon became clear that their Twitter messages were interesting for several communities or stakeholders: (1) mainstream media - journalists rapidly followed the Twitter account as a means to receive timely information, (2) local authorities that needed to take informed decisions during an emergency affecting their areas, and (3) citizens, the biggest community. Thus, they developed specific messages targeted to different stakeholders, including messages in languages other than Catalan.

5.4.2 Building communities and using SM to educate communities

Several strategies used to build communities online through SM have already been reported when explaining the strategies EMAs have used to get followers. Before offering strategies that go beyond getting followers, it is necessary to highlight the relevance of online communities before, during and after a disaster happens. Building communities is not only important for disaster response and relief, but as well in terms of preparedness. Thus, in this section we are also going to describe the actions that EU EMAs have undertaken to build communities for effective risk and crisis communication.

Early development of an online contact list will prepare an EMA to reach those stakeholders, including the public, who most desire and need information at the time of a crisis. In this sense, SM is an opt-in service, meaning

that the users need to subscribe because they are interested in the topic. However, the challenge here is to keep followers interested in the content EMAs provide through SM, so that vital emergency messages reach as many people as possible.

In order to reach the targeted community, which is essential to success in risk and crisis communication over SM, a UK Fire Brigade promoted activities over Twitter and Facebook during Guy Fawkes night 2011 to foster engagement with citizens. The night, which is associated with bonfires and fireworks, is an intense peak of activity for fire services in the UK. The press office held a 'Twitterthon', tweeting incidents live as they happened during the evening. The result was a rise of 2,362 followers in 24 hours and 25,000 views of a Facebook post. They also won an award for this initiative[3]. The organisation also saw an increase of 3,146 followers during the riots in Summer 2011. In this sense, the Head of the Media and Communications Department highlighted again the importance of building a social network of influential SM users, working with them and getting their help in spreading the messages. Another action undertaken by this fire brigade is active community building and the provision of safety and emergency preparedness education to the citizens. They posted pictures on Facebook of burnt buildings, as shown in figure 5.10, and ask the online community to identify what caused the fire. This is a very good strategy as they are asking for response, not just posting updates and it promotes interactive engagement while educating the community.

YouTube is a very popular SM site for EMAs. One of its principal usages is to provide safety education to communities at risk of specific hazards. And that is exactly how it has been used in the north of Italy, which is at risk of earthquakes. The EMA in charge of earthquake measurements, and other geophysical and volcano research, uses YouTube and FreeRumble[4] to upload podcasts which educate the general public about earthquakes. The Institute also provides information about its research projects and explains them in common language so the general public can understand them. The UK Fire Brigade, the Crisis Centre of Belgium and several Police Forces also use YouTube to educate the public.

Another illustration of the use of SM to engage the public and build communities comes from a Greek Police Force. Engaging with the public to "humanise" the EMA was the core of the SM strategy. They used Twitter, under personal/professional and official profiles, in addition to YouTube. The press office believes that the community built over SM helps them to avoid rumour spreading. During recent demonstrations in Greece they used SM in order to detect and combat rumours. It was proved that the institutional Twitter

[3] http://www.london-fire.gov.uk/news/LatestNewsReleases_PR2954.asp#.UjG5rMY3tPM

[4] FreeRumble (http://www.freerumble.com) is a SNS for audio. Podcast can be uploaded and commented.

Figure 5.11: Picture of a burnt kitchen. FB post: “A real fire in a [. . .] home . . . we’d like you to guess how this fire started & we’ll post the response in the morning. The idea is to get everyone thinking about how to prevent fires.” Source: FB page of the EMA.

account helped to establish the correct information but relied upon a strong community of followers to help share and spread the truth.

Before concluding this section, it is important to highlight the fact that a real emergency, such as the UK Riots or the forest fires in Spain, can grow the community following and EMA’s SM profiles. People need information during a disaster and today they look to SM to get this information. Engagement and community building is essential to build and maintain trust. At the same time, SM can provide education to the community. All together this helps to build disaster resilience.

5.4.3 Engage in a two-way conversation

Research after Hurricane Katrina (Procopio and Procopio, 2007) suggests that interactive information is preferable to static. As seen in the previous section, a relationship-building process allows for perpetual connectedness, which can be useful even in an unexpected event. Interaction is further enriched through SM features described in chapter 2. In spite of this, EU EMAs are mainly applying a push strategy in their crisis and risk communication plan. This section provides examples of actions designed to engage the public in a conversation with EMAs. The case below is of an EMA that aims to engage in a two-way conversation with the community.

Another police force in Greece held conversations with groups of the public about particular concerns or reports and acted on the information

Case Study: Social Media for Risk and Crisis Communication	
Hazard	Riots, civil disturbances
Country	UK
Web 2.0 service	Twitter, YouTube and Flickr
Objective	To achieve people understanding what is involved in policing. To provide risk and crisis information engaging in a friendly conversation with the population.
Procedure	This EMA started listening to what people said over SM. After research about the community and the communication needs of the EMAs stakeholders, they developed the first SM media strategy in order to have something to backup and frame the SM actions. It was quite focused on Twitter because of its obvious benefits in engaging communities. But the most important part of this strategy is that it was the beginning of the shift from pushing information to engaging in conversations. This move implied a strong emphasis on monitoring and evaluating what the EMAs were doing, in order to reinforce the benefits. Now, they are working under the 7th strategy of SM use. They use SM in an integrated way together with other media as part of an overall communication strategy. The approach is based on learning by doing. They learnt that (1) the EMA needs a level of engagement with the communities, (2) EMAs need to develop an appropriate tone (not too authoritarian but still using a friendly conversational approach), and (3) they need knowledge of the conventions over SM. They also started to train local police officers and local police brigades in the use of Twitter. They have now about 170 officers who use Twitter for the organisation. They strongly used SM during the 2011 UK Riots. And the EMAs experiment quite a lot with SM media as they undertook some actions that were not covered by the strategy. The approach was very similar to the one employed by WMP.

Procedure (cont.)	The first action was monitoring SM. When the riots arrived to the city, they used the traditional channels of press conferences, but at the same time they recorded and published them on YouTube. They monitored, provided information and answered questions over Twitter. The EMA also used the photo-sharing site Flickr to publish photos –sometimes provided by the citizens– of perpetrators and asked for the public's help to identify them. They realised soon that people wanted a lot of information about what was going on and that people wanted to be involved and help. During the management of this emergency they integrated all the communication strategy. After the riots they sent reassurance messages explaining that everything was under control. They engaged with a friendly tone in conversation with the public and it was beneficial for both, the Police and the public. The police received a lot of information that helped to control the disorders and the public was constantly updated about what was going on. They evaluated the strategy over SM and rewrote the strategy taking into account what they had learnt.
Benefits	Twitter, with its 140 characters long messages, allowed them to inform the public at the same time while keeping anonymous the source of the information. Instant update of the information. High impact and low cost. Capability to manage rumours. To become the trusted voice.
Difficulties	During the 2011 Riots they faced some technological difficulties with different operational systems and access to the services they needed. The need to continue working in the operational part of the usage of SM.
Recommendation	Engage in a two-way conversation with the public. Remember SM is interpersonal communication. Evaluate not just monitor SM. Engage with SM before a crisis started.
Conclusions	This case study highlights the need to move from a purely communication strategy to an operational communication strategy. In this case study, incorporating SM to the communication strategy ensured the tools were analysed and tested before the crisis. However, the riots demonstrated that this plan requires continual updating and strategies need continual evaluation too.

received. They did it through the personal Twitter account of the Head of the Press Office, who replied directly to the public's queries, and through the official EMA's account. There was a difference between the type of answer provided by each Twitter account: the Head replied in a more personal and friendly way, while the official account provided an "official" answer. In this sense they used Twitter to its true potential as a service. The time and labour-intensive nature of these activities was a limiting factor.

Another approach was applied by Catalonian Civil Protection. Their strategy was based on general Generalitat guidelines (GENCAT, 2012). The organisation replied to any query through a direct message (private) unless they considered the answer was of public interest.

EMAs, besides using SM to reply the public, can use videos and photographs taken by citizens and volunteers, creating a relationship of exchange (Waters, Burnett, Lamm, and Lucas, 2009). As further illustration of a two-way conversation with the public using images we can refer again to the Facebook actions of the UK Fire Brigade (Disaster 2.0 Case Studies).

5.4.4 Conclusions for risk and crisis communication

SM tools allow for both one-to-many communication (push information) and two-way-communication (push and pull). The first strategy is broadly adopted and delivers a more controlled environment where the EMAs can disseminate the information to the stakeholders. SM services enable sharing to other social networking sites, fostering peer-to-peer dissemination of the information, and developing relationships of trust. The second strategy (two-way communication) is less commonly adopted, and it is very contingent on the aims of the EMA in using SM. In this section several strategies and actions have been reviewed that leverage SM for risk and crisis communication. The findings show how SM can encourage distribution and communication of information.

- SM can be used to both communicate directly with the public and the media at the same time. It provides a built-in channel for stakeholders to communicate directly with the organisation.
- Organisations should use SM as the primary tool for updated information. Using SM for timely updates allows the organisation to provide a human approach to the emergency.
- SM tools need to be analysed and tested before a crisis arises and any communication plan should be continually updated as SM and society evolve.
- EMAs need to use social media in daily communication activities.
- EMAs need to build communities (followers in Twitter, friends, fans or likes in FB, subscribers on YouTube channels, etc.), partnerships and

in doing so, build trust. This will mean the affected people will receive crucial information to mitigate the disaster.

- EMAs should engage in the SM conversation, this allows rumour management and stops the spread of false information. Responding through SM shows the organisation cares what stakeholders think and can be trusted to address their concerns.
- EMAs can reach specific demographics with a key targeted message. However, in risk and crisis communication, practitioners often chose the standard mass media push to reach everyone at once, and often use SM with the same approach. EMAs should consider how messages will be interpreted and who will not be reached.
- The best communication channels for public communications - offline, online, or in the community - should be incorporated into the crisis communication plan, taking into account SM as well.
- Remember Web 2.0 is not a strategy or tactic by itself. Social media remains a channel despite its benefits, such as rapid spread of information, capability to reach a large number of stakeholders, low cost, and ease of use.

Effective emergency communication depends far more on the approach and content employed by the EMAs, not in the technology they employ. The actual significance of any communication – communication through social media included – remains in the quality of the content disseminated, the empathy expressed for affected stakeholders, and the appropriateness of the channel regarding the content transmitted. SM is a tool that can assist practitioners in enhancing risk and crisis communication and it needs to be integrated as an additional channel in communication plans.

5.5 Social Media for Situational Awareness

In 2010 a train accident occurred near Brussels (Belgium). Only six minutes after the Emergency Management Centre received the first telephone call, the first tweets and pictures were published on SM. This happened nearly two hours before the first press release. Emergency managers observed that traditional media asked for photos from Twitter users affected by the tragedy or located in the accident area. The information telephone number for the victims' family was also first published on Twitter but not by the governmental authorities. A year later, the 2011 Pukkelpop, an annual music festival which takes place near the city of Hasselt, was affected by a severe thunderstorm during the evening of the opening day. The storm collapsed concert tents, uprooted trees and knocked down festival light towers and video screens. Five people were killed and around 140 were injured. While

this accident was happening the first Tweet was published. As soon as a major event happens, Twitter activity increases, in this case peaking at 576 tweets per minute (Terpstra et al. 2012). This section deals with how emergency managers can use the online pro-active behaviour of the public to enhance situational awareness.

Situational awareness is "the perception of elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future" (Endsley, 1995). A disaster, crisis or emergency is a dynamic situation, and no single individual or organisation can acquire the varied and often rapidly expanding information needed to fully understand what is going on. In these dynamic events, emergency managers have to seek, collect, integrate, analyse, communicate and disseminate information from multiple domains and resources to several stakeholders or audiences. Additionally, EMs must create and execute action plans or adapt operational procedures as they react to the evolving situation. In other words, situational awareness is a critical part of making successful and effective decisions for emergency management. SM generates numerous updates from which useful information related to the emergency can be found. This offers emergency managers new information sources with which to enhance their emergency situational awareness. People geographically located in the impacted areas can report on-the-ground situations, providing multimedia information (not just text, but pictures and videos) about what they are observing, feeling, hearing and experiencing. People from surrounding areas can provide nearly real-time observations about disaster scenes.

5.5.1 Monitoring Social Media

The Belgium incidents opening this section highlighted the relevance of SM for risk and crisis communication. After these two events Belgian authorities organised an expert group to develop guidelines on the use of SM in crisis communication (Kortom, 2011). This led to an increase in EMAs using Twitter and emergency managers realised the need to pay more attention to information that the public is sharing over SM. The guidelines cover extensively the need to monitor SM to obtain relevant in-situ information to guide the emergency response process and to take decisions.

Although it is not possible to offer here an exhaustive review of monitoring tools, a description of some tools through real cases can shed some light on how to monitor social media. Understanding how early adopters are currently monitoring SM understanding whether these approaches makes sense for EMAs can guide the adoption.

Social media management applications

We are going to start with a simple way to monitor SM. The Hellenic police Communication department used Twitter to gather information about what people thought about their activities. Tweets were copied from Twitter manually and categorised according to whether they were positive/negative/neutral. These tweets formed the basis of a report that was submitted daily to the PR spokesman so that he could understand how the public perceived the police's actions and responses to their queries. The police also collected general information from the public including data about damaged infrastructure and incidents. These were passed on to the relevant organisations for action, but no information was available about the reliability of these reports. In this case, monitoring SM was helpful for providing situational awareness as the police could immediately access live public information about the issue.

There are several emergency management organisations, such as Catalonian Civil Protection or Belgium Crisis Centre, that have used SM management applications to monitor and manage their accounts. Specifically they are using TweetDeck and Hootsuite respectively. TweetDeck consists of a series of customisable columns, which can be set up to display your emergency Twitter account, mentions, direct messages, lists, trends, favourites, search results, hashtags, or tweets by, or to, a single user. All columns can be filtered to include or exclude words or tweets from specific users, consequently this is very helpful during emergencies as you can search for specific terms (i.e., help, damage, etc.). It also allows programming of Tweets, so they can be send at any scheduled time, if immediate delivery is not desired. Previously, TweetDeck supported the connection –in columns– of other social network sites allowing the monitoring of Twitter and Facebook, for instance, from the same application but currently it only supports Twitter (cf. Figure 5.12).

In the Communication Department of Catalonian Civil protection they have TweetDeck constantly running and they use it to manage their @emergenciescat account. A member of staff is reading it constantly. They discussed how it is very helpful during a major emergency as the activity dramatically increases and the filtering options help to observe trends, specific accounts or follow the trusted sources of information.

Another example of SM management is the use of Hootsuite in Belgium. Its structure is very similar to TweetDeck. It is also organised by columns that the emergency manager can customise according to their specific needs. This software was developed for brand management, but in Belgium it has proved to be a reliable tool to monitor SM. The advantage over TweetDeck is that it accepts social network integration from Twitter, Facebook, LinkedIn, Google+, Foursquare, MySpace, WordPress and Mixi. Additional integrations can be made through HootSuite's App Directory, including Instagram, MailChimp, Reddit, Storify, Tumblr, Vimeo and YouTube.

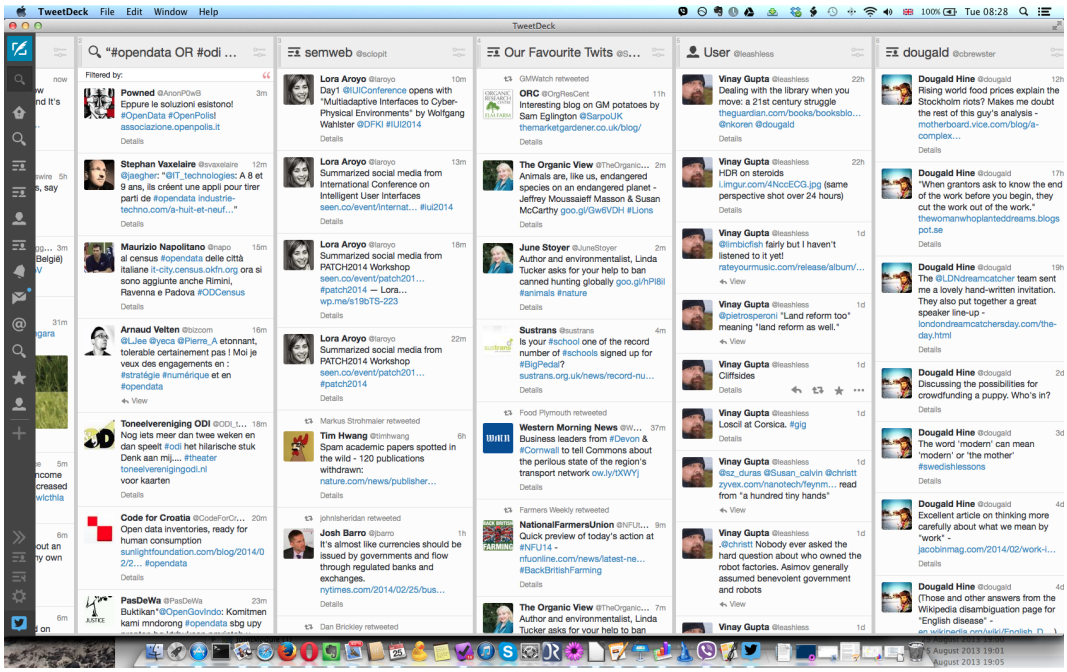

Figure 5.12: Screenshot of TweetDeck

This monitoring helps to detect unexpected incidents and follow the evolution of emergencies in real-time.

Use of hashtags

The SM guidelines and recommendations elaborated in Belgium (Kortom, 2011) contained the advice of setting up hashtags in collaboration with stakeholders in event planning and emergency planning. Then, when an emergency happens, all the stakeholders can communicate with hashtags that will, first, establish these as the tags for the topic when people publish content, and second, facilitate monitoring by the EMA.

A hypothetical case of hashtag usage was developed by a group of emergency managers in the North of Italy. The proposed model for using Twitter and other social media platforms for emergency management purposes is described in Azzalin, et al. (2012) and SMEM Manifesto (2012). In the proposal, it is recommended that a unique hashtag be used to delineate social media emergency messages from other types of message (including requests for help). For instance, any number of tweets might include the hashtag #terremoto (the Italian word for earthquake). However, the simple presence of the hashtag leaves the meaning and intention of the message uncertain. It does not even clearly identify messages about actual earthquakes. So, to clearly identify that the message is about an earthquake and is intended to provide information of use to others, another hashtag (for instance, #terremotoserv) is used. In Azzalin, et al. (2012) and SMEM Man-

ifesto (2012), a hierarchical structure is used for messages. The general tag #smem is used to indicate that the message is a social media emergency message. Joining another keyword with #smem (for instance, #smemflood) identifies a particular class of emergency. Additional hashtags would be used to encode a location, either by name (#santalucepi) or geocoordinates (#43.46435-10.55853), or other relevant information. A standardised representation of location would enable automatic mapping of messages. These hashtags are intended to be sent by official EMAs, members of the press, or by private citizens, and they are intended to be used only to provide factual, verifiable information. When used by the public, the tags provide information to EMAs and other citizens. The proposal, after a discussion, was that emergency managers adopt the role of guiding the information flow.

Data capture, methods of analysis and visualisation

Social media brings new challenges about how to sift relevant information from the total volume of data being broadcast before, during and after emergencies. As described previously, SM content – online conversation – is inherently noisy and uses language that is different from the emergency managers' language.

There are several data mining techniques than can be used by EMAs both (Bruns and Liang, 2012), in their everyday routines and in emergencies, although they are particularly relevant during emergencies when the amount of data increases. Below, we explain an example of a sophisticated way to monitor SM, analysing and visualising data. This approach includes graphic, semantic and geo-tagging techniques.

Case Study: Social Media for Situational awareness	
Hazard	Severe weather condition. Heatwave
Country	Italy
Web 2.0 service	Twitter
Analysis	Daily number of key tagged tweets (DNKT) metric Spatial Associative map Semantic analysis of Twitter feeds: Clustering Word clouds
Objective	To notice geographical areas specially affected by the heat wave. Once these affected areas are detected EMAs can undertake special actions to relieve the citizens.
Procedure	They undertook a semantic analysis of the Twitter feeds during the heat wave period (6-13 April 2011) in order to check how people perceived the weather conditions and to compare the perception with the actual temperature measurements. First, they collected the Tweets containing three different Italian terms related to the weather condition: Caldo (hot), afa (sultriness) and sete (thirst). Only tweets containing these terms were collected during the period investigated. 6069 tweets were collected. Second, they retrieved the technical weather conditions and measurements and mapped them for Italy. Third, they identified the hottest hours and compared the semantic Twitter analysis with the heat peaks as the shown in Figure 5.13. Fourth, they created maps crossing temperature (objective) data from weather agencies and Twitter collected data. Figure 5.14 shows the associative map they created with the social data and the weather data. The red areas are where the association between the social data and the measurements is higher. Hence, there is a big overlap of people perceptions and high temperatures. Finally, they conducted several statistical tests to check the significance of this relationship. In this experience they also used a tag cloud (Figure 5.15) to check whether the terms used over Twitter are different in the hottest days. They not only observed an increased usage of some terms but as well the appearance of the geographical areas where the heat wave hit (such as Milan). Once the agency knows the word cloud in non-heat days and the one for hot days, an easily constructed world cloud from the Twitter API can help EMAs to detect any irregular activity.

Benefits	The results showed that: (I) an associative map based on temperature measurements and people perceptions can be used as a tool to identify the areas where the hot weather is affecting the population; (II) this methodology provides a reliable situational awareness as it combines perceptions with objectives measurements; (III) text mining applications on SM are very useful to detect the worse peaks of a heat wave. Monitoring SM and visualising the data EMAs obtain from it, together with the objective measurements helps to have a situational awareness.
Difficulties	This methodology has not been systematically implemented in the agency's standard operational procedures. It was experimental and it was only used during that week. The problem with this kind of technique is that they are too difficult to be undertaken routinely. Besides, it needs high levels of knowledge and skills to model the data and set up the model that allows future risk activity to be easily detected on SM.
Recommendation	To implement complex analysis techniques that facilitate the usage of tools for situational awareness for emergency management agencies the relationship and knowledge exchange between research organisations and emergency respond agencies needs to be improved.
Conclusions	This case describes a methodology to monitor SM, specifically Twitter, which can be helpful to visualise the impact in different areas of extreme weather conditions. These visualisations can help EMAs to take decisions about the actions to support the affected population and the information they need to provide to them.

In this case study from Italy, the monitoring methodology and the analysis used by the emergency agency not only provides insights of the real situations of the people affected, it also guided emergency managers in their response to the emergency and led to them communicating messages targeted to specific situations and the specific audiences. It uses several techniques that we are going to describe separately.

Before any analysis can be undertaken, it is necessary to capture a comprehensive or representative set of data. To do that, one must access the Application Programming Interface (API) of the SM platform. Twitter provides access to public tweets through two key elements of its API: the search API and the streaming API. Tweets can be captured using several criteria: geographical areas, time periods, hashtags or words, users, etc. The challenge is to obtain, filter or select the relevant tweets for the incident. For example, as the Twitter feed provides tweets from all over the world, the EMA can use Twitter's location-based search API to provide a feed of tweets from people within a region of interest, although tweet datasets cannot be easily

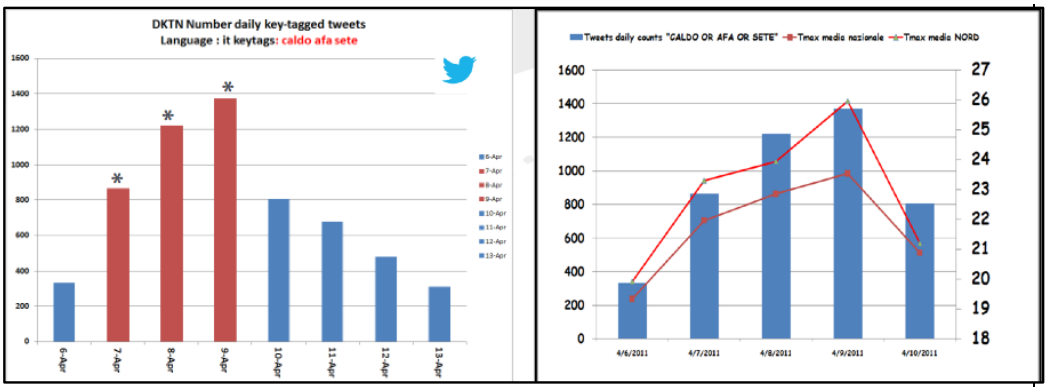

Figure 5.13: Hottest hours compared to Twitter feed

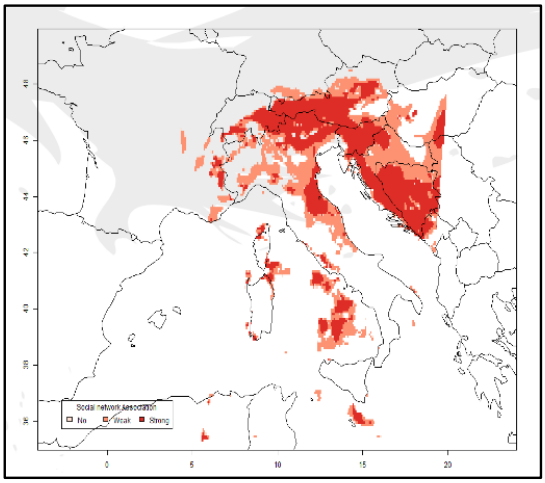

Figure 5.14: Associative map of social data and weather data.

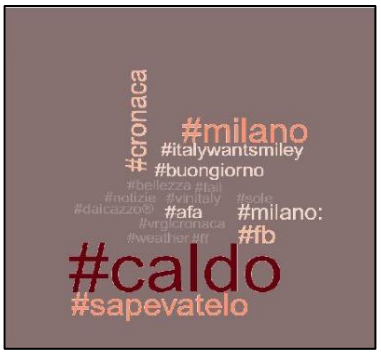

Figure 5.15: Tag cloud of most frequent words used on hot days.

confined to certain geographic areas. An easy way to capture and manage SM feeds, used by Belgian emergency managers during recent incidents, is through Storify (`https://storify.com/`).Storify is a web-based service that collects SM content from diverse sources and merges it to make a coherent story.

The first technique mentioned refers to measurements of the SM activity (measuring Tweets, RT, hashtags, impacts, etc.). Once the Twitter activity is registered, a burst detection technique using graphs can be used. This is quite common, and several EMAs use Twitter graphs to check and monitor activity. In addition to its situational awareness benefits, this technique is also helpful to evaluate the impact of their emergency accounts. For instance, Civil Protection Communication Department at Catalonia receives a weekly report with the analytics of their @emergenciescat account and other emergency accounts (Fire Brigade, etc.).

In Figure 5.16, we can see the huge increase of the Twitter activity after a bus incident in the city centre of Liege (Belgium).

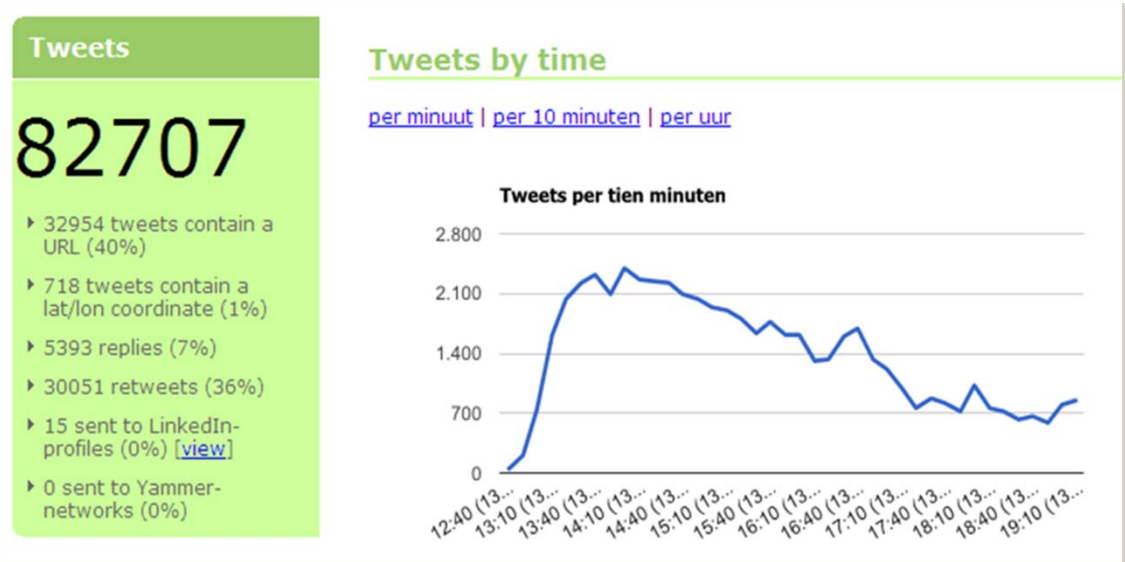

Figure 5.16: Graph with the burst activity on Twitter. (Source: Masterclass presentation by Peter Mertens)

Second, EMAs can also use semantic or hashtag analysis in order to identify high-value messages from Twitter. In our interviews with emergency managers they highlighted the need to understand the impact of the incident as soon as possible, hence, identifying messages on SM can be very useful to detect impacted infrastructure. For instance, agencies can filter messages which contain information about damage in critical infrastructure by searching words such as ‘roads’, ‘water’, ‘electricity’, ‘bridges’, ‘railways’, etc. Wordcloud displays, or cluster analysis of words appearing in the Twitter stream can be useful to observe any change in the used of the words on

Social Media streams, as showed in the case study. The Greek Police have used manually collected tweets to collect information about damaged infrastructure, such as traffic lights, which were in need of repair, and created a report to be sent to the department in charge of taking actions.

The third technique is geotagging Tweets –or other Social Media content- and displaying them in a map. The mapping possibilities that SM offers, with tools such as GoogleMap, OpenStreetMap or Foursquare, create geolocated information that can be very useful in times of crisis (Stefanidis, 2012).

In Italy, we met a regional emergency agency that wanted to phase out paper maps, which were cumbersome, and switched to Google Maps as a substitute. In addition, the commander wanted to explore new ways of collaborative working with other local organisations, including the use of crowdsourced or collaborative maps. In this case Twitter was used to broadcast information to the public and not to collect information about incidents. Information was restricted to a factual tweet (e.g. temperature, weather event). Google Maps were used to create risk maps for the area, but these were not shared with the general public. They were shared, managed and used intra-organisationally. The maps were used to identify elements of critical infrastructure at risk from floods or forest fires and to collaboratively plan incident responses. Information was also displayed about flood gates that needed to be closed during heavy rain. These could be updated during an incident so that the command centre knew which gates had been shut and all the staff of the EMA could access live information. This represented an advance on the previous system which relied on individuals telephoning the centre to confirm that the gates had been closed.

The same EMA also used a more complex system that provided geographical data and displayed SM streams: Ushahidi. This was used in two ways. First, it displayed the activities of the fire-fighters during an incident, and this information was available both to the general public and the command centre. The command centre used Ushahidi as command and control software during an incident. This was an improvement on previous methods that relied on paper maps and markers to represent where the units were. The difference in approach lay in the fact that the fire-fighters themselves were now responsible for reporting their positions, rather than being checked up on by the command centre. The system could also be used by the public to report incidents, but this rarely happened. Public engagement with the system was low, but it granted a large amount of access for the public to monitor the EMA activities and the evolution of an incident. It represented a considerable opening of their activities to public scrutiny.

The reasons for this lack of pro-active public behaviour were not clear to the emergency managers, but according to the findings of this research people tend to use the Web 2.0 platforms that they already know and use. However, we also want to highlight that the Ushahidi deployment by this

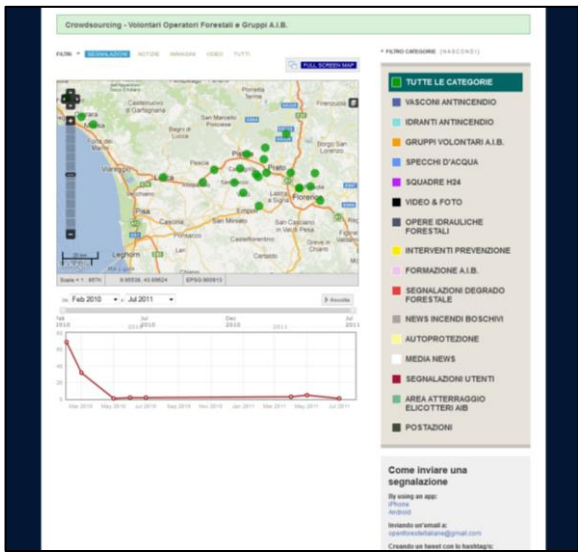

Figure 5.17: Ushahidi deployment to monitor forest fires in Italy.

EMA included response to a citizen reporting incidents.

It is worth mentioning here that several researchers have begun to develop software to automatically or semi-automatically rate the credibility of Tweets. However, the team has not found any EU experience of using such tools, but reliability and credibility of the information obtained through SM was a concern for EM.

Citizens as sensors

The underlying idea of “citizens as sensors” is that every member of the public is able to act as an intelligent sensor, equipped with simple technologies as Twitter or other mobile applications to introduce measurements of environmental variables. The notion that citizens might be useful and effective sources of rigorous observations has a long history, but it is only recently with the advent of Web 2.0 and its collective intelligence capability that the emergency management community has come to consider amateur observation as a legitimate source for situational awareness. Seeger (2006) suggests that the citizens can serve as a resource in emergency management (p.238). As observed previously, people in the geographic space of the disaster can serve as eyewitnesses and, therefore, prove valuable sources of information about crisis events.

Following the deployment of Ushahidi’s deployment by a regional agency in Italy, the agency developed a mobile application (Figure 5.18) for measuring the snow in order to prevent and forecast snow avalanches in the Alps. The trusted sources provide the required data and send it to the centre via the mobile application, including geo-tagged data by GPS. This data was displayed in an Ushahidi Map.

Case Study: Social Media for intra-organisational cooperation	
Hazard	Snow avalanches
Country	Italy
Web 2.0 service	Ushahidi
Objective	The purpose of this activity was to improve the monitoring of snow in the Alps, setting up a bi-directional data flow between the agency and the practitioners in charge of manually measuring and reporting the features of the snow. To improve monitoring with smaller budgets.
Procedure	As with other EMAs in Italy, this organisation, which is part of the Italian Civil Protection, started using Ushahidi to improve the snow monitoring in the Alps. The procedure is done by an automatic network of measurement tools and as well by hand twice per week. Staff manually measure the characteristics of the snow, which is essential for avalanche risk evaluation. Both measurements are sent to the server and they are displayed and mapped together with a specific information system. Recently they have customised Ushahidi to undertake this same task but offering, at the same time, the possibility of adding crowd-sourced information. This deployment of Ushahidi permits a better data flow as the information can be sent through a mobile application that they have developed. The geographic location of each report is automatically added using GPS technology, which is more reliable than manual estimates of location.
Benefits	A better flow of information within an organisation Possibility of automatically mapping continuously changing information Visualise complex information allowing better risk assessment
Difficulties	It was very difficult to customise the Ushahidi platform and to develop the mobile app. When fostering the use of crowdsourcing capacities it is hard to maintain the public interest in collaborating. It is not clear who is legally responsible for the information. They also detected a lack of technical skills to use crowdsourcing tools.
Recommendations	Provide guidelines of use of these customised applications. Provide training to the organisation's staff. Explore how to improve this experience of integrating SM data.
Conclusions	This case highlights the huge potential of Web 2.0 platforms for improving information flow within organisations and between organisations.

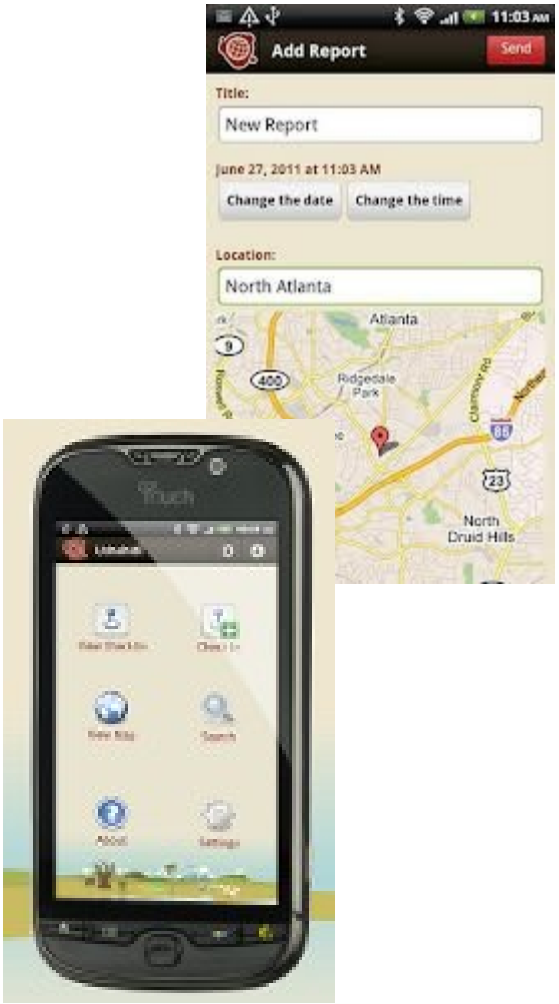

Figure 5.18: Mobile Application for snow measurement.Source: Presentation by Roberto Cremonini at Masterclass 2.

Although the literature review has shown how useful the information provided by the citizens is, the idea of using citizens as sensors in Europe has not often been applied. Even the three Italian cases described, two in this section and another one in the case study book, are experimental, limited and non-systematic in their implementation.

Conclusions concerning situational awareness

EMAs need to engage in more consistent and systematic monitoring in order to leverage Web 2.0 technologies for situational awareness. The cases reviewed show that SM information is crucial in order to achieve quick and reliable understanding of situations and EMAs can deliver increased situational awareness by engaging with SM. SM also offers multimedia data in the form of pictures and videos that give deeper insights into a situation and

can assist strategy and planning.

- Social Media can be used for crisis detection by monitoring.
  - There are a huge amount of tools to monitor SM. Chose them according to the SM platform your EMA uses and get training and experience. Develop a strategy and procedure to monitor.
  - It is important to monitor always, before, during and after an incident so changes in activity can be easily detected.
  - EMAs need to take the lead in providing information and communicating on SM as it will allow them to set-up the hashtags and the Tweet structures that will be useful to monitor during emergencies[5].
- Mapping / Crowdsourcing information over online maps is useful to gather location-specific information that citizens can provide about emergencies.
- Visualisation and decision support tools (application of statistical techniques to spatial data for real-time pattern or signature detection, use of charts, sociograms and smart search for information and mapping and crowdsourcing capabilities), although sophisticated and complex provide a very reliable and complete situational awareness.
- A situational awareness from interaction of several actors including citizens appears to facilitate response to dynamic, constraint-bound situations.

5.5.2 Social Media for organisational communication and cooperation

Easy updating of information is a chief advantage of using Web 2.0 tools in preparing for a crisis. Up-to-date reports, manuals, plans, information related to a crisis, statements, and contact lists need to be available to internal, and sometimes external, stakeholders in real time. Using Web 2.0 technology like wikis on day-to-day projects can streamline intra-organisational communication and increase efficiency. Using Web 2.0 tools to collaborate or cooperate with other agencies involved in emergency management can increase efficiency as well.

From the EMA perspective, there are a series of information system activities that can be supported by Web 2.0 tools or Social Media. Braune et al. 2011 provide a general list of activities that ICT should support. The list is small but nevertheless covers a range of activities discussed in this report that could be supported by SM as well.

[5]Cf. `http://www.cs.colorado.edu/~starbird/tweak-the-tweet.html`

1. Information access: including discovery, sharing, and evaluation of information.
2. Operations planning: scheduling the activities comprising the response effort.
3. Collaboration: aiding the interaction between practitioners.
4. Decision making: improving the speed and reliability of the actions taken.
5. Situational awareness providing an overview of the disaster and the response effort.

Inter and intra-organisational use of Web 2.0 tools

In Italy there are several EMAs fostering the intra and inter-organisational use of Web 2.0 tools as emergency management tools, beyond mere communication tools. The case of an environmental agency using Twitter, Google Docs, Google Maps and Ushahidi to improve organisation's command and control capacity, and explore new ways of collaborative working is included in the case studies book that accompanies this report.

Practitioners engaged in using SM have generally reported using these tools for inter-organisational communication, sharing of documents, meetings, etc. However, they can also have a great impact on internal communications. In Belgium, besides using Twitter, they internally use Yammer[6]. A police force in UK has implemented the use of SM for internal meetings through live-stream platforms and participation has increased when compared with the previous face-to-face meetings. As further illustration of this a Fire Brigade in Poland which reported using technological solutions to support internal staff discussions.

It is less common to find EMAs using Web 2.0 tools for inter-organisational cooperation. One example was found in Italy, where a Civil Protection agency used a forum to share information about heavy snow fall with stakeholders responsible for maintaining critical infrastructure in the area (described above).

Civil Protection in Spain is also engaged in communicating with other organisations. Local emergency services and other stakeholders (such as fire fighters, transit services and weather forecasters) use the @emergenciescat account as a hub of information. Thus, these other agencies often send their own messages to the press office in order to receive help in spreading the message (via re-posting or re-tweeting), as they are the most popular SM profile. As a future plan, this EMA wants to foster communication with local authorities through SM, as in the last forest fires this proved to

[6] A SNS used for private communication within organisations, `https://www.yammer.com`.

be very valuable. Furthermore, this organisation monitors Twitter to receive information about damage to CI, such as traffic accidents blocking roads or damage to public services caused by thunderstorms. They then report what they find to the operational centre or to other agencies and very often they are able to detect these incidents before the operational centre receives the information by other means.

Virtual Operation Support Teams

Recent research demonstrates (i.e. Denis et al, 2012; Starbird and Palen, 2011) how SM fosters the formation of virtual groups, remotely assisting the disaster response. In our fieldwork, we met a non-government organisation using Facebook to help with disaster mitigation. During the 2011 flash floods in Geneva this NGO formed a digital team to gather information from institutional sites, synthesise and simplify it for the affected population and publish it in the Facebook page. The Facebook page also offered a platform for people offering help and people requesting help in disasters.

The Disaster 2.0 team observed one of these actions during the recent Boston Marathon bombings, during the course of the SMERST conference organised within the project. Three conference participants remained awake through the night participating in the online emergency response generated by the tragedy and later shared information with delegates on the process they had gone through.

Teams helping the disaster response online are called Virtual Operation Support Teams (VOST). Government organisations need to prepare for managing the flow of information during a disaster and this is very challenging. The VOST is a way to manage the stream of information, mainly over Web 2.0 platforms, and to find the relevant information in the noise. VOST normally comprise a small number of people with detailed expertise and practical experience in Web 2.0 tools put together to manage the influx of information and overall SM management during a crisis.

Conclusions for Web 2.0 intra and inter organisations usage

EMAs need to further adopt Web 2.0 tools for internal collaboration and cooperation, as well as for cooperation with other stakeholders.

- SM can support internal exchange, sharing and communication of information in all the phases of the emergency management cycle.

- Web 2.0 services, as instant message systems, online maps and documents, allow for teams of emergency managers sharing information during emergency operations.

- EMAs can take advantage of the increasingly tech savvy population organised as online volunteers and interact with them to share common goals during emergencies.

- EMAs and volunteering organisations should work on the logistics beforehand.

5.6 Adoption of Web 2.0 and Social Media

As emergency managers add Web 2.0 tools to the array of tools they use, an investigation of how and why these tools are adopted is essential. Implementation of new technology requires allocation of human resources, technical equipment and time. Very often adoption also requires changes in the organisational structure or standard operational procedures. While the general discussion in the literature covers how to leverage Web 2.0 technologies for emergency management and during disasters, there is no much research about how EMAs face adoption. Thus, this section reports findings on the drivers and barriers for SM adoption for EMAs. The Disaster 2.0 team studied how SM was adopted and institutionalised by EMAs and identified barriers to SM adoption. This report examines adoption patterns and the organisational policies and strategies that influence or are influenced by specific adoption behaviours.

The public's usage of SM differs substantially from its usage by emergency managers. The conversations with emergency managers allowed us to focus on how and why EMAs –local, regional, national and international– implement social media at the organisational level.

5.6.1 Social drivers and barriers

Social factors comprise public engagement and participation with SM, practitioners' willingness to use SM and organisational factors. Thus, this dimension includes the citizens' perspective on the acceptance and organisational dimension of acceptance. First, we will see which social factors favoured SM adoption and second we will describe some of the social barriers to adoption.

Awareness of the social impact of SM

The widespread use of SM by the public has been a key driver to its adoption by emergency management agencies. In the words of one interviewee: "It is important to engage with society and society is now online.".

In Greece, the first major explosion of SM use for political and civic purposes took place in December 2008. Riots and demonstrations took place, mainly in Athens, after the killing of a 16-years-old student by a police officer.

Alongside the riots a massive online protest happened. The demonstrations were organised on Facebook, tweeted in real-time, broadcast on YouTube and the Greeks' opinions were shared with the world via SM. Unceasing blog posts, videos, comments and pictures flooded the online networks.

The second major SM explosion happened after the first bailout in 2010. Greek citizens began to express their loss of confidence in mainstream media, seeing them as motivated by interests that led to the current economic situation. Social networks, however, not only provided a platform for commentary on the crisis, but also served to help the organisation of actions. In this crisis context, a Police force in Greece began to experiment with SM as a means "to humanise the Police and to reach out to the public in a new way". Other EMAs, such as civil protection, coast guard or fire brigades, also adopted SM for risk and crisis communication.

Belgium is another country where incidents raised EMA's awareness of the potential of Web 2.0 tools. They noticed that the general public's use of SM had drastically altered the level of control the emergency services have over disseminating information. Two recent events highlighted the impact of SM on crisis and risk communication. First, in 2010, a train accident occurred near Brussels. Emergency managers observed that traditional media were sourcing eye-witness photos from Twitter users. Also, the telephone hotline number for victims' families was first published on Twitter rather than by official channels. The emergency services also observed how other organisations were using SM to respond to the incident (e.g. the Red Cross using Facebook to publish requests for blood donations). The following year, Pukkelpop, an annual music festival which takes place near the city of Hasselt, was affected by a severe thunderstorm on its opening day. This incident revealed significant increases in Twitter activity as events unfolded (Terpstra et al. 2012). While this event highlighted the need for authorities to use SM in emergencies, it also showed how quickly information can spread among the population via Twitter and Facebook updates, without official intervention. From the organisational point of view, after these two events there was an increase in EMAs using Twitter and a recognition of the need to carefully monitor information that the public is sharing over SM.

The riots in UK (2011), already mentioned, were a turning point regarding the use of social media. During widespread rioting in London, offenders used social media and smartphones to organise looting and other disorder, inciting a debate within emergency organisations about the need for effective use and monitoring of SM. These reflections were included in a report that aimed to examine and understand why the riots took place. The report stated: "the riots highlighted how far behind many public services are around the use of widely used modern methods of communication, such as social media" (Singh, 2012). Furthermore, as one interviewee from this country underlined "What's the point of using SM? The emergency services cannot afford not to use SM given all those conversations that actually are

going on" (interviewee, 2012).

The L'Aquila's earthquake posed a serious challenge to the complex Italian risk and crisis communication structure (Etienne and Palermo, 2012), and this fostered the use of SM to provide better risk information to the public.

Although these examples show many EMAs in EU countries are giving serious thought to SM adoption strategies, the team visited EMAs in two other countries which, although they suffered floods during 2012, displayed low levels of adoption, if any. The majority of practitioners interviewed seemed quite sceptical about the use of Web 2.0 tools for risk and crisis communication. In Poland and Germany, it was clear that the lack of interest from the EMs made it difficult for any move towards the use of Web 2.0 tools. These are examples of how the high level of SM adoption among the population, as observed in section 1 of this chapter, and recent disasters are the most powerful drivers of adoption within EMAs. The unplanned and unexpected use citizens made of SM fostered the adoption among EMAs, as they realised the huge potential of these tools to provide information and spread emergency messages.

The role of the entrepreneur in SM adoption

The adoption of SM in a Greek EMA began with the arrival of a new Chief of the press office. The proximity of this new manager to other senior officials facilitated discussions about adopting new technologies and smoothed progress, ensuring robust support from the highest levels of the organisation. This level of support, combined with a deep understanding of the technology allowed the staff to use all of the potential offered by SM to respond to challenging situations in Greece. In this organisation they created a SM department within the Communication Department, with members of staff especially dedicated to the management and monitoring of SM. Because leadership gave complete support to the scheme, there were few institutional barriers to the success of its SM strategy. The biggest challenge seemed to be one of manpower, as the sheer weight of data generated by SM and the number of responses required was overwhelming at times. Given the large number of social media platforms of equal utility, the police service had to pick and choose their activities and often appeared to make these choices intuitively, rather than following the trends of SM usage in the country. However, after the data collection visit, a new senior press officer was appointed due to the political instability of the country. This slowed the rate of SM adoption, clearly illustrating the need for a SM committed person, or an entrepreneur, to ensure systematic adoption.

In Italy, another of the Disaster 2.0 countries with high rates of adoption among EMAs, the role of the SM evangelist or entrepreneur has proved to be a key enabler. The encouragement came from a person external to the organisation, a researcher who demonstrated the systems and encouraged

experimentation with them. This researcher fostered the use of Web 2.0 tools in North Italy, such as *GeoCommons* (`http://geocommons.com/`) for rescue operations. He/she also promoted Crisis Camps with EM to discuss several topics such as the use of hashtags or monitoring of SM. The role of local emergency managers was a key enabler as they provided the real setting to initiate the experimentation phase.

These two examples illustrate the important role the entrepreneur who brought the expertise in Web 2.0 tools plays into the initial stage of use and experimentation into the emergency management area. In some cases, the experimentation stage has given way to an institutionalisation of SM usage, although in other cases, the barriers they faced have slowed down adoption. The Disaster 2.0 results in this sense suggest that such entrepreneurs, from inside or outside the organisation, are necessary to serve as experts mediating between technology, content, organisations, and the public. These EM can be considered as early adopters and innovators within organisations.

5.6.2 The social barriers to adoption

During the interviews with emergency managers, the following social factors impeding further social media adoption were reported.

- A **lack of public engagement** with Web 2.0 activities has not been reported generally as a barrier. However, during one experience with Twitter and Ushahidi, the chief barrier to using the technology seemed to lie in the public's attitude. The EMA found it hard to encourage members of the public to engage with them through these tools. The reasons for the lack of public engagement were not clear, but were attributed to demographic factors, particularly the age of the local population.

- The **age divide** was consistently reported as a barrier to further adoption, specifically for local EMs. First, local emergency managers are aware that there is a segment of society who is not engaged with the Internet in general and SM in particular. Second, it was observed that older EM were less likely to adopt SM, because they have less experience with it and are unaware of their potential. Moreover, these EMs are the ones involved in decision-making process within the organisation.

- In a related issue, EMs who fail to engage with SM and Web 2.0 tools, think of them as **leisure and fun tools**. Thus, they do not consider them suitable for professional purposes. In both countries visited with low adoption levels, EM showed their scepticism about the benefits of SM and this is consistent with EMA which never has had any experience in Web 2.0 tools.

5.6.3 Technological drivers

This dimension explores the integration of Web 2.0 tools for crisis, equipment, access to the Internet and mobile technologies. The main drivers for Web 2.0 tools are as follows:

- *Web 2.0 services are cheap*. In the current economic climate, with budget cuts in all government agencies, the free availability of the software, tools and platforms Web 2.0 is a powerful driver. Because experimentation with these tools has a low cost, EMs are more open to explore their benefits. From the interviews, and as explained before, committed EMs are the ones who fostered the usage of Web 2.0 tools and that was possible because no economic investment was needed.

- *Web 2.0 platforms access*. Currently, the access to the Internet and to Web 2.0 services is increasing in the headquarters of EMAs. However, the access to corporate mobile phones is still low, although some emergency managers use their own smart phones.

- *Web 2.0 tools are easy to use*. As the statistics showed, a large proportion of the population is using SM and this is because people need no specialist technological skills to access and manage a SM profile.

- *Access to the data*. To share, update and manage data online with Web 2.0 tools assures that in the event of a major disaster the servers and the data is safe as it is decentralised and it is not stored in the computers of the headquarters (that can be affected by the disaster as well). Besides, this feature, as one interviewee reported, allows access to the data from any mobile device from any place with Internet access.

5.6.4 Technological barriers

On the other hand, the technological barriers to adoption are:

- *Lack of Internet access*. Although, as stated below, the number of emergency managers with full access to the Internet seems to grow, several EM reported that they cannot access the Internet from the computers of their headquarters, and on other occasions they can access but they are banned from using sites as Facebook or Twitter.

- *Lack of equipment*. Access to computers is broadly extended but smartphones are rarely provided to the EMs. Some other times computers are outdated so some software and tools cannot be installed.

- *Security concerns*. Several EMs, particularly the more sceptical about using SM for emergency management, raised concerns about the

ownership of the data and the location of the servers where the information is stored. Consequently, they still rely predominantly on proprietary purpose built software for each EMA to manage the data, which makes sharing information a difficult task.

5.6.5 Organisational and operational drivers

This dimension focusses on the organisation and its culture, roles, processes, competences, training and operational procedures to explore how to adapt the organisation to work with Web 2.0 tools and facilitate the process of adoption into operational processes.

We found very different structures between local, regional and national organisations. On one hand, local EMAs are more open to the consideration of Web 2.0 tools, including them as operational tools. However it seems difficult to further exploit the benefits found in the experimentation and even more to institutionalise the use of SM, and extend it to other local organisations, as all the usage remains experimental. Regional or national EMAs rely on their communication departments for the adoption of Web 2.0 tools, thus the press officers introduce SM as an addition to their operational toolbox for risk and crisis communication.

In other organisations we found some disconnect between the activities of EMs as innovators and the organisation support structure within which they work. For example, in some cases the information needs to be authorised before published and this delays its availability for the public. Some other cases a department gets valuable information on SM by the organisation have not established the procedures to pass this information to the operational department. However gradually organisations are becoming more aware of the necessity to adopt Web 2.0 tools. Then, taking into account that EMAs have different sizes, cultures and structures, we found the following drivers for adoption:

- Regulations and Policies. The team has consistently found that EMAs which have any regulation and policy regarding SM at any level, - internal guidelines or local, regional or national guidelines or recommendations- are further advanced in adoption terms. The guidelines about how to use SM decrease some of the barriers which will be addressed later. EMAs in Spain, Belgium and UK have regulations and policies about SM use and they are the more systematic users of SM.
- In a related subject, when the communication plan includes the usage of SM, adoption is more widespread.
- Work load, while some EMAs reported that the workload of EMs increased with the addition of Web 2.0 tools, others have reported the benefits that their use brought during crisis times (such as the case study of Catalonia Civil protection in the Case Studies report.

The cases studied show that entrepreneurs or "evangelists" from within the organisation lead adoption, although we also studied one organisation which hired the SM "evangelist". Often adoption follows a bottom up approach, although systematic adoption requires a top-down decision-making process and support from the higher levels of organisations.

5.6.6 Organisational and Operational barriers

The organisational barriers to adoption are:

- *Lack of skills and knowledge.* While ease of use is one of the main features of Web 2.0 services, several EMs reported a lack of skills in using this array of tools. This was linked to the age of their staff. Another related issue is the lack of knowledge of how best to use SM within the emergency management area. Several EMs acknowledged using SM in their personal life, but did not know how to use it in their professional life.

- In a related issue, a *lack of training* for practitioners has been reported as a barrier.

- *Lack of legislations and guidelines*. Innovation in government agencies is difficult and it is even harder for agencies dealing with uncertainties. Where there are not guidelines or legislation, practitioners tend to use the standard operational procedures of the institution.

- *Command and control*. Another barrier seems to reside in the command and control nature of the organisations. SM provides any member of staff the opportunity to publish and share content, and this generates some mistrust from the people in charge. The Disaster 2.0 team also observed very hierarchical structures within organisations and inter-organisations, which prevented exploitation of the benefits of SM.

- *Lack of ethical and legal frameworks*. This dimension emerges from the debate on the boundaries of privacy rights and public security with respect to publication of content online.

5.6.7 Economic drivers and barriers

The current economic crisis in Europe and the lack of investment impacts hugely on the EMAs, as in other areas of government. An in this context, it becomes more relevant to share results and promote knowledge exchange among EMAs and they can learn from each other. The economic drivers have already been formulated in the technological section. Web 2.0 tools are cheap and free and they do not require any extra software investment.

The most part of the initiatives over SM studied in this project has been carried out with no extra funding, except one case in Greece, which outsourced part of the media monitoring. Some interviewees reported how SM has allowed them to make the most of their work force and be more efficient when an emergency happens.

The main barrier reported in economic terms is the lack of staff available to work specifically on SM strategies and the lack of equipment, such as smart phones and other mobile devices that could be used from any location.

The lack of staff is a significant barrier. For small EMAs, where the use of SM relies on a single entrepreneur, when this practitioner is not available or is relocated, the progress is put on hold. For regular EMAs, which rely on communication departments not working 24/7, the use of Web 2.0 is confined to office hours. However, at least one EMA reported rolling out their SM strategy entirely without extra financial support or resources. The Public Relations officer took it upon themselves to both use SM and train other officers in the EMA to use SM appropriately. The lack of *extra* resources does not have to be a barrier on uptake especially as SM is ubiquitous on personal technology.

5.6.8 Adoption Challenges for Emergency Management Agencies

There are three main challenges for EMAs to further Web 2.0 or SM adoption.

The first one is to systematically implement the tools, developing formal strategies and procedures for both crisis and risk communication and operational emergency management, and continually evaluate and reformulate implementations according to the latest Web 2.0 developments.

The second challenge is to develop and test the use of SM as an emergency line, for example with the implementation of the hashtag '#112'. An eventual advancement in the use of SM for risk and crisis communication would be the development of an European standard for emergency calls (112) via SM. Although newspapers and other sources have reported a huge amount of cases where SM has been very useful to report emergencies, enriched by the geo-localisation tools of smart phones, EMAs are far from adopting SM with this aim. The main concern practitioners have expressed in the interviews about the use of SM as an emergency line is the lack of tools and capacity to monitor SM properly. Thus, they are afraid of not being able to register and attend the entire emergency requests received through SM. In this sense, the main problem when an EMA is using SM is to manage people's expectations and make clear that the SM is not an emergency line. Only one EMA studied in this project reported that the possibility of us-

ing SM as an emergency line is under scrutiny, although several managers were sure that will be a reality in the near future.

The final challenge is to reinforce EMAs collaboration with third sector organisations (including humanitarian agencies, volunteer organisations, etc.) through the use of SM. Although only one EMA reported the collaboration with volunteers for the adoption of SM, Virtual Operation Support Teams (VOST) can be very helpful in assisting governmental EMAs to monitor, gather and filter information over SM during disasters.

5.6.9 Conclusion concerning drivers and barriers

Emergency management agencies, besides planning strategically how to use Web 2.0 for emergency management, need to plan how to adopt and institutionalise their usage within the organisational structure, as well as thinking about the impact and collaboration with other stakeholders.

- Citizens' SM usage during major emergencies is the most powerful driver for adoption.
- SM adoption needs public engagement of the targeted population.
- For a successful adoption the organisation needs to rely on an "evangelist" or entrepreneur emergency manager.
- Regulations and policies have a huge impact in adoption. EMAs need to spread them among staff members where they already exist, or create them where they do not.
- Introduce SM strategies in the communication plan.
- Standardise SM actions and strategies for emergency management.
- Work towards a more systematic adoption of SM.

5.7 Conclusions on the findings

This chapter has summarised the findings of the Disaster 2.0 project in terms of Web 2.0 strategies and actions for emergency management. It also explored the drivers promoting, and barriers preventing, adoption of Web 2.0 platforms for Emergency Management Agencies.

The results are intended to provide practical examples that EMAs can use to adopt Web 2.0 tools for risk and crisis communication or emergency management, both in their everyday routines and during disasters. The next chapter will provide recommendations to apply the principles learnt through the cases to any EMA.

Chapter 6

Recommendations for Emergency Management Agencies

In the previous chapter, we presented the findings from the Disaster 2.0 project and outlined various approaches and ways of using Web 2.0 tools during emergency management operations. This chapter takes those findings and creates, firstly a set of recommendations and secondly, a tool for Emergency Management Agencies (EMAs) to adopt Web 2.0 services for risk and crisis communication and emergency management. This tool, called the Social Media Adoption Assessment Worksheet – SMAAW (see below Section 6.3) is a practical way to help Emergency Management Agencies, Government Organisations and Non-government organisations involved in emergency management, plan their Social Media strategy or improve its usage.

As shown in the previous chapters, Social Media (SM)is redefining social interactions as people are increasingly using it in their everyday life. These days the Internet, and specifically SM applications, have become an essential communication and information media. As with other areas of our life, emergency management is being affected by the use of these technologies. From the advent of SM, it has been used during disasters, initially by citizens, but increasingly by organisations and institutions. Emergency Managers (EMs) need to understand why SM and Web 2.0 technologies matter. Chapter 3 offered a review of recent disasters, describing how the public used Web 2.0 and SM. Chapter 4 provided an overview of how citizens in the project countries and in Europe as a whole are using the Internet. And chapter 5 offered practical cases of SM usage in Europe. The examples provided can act as cases to demonstrate the potential and benefits of SM as a communication channel.

6.1 Why use Social Media?

Before moving on to the recommendations it is important to highlight what SM is and why EMAs need to use it. Very broadly SM can be defined as any web platform or mobile application that enables an individual or agency to communicate interactively and enables exchange of self-generated content. SM is basically conversation online powered by tools. This conversation is not organised and consists of information that can be shared, exchanged, collected, aggregated, organised and widely disseminated in a second. SM allows connectedness, collaboration and the creation of communities spanning geographic boundaries.

From the perspective of EMAs, the following represent the main benefits of using SM reported in the findings:

- Benefits for risk and crisis communication.
  - *Enhanced outreach of the message:* As recent disasters and fieldwork have confirmed, SM has emerged as a powerful platform for reaching many people at once when (1) offering time-sensitive information, (2) sharing information in cooperation with other EMAs or other stakeholders; (3) becoming the trusted voice online to stop the spread of rumours; (4) offering targeted messages to different audiences, including messages in different languages; and (5) collaborating with mainstream media online. Various sites have huge numbers of users, such as Facebook (over 1.1 billion) and Twitter (over 200 million). These platforms then offer an opportunity to EMAs to reach out to their audiences easily before, during and after a disaster. Moreover, SM also facilitates access through mobile devices and with 136.2 million smart phone users (comScore, 2013) in Europe, the outreach potential for EM is unprecedented.
  - *Building and educating communities:* A community of followers is not only important for disaster response and relief, but also in establishing preparedness and educating the public. SM is useful to educate communities at risk or living under a determined threat. To build SM communities before disasters strike amplifies the potential outreach of the messages during an emergency and could also speed up recovery.
  - *Engage in a two-way conversation:* In mainstream media and traditional forms of risk and crisis communication, interaction with individuals is very limited, and even impossible during disasters. SM platforms offer the chance to connect with individuals and communities. Real-time interaction with the public offers a quick and timely engagement between EMs and citizens, for instance, to assist in evacuations, or to inform about roads that should be

avoided. Furthermore, it has a profound effect in the image of the organisation and in how it handles sensitive information in difficult times.

- **Improved Situational Awareness:** SM users generate huge amounts of content during disasters, from which useful information related to the emergency can be found. Hence, EMAs need to develop strategies to:
  - *Monitor SM streams* using Web 2.0 tools.
  - Take the lead in the *use of hashtags* on Twitter and Facebook to facilitate the organisation and retrieval of the information, and to assure that affected communities are reached.
  - Develop *analysis and visualisation techniques* to detect bursts of activity related to disasters;
  - Use *geo-location tools* to describe the impact of a disaster on CI, for instance, and support decision-making processes.
  - Use *citizens as sensors* to amplify situational awareness.
- **Benefits for intra-organisational and inter-organisational disaster management**:
  - *Improved communication flow* within EMAs and between EMAs and other stakeholders. The opportunity of easy updating and sharing of information is a chief advantage of using Web 2.0 tools in preparing for a crisis. Up-to-date reports, manuals, plans, information, statements, and contact lists need to be available to internal, and sometimes external, stakeholders.
  - SM also offers new benefits regarding the collaboration of government emergency agencies and voluntary groups through the *virtual operation support teams* (VOST). This cooperation is key in making sense of the huge amounts of information and fighting rumours and unverified information.

One final and important reminder is that SM is not a communication strategy or tactic by itself, it is just another channel of information technology that can be used for emergency management. The following screenshots, in Figure 6.1, provide an idea of how many people can be reached, informed and engaged through SM.

6.2 Recommendations

SM and Web 2.0 tools offer a unique opportunity for EMAs to engage with all their stakeholders, especially citizens, in real time and to improve their

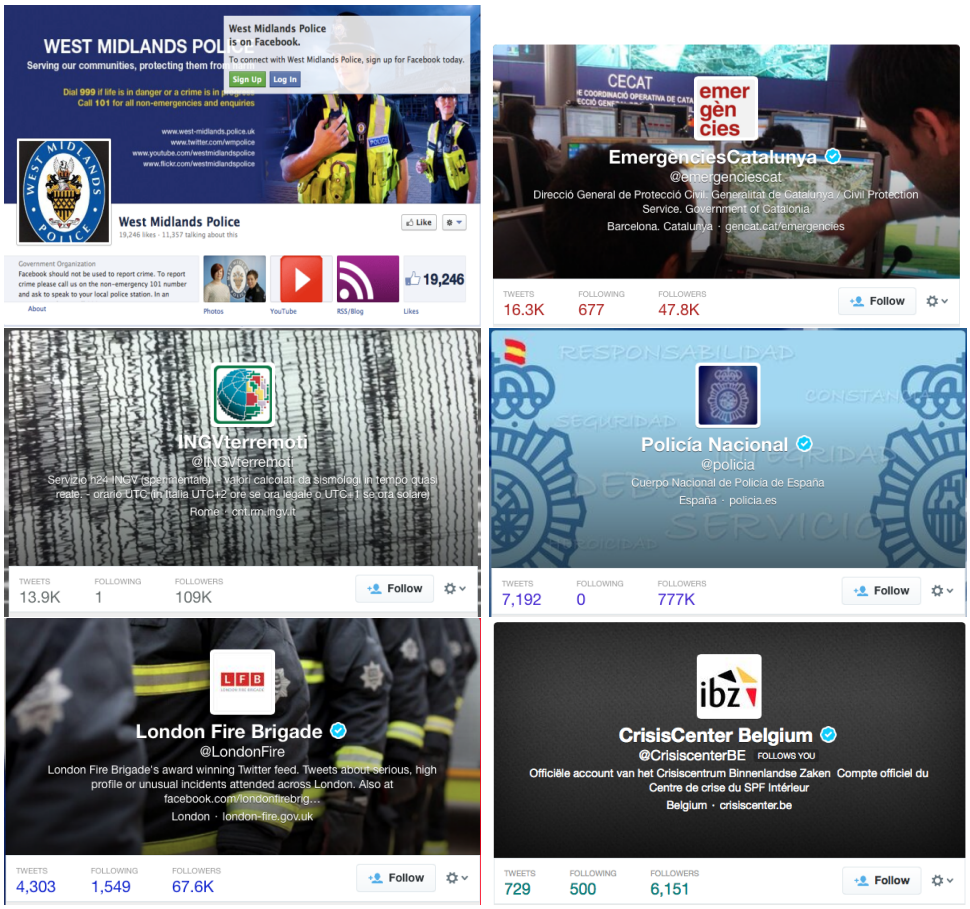

Figure 6.1: Numbers of followers of EMAs Social Media channels

operational response to disasters. Many EMAs, governmental and non-governmental, around the world are using SM platforms to reach out to their citizens and other stakeholders to advance their disaster management. However, many concerns remain SM adoption including, but not limited to, issues of authority of the agency, lack of trust, scope of engagement, difficulties in creating synergies between different channels of communication or between agencies, compliance with existing legislations and standard operational procedures, to mention a few. Web 2.0 technologies and SM present an unfamiliar environment for many EMs, and even for many EMA's communication departments, where the traditional models of holding, releasing and controlling information no longer apply.

The Disaster 2.0 team therefore felt it vital to develop recommendations for the use of SM, which would enable EMAs to implement these platforms effectively. These recommendations will help EMAs to prepare, plan and execute the use of Web 2.0 technologies, but also in facilitating preparation for adopting Web 2.0 tools. The guidelines have been developed for use by any EMA - local, regional, national or international. Although the main

objective is to guide government organisations, this set of guidelines can equally be used by non-government organisations wishing to use SM or improve their performance online. In Figure 6.2, the outline of the nine-step model is shown.

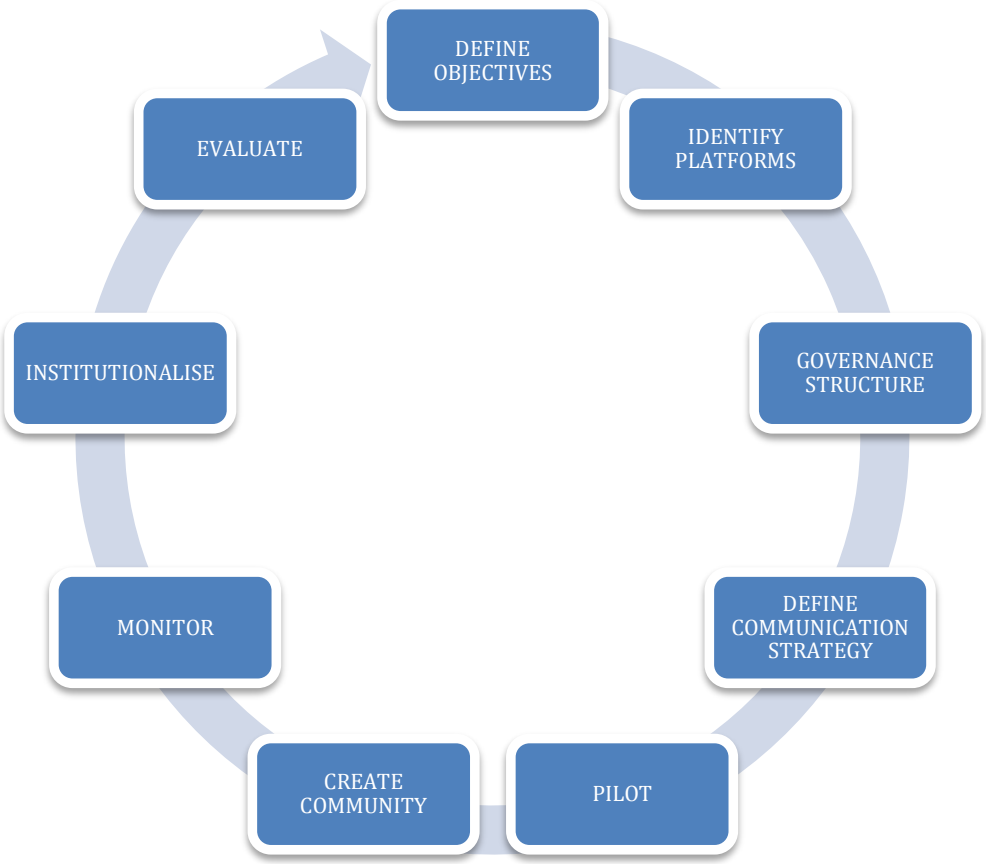

Figure 6.2: Recommendations — Nine stage model for SM adoption to emergency management

6.2.1 Define Objectives

The examples of SM use offered in this report have demonstrated that even though dissemination of messages is the main objective for EMAs, other objectives can also guide SM strategies, ranging from community building to recruitment. SM can have a relevant role in situational awareness and supporting operations as well.

Each EMA needs to define its own objectives as there is no a general list that fits with all of them. Identifying the opportunities for an organisation in leveraging SM tools is an important task. Thus, EMAs need to formulate objectives as a priority, in order to guide their next steps. In formulating objectives, policy makers or emergency managers need to remember that they

cannot do everything. Agencies need to choose their objectives according to their specific responsibilities and duties, as well as their structures and operational procedures. EMAs also need to take into account previous communication plans and introduce SM and Web 2.0 tools as another channel, reinforcing objectives or adding new ones. Once they have listed their objectives, it is important to prioritise them keep them under constant revision while advancing through the nine-step model.

Table 6.1: Stage 1: Define Objectives

Stage 1	Examples
Define objectives	• Build a shared and updated risk map for internal coordination during floods • Build a resilient community providing safety education • Enhance outreach of emergency message • Event planning
Prioritise objectives	• Enhance outreach of emergency message • Event planning • To build a shared and updated risk map for internal coordination during floods • Build a resilient community providing safety education

6.2.2 Identify platforms

Having defined the objectives, the next step is to identify the platforms in which the EMA will engage. Since the choices are many, EMAs again need to think careful what each platform offers in relation with the objectives formulated in the first stage. It is tempting to use many SM platforms, but EMAs has to develop a plan of action for each platform and keep streams updated as finding has shown the relevance of engaging with the public in a daily basis. Thus, EMAs should only use the platforms that the organisation can keep constantly updated and manage during disasters. It would be useful to review the previous chapters, where platforms are defined and especially Chapter 5, where the functions that Web 2.0 supports for the emergency management area are described through examples of usage.

Once the most appropriate platform has been chosen, it is useful to obtain information about social media sites the targeted population use. Although the strengths of some particular services may be better suited to the objectives, such as Twitter for crisis communication or YouTube for educa-

tion, if that particular service has no users at all, the efforts will be in vain. A recommendation is to begin with only one or two platforms with which the EMA will initiate the interaction with citizens and other stakeholders. The choice of the platform is also conditioned by existing regulations and issues such as privacy, data protection or security.

Table 6.2: Stage 2: Identify Platforms

Stage 2	Examples
Identify Platforms	• Facebook and Twitter - objective 1 (Hootsuite to post in both at the same time) • Twitter – objective 2 (set up hashtags for each event) • GeoCommons – objective 3 • Facebook and YouTube –objective 4
Population usage	Use databases to search which are the Web 2.0 tools the population or community addressed are using and check if the platforms identify match with the data.

6.2.3 Governance Structure

The EMA needs to define a governance structure to manage the SM profiles according to the governance structure of the whole agency. For example, will it be a 24/7 activity? Or, will it be an office hours only activity? Can the practitioners use their personal accounts during emergencies? What information can they provide? Who will manage the official account? The Disaster 2.0 research team consistently found that the Web 2.0 usage improves and is more widely adopted when the practitioners know the rules and regulations for effective use of SM. Moreover, it is crucial to define these rules and publish them within the organisation. Some key aspects to define are:

- *Account governance:* The first main issue related to the account governance is the decision of using official account, personal-professional accounts or both. The second aspect is the creation of the institutional image or what image the institution want to imprint in the citizens. Relevant examples include the case in section 5.4.3 “Engage in a two way conversation”, where the EMA used a friendly and intimate tone to communicate with the citizens, or the Greek Police force case (described in the Case Studies report). This stage includes such tasks as choosing the name of the accounts, establishing consistency across all the platforms in use. It also includes rules for management of logins and passwords (who will manage the account, who will have access to them, etc.).

- *Allocation of resources:* The human resources available need to be assessed. It is essential to ensure that personal and their responsibilities are clearly marked out very early. Obviously a sufficient number of resources must be available to achieve the operational objectives and to manage the Web 2.0 platforms chosen. Some organisations have relied on their communication departments, others on emergency managers, but in the current economic -climate very few EMAs have hired specialised community managers to reinforce Web 2.0 adoption.
- *Roles and responsibilities:* Once human resources have been allocated, the roles and responsibilities of the Social Media team should be clearly defined. This means to clearly identify who has the responsibility over the accounts in any situation, both during an emergency and while on standby. And this is related with the next issue. Remember how important it is to hire or enrol a SM "evangelist"? Identify the younger staff members within the organisation, as it is more likely that they already have more extensive experience in using SM than the older EMs.
- *Content creation:* To define which content will be published on each platform and from each account (official and personal). This informs staff what they can post whilst protecting others within the organisation or outside (staff, affected people, etc.). Relevant legislation – internal or external – should be taken into account, such as copyright.
- *Legal frameworks:* Review the legal provisions of the area that the organisation operates within.

Important aspects of this stage are presented in Table 6.3 below.

Table 6.3: Stage 3: Governance Structure

Stage 3	Examples
Governance Structure	Organisation structure: Hierarchical, command & control structure, communication department, press officer
Account Governance	• Official accounts: e.g. FB: XYZPolice; Twitter: @XXYZPolice; YouTube channel XYZPolice YouTube Channel • Friendly and approachable tone of messages • Accounts managed by the communication department with the Head of the Press Office in charge • The EMA allow to their practitioners to have their own personal-professional account.
Allocation of resources	• The Communication Department will be in charge of the official accounts. • They will provide training to staff to manage their personal accounts.
Roles and responsibilities	During peace times the staff from the Communication Department will update the accounts. During emergencies or disasters, information needs to be approved by the Head of the Press Office.
Content creation	• The Communication Department is the responsible for content creation in official accounts. Twitter and FB will be updated at least three times per day in peace times, as needed during emergencies. The content will be related to information of Police activities, public safety, and damages in CI. • The personal accounts cannot publish any information about police operations, can not publish pictures of staff in operation, etc.
Legal Frameworks	Regulations of the specific country, i.e.. Copyright laws, privacy laws, data protection, guidelines for the SM use.

6.2.4 Define the communication strategy

For many EMAs, the use of Web 2.0 tools and SM carries a real concern that organisations will lose control over information, of their identity and of their governance structure. To define the SM communication strategy and publish it to all the members of the organisation is a vital activity that fosters adoption as it clarifies potential confusions while guiding their use. The SM strategy should be incorporated into the general communication strategy of the EMA, if they have one.

The communication strategy should cover topics such as; the integration of SM into routine procedures; connections with existing social networks in the area;the sharing SM content across sites; and publicising use of social networking through traditional media. The specific activities have to be defined in the context of the particular EMA, but the findings offer some general issues that need to be considered:

- *Responsiveness:* It is important to define a strategy that promotes a two-way conversation with citizens and other stakeholders on some level. The communication strategy should define how to do it, in which tone, from which account, etc.
- *Audience:* The people and groups with whom the organisation wishes to communicate need to be identified. Remember that one can communicate with the public, but SM also supports internal communication and communication with other agencies involved in the emergency management sector.
- *Types of communication:* This can include warnings, risk maps, alerts, instructions, safety and preparedness tips. List all the type of communication, prioritise and decide. Ambitions need to be realistic.
- *Methods of communication:* Decide which type of communication will be made on each SM platform. For example, where will the risk map be published? Where will warnings be sent?
- *Managing expectations:* A very important issue is to define the expectations of citizens and other stakeholders will be managed. The audience needs to be informed of the objectives and limitations of the account. For example, some EMAs in their Twitter account inform that they do not work as an emergency telephone line.

Table 6.4: Stage 4: Defining the communication strategy

Stage 4	Examples
Communication Strategy	Include the SM strategy into the Communication Plan of the organisation. Write down all the objectives, platforms, accounts, rules and regulation defined in the previous stages.
Responsiveness	• This organisation will answer to specific public queries in an official way, no in a personal way. • The personal accounts can give answer to personal queries but only if they have to follow the rules stated before.
Audience	• Internet users living in the city or surrounded areas. • Tourists visiting the area. • Private companies organising big events in the city. • Public attending these events. • Agencies managing the traffic, weather, etc.
Types of communication	Warnings, weather information about flooding risks, road conditions, safety tips, evacuation messages, etc.
Methods of communication (to add to the existing methods)	• Twitter and Facebook for warnings and information related to weather, road condition, etc. • Youtube for safety tips and preparedness.
Managing expectations	In the profile of the Twitter account, a disclaimer should be publish informing to the followers that it is not an emergency channel. In the Facebook profile description as well.

6.2.5 Run a pilot

A pilot should be run as soon as team members have been assigned account details. It is better to test operational efficiency and team work with a small pilot check the barriers and problems in using SM. Choose one or two objectives and one or two platforms. Determine the time schedule for the pilot and work with the platforms with all the team that will manage the SM profiles. The main thing to do during and after running the pilot is to evaluate it. This will allow reformulating of objectives, platforms and communication strategy according to the pilot experience.

Table 6.5: Stage 5: Run a pilot

Stage 5	Examples
Run a pilot	Using Twitter during an event to inform of the weather conditions and the road and traffic conditions
Evaluate	To evaluate the pilot and rethink the communication strategy on SM according to the results

6.2.6 Create community

Some recommendations for community building include:

- *Build the community online*: SM supports the creation of social networks as one of their main features. The social network needs to be created in accordance with the objectives identified. It is good practice to contact and make agreements with influential SM users in your area as they can help to publicise the accounts and to spread messages.
- *Connect with existing networks:* Existing networks refer to other EMAs or groups of people interested in the use of Web 2.0 for disaster management. They can help the organisation to keep up to date with the latest technological innovations, tools, new procedures, official publications, etc. in the area.
- *Integrate SM into the office operations routine:* Although it has been stated before, it is important to have an awareness that a timely and constant flow of information is a key to sustaining the community.
- *Engage in a two-way conversation:* two way conversations keep audience engaged with SM accounts.

6.2.7 Monitor

SM monitoring must be an integral part of any SM strategy, not only in analysing impact and reach of the message but in operational terms as well. SM monitoring is not only about public engagement with the EMAs or promoting the institution. It is a key aspect of leveraging Web 2.0 technologies for disaster response, as it can help to achieve a better situational

Table 6.6: Stage 6: Create a community

Stage 6	Examples
Create a community	
Build your community online	• Search influential users in the city, follow them, get them follow the official accounts, and make agreements with them to help diffusing relevant information. • Get followers, friends and subscribers.
Connect with existing networks	Connect with the EMAs in cities around your one, the same region or at national level and share practices and interest with them. Ask them how they are undertaking specific task over SM and think how your organisation can apply them.
Integrate in the routine	• Everyday at 8:00, 13:00 and 17:00 the traffic conditions around the city will be published. • Everyday at 8:30 and 20:30 the weather forecast will be publish. • Every day at 17:30 a bulletin with the incidents the Police have dealt in the last 24 hours will be published. • Routinely update the risk map shared with the weather forecast agency with the CI damaged or affected.
Engage in a two-way-conversation	The EMAs give official answer to the public concerns.

awareness and to detect emergencies. It is also the most technical and difficult part of Web 2.0 usage as it can require technical skills and knowledge. Today a multitude of tools offer solutions for measuring conversations, sentiments, influences and other parameters. They help in discovering and filtering data from conversations and can be used to assist emergency and crisis management. It can be a complex task, thus some tips for SM monitoring include:

- *Define what is to be monitored*, crisis detection, CI conditions, evolution of a crisis, perceptions of the population, etc. Knowing what the objectives for monitoring are is key to picking the right platform.
- *Real-time instantaneous monitoring:* Systems such as Hootsuite, TweetDeck and Topsy can be used to gather information related to a topic, category, event, name or incident related information. These

systems usually rely in the use of hashtags (in Twitter and FB) or on the use of tags (Flickr, YouTube) to organise and structure the information. This monitoring can also be geographically related.
- *Collective monitoring:* SM tools can be established or the relevant profiles and communities can be used to apply the idea of citizens as sensors.
- *Establish the tools for monitoring and standardise procedures*, as there are a large number of tools available. A choice needs to be made and formal procedures established to govern the monitoring, both during emergencies and routinely. Review the tools and technology regularly as monitoring tools are evolving rapidly.

Table 6.7: Stage 7: Monitor

Stage 7	Examples
Monitor	
Define	Monitor any burst of activity during hard raining to detect flood risk.
Instantaneous monitoring	Use TweetDeck and a WordCloud tool to monitor Twitter activity
Collective monitoring	Locate the SM users living in areas at high risk of flooding (e.g. close to the river) and check what they are saying.
Establish tools for monitoring	TweetDeck, Hootsuite, etc.

6.2.8 Institutionalise

The final step is to institutionalise the SM and Web 2.0 profiles and integrate them into the existing administrative and communication structure. An indicative list includes the following activities:
- To publicise the SM communication strategy, including all the policy announcements, both internal and externally.
- All traditional media channels need to publicise the new SM communication channels.
- Run internal workshops and seminars to raise awareness of the SM presence and to provide training to interested practitioners. Share experiences with other EMAs using these tools, capture and communicate success stories.

6.2.9 Evaluate

Web 2.0 tools, SM and the technology we use are evolving and changing rapidly. New innovative uses are also constantly emerging. Consequently, all EMAs making use of these tools should not just rely on what they have

Table 6.8: Stage 8: Institutionalise

Stage 8	Examples
Institutionalise	Set up all the Web 2.0 tools and SM profiles planned and integrate them in the EMAs
Publish	Make a press office realise to publicly announce the use of SM.
Traditional media	Include the SM profiles in leaflets, cards, etc.
Collective monitoring	Locate the SM users living in areas at high risk of flooding (i.e. close to the river) and check what they are saying.
Workshop	To provide a webinar to all the members of staff to explain the rules and regulation and share the first experiences of SM usage.

planned to do. The SM landscape for new tools, improved features or innovative uses in the disaster management area needs to be continuously monitored. More importantly, the use of SM and the governance structure needs to be reviewed constantly. The evaluation will lead to improvement in the original SM strategy. Findings of this project showed how the EMAs have mainly learned through experimentation and trial and error.

Table 6.9: Stage 9: Evaluate

Stage 9	Examples
Evaluate	Establish a periodic evaluation. In the evaluation you can use this 9 stages model to review any stage and reformulate it if needed.

6.3 Social Media Adoption and Usage Assessment Worksheet

Below a worksheet is shown that can be adapted to the particular instance and requirements of an EMA.

		Specify those relevant to the institution/EMA:
1	**Objectives**	
	Prioritise objectives	
2	**Identify platforms**	
	Population usage	
3	**Governance Structure**	
	Account Governance	
	Allocation of resources	
	Roles and responsibilities	
	Content creation	

	Legal Frameworks	
4	**SM Communication Strategy**	
	Responsiveness	
	Audience	
	Types of communication	
	Methods of communication	
	Managing expectations	
	Responsiveness	

5	**Run a pilot**	
	Objectives	
	Evaluate	
6	**Community building**	
	Build your community online	
	Connect with existing networks	
	Integrate in the routine	
	Engage in a two-way-conversation	
7	**Monitor**	
	Define	

	Instantaneous monitoring	
	Collective monitoring	
	Establish tools for monitoring	
8	**Institutionalise**	
	Publish	
	Traditional media	
	Collective monitoring	
	Workshop	
9	**Evaluate**	

6.4 Conclusions

In this chapter we have presented the recommendations and guidelines to adopt more systematically Web 2.0 tools and SM for disaster management. It provides a nine stage model that can be used to define and apply the EMA's SM strategy, both for communication and for disaster management. These tools have been developed from findings of the project.

Chapter 7

Overall Conclusions

This report has described the findings from data captured over two years of research into how emergency management practitioners in a number of EU member states, currently deploy and can potentially effectively use Web 2.0 applications to protect the public and critical infrastructure (CI). Governments and government organisations across Europe are preparing to respond to a variety of disasters. New communication technologies are one tool that governments can use to plan for, prepare, coordinate and execute a proportional response to crisis, emergencies and disasters. The key concepts that underpin the Disaster 2.0 project are summarised in Figure 7.1 (below) – which suggests that Emergency Management Agencies (EMAs) can improve public resilience and protect CI through introducing Social Media (SM) and Web 2.0 tools to their emergency toolkit. Sharing best practice can also help EMAs to prepare themselves in the light of others' experiences.

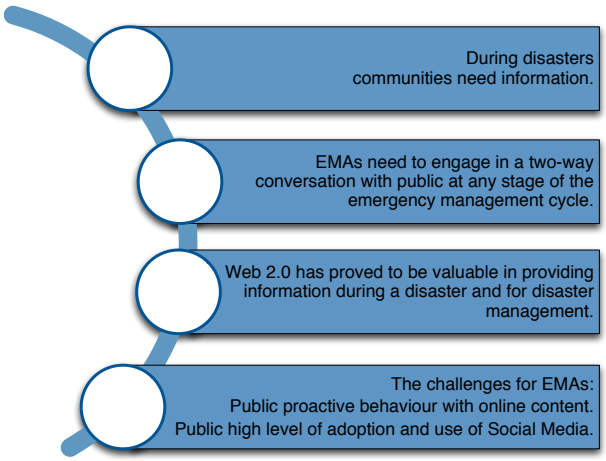

Figure 7.1: The Disaster 2.0 project concept

Figure 7.2 visually tells the story of Disaster 2.0 project. During the in-

ception stage, the team formed, set up the aims, the advisory board, selected the countries and EMAs and discussed the project aims to align with their communicational and operational needs. During the project's data collection phase, the team conducted over hours of interviews with practitioners and specialists involved in emergency management. The team spoke formally with over 50 people from the selected countries, and also collected materials from each country on how they currently use, or have plans to use, Web 2.0 tools. The questions posed to interviewees were developed over a four-month period, and were informed by the findings of a detailed literature review.

During the project's feedback phase, the team organised two Masterclasses (Birmingham, UK and Brussels, Belgium) which provided emergency management practitioners from across Europe with an opportunity to share their knowledge and experiences of using Web 2.0 technologies. In addition, the team visited each participating country and delivered presentations describing their interim research findings . The team presented to over 60participants over the feedback period and provided each country with a tailored report highlighting the strengths and opportunities in their countries. The team also organised an International Conference on Social Media and Semantic Technologies in Emergency Response (SMERST13) at Warwick University, which took Social Media and Semantic Web as its theme.

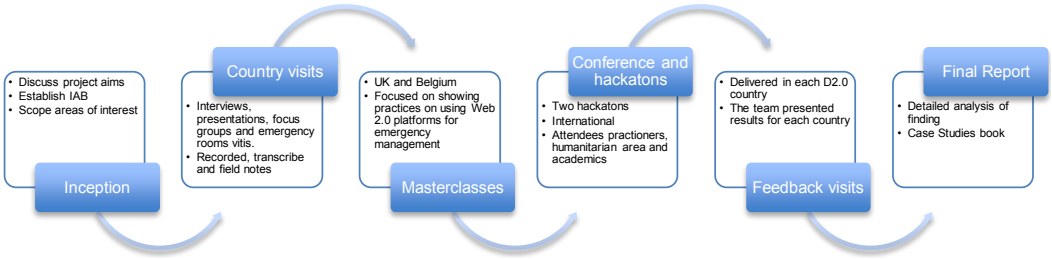

Figure 7.2: The Disaster 2.0 Data collection and dissemination structure

Previous chapters in this report have described in detail why the project was carried out; what it intended to explore; how the research and analysis was carried out; and it also drawn conclusions regarding the topics investigated. The report has also shown how the project not only built on previous work, but also filled significant gaps in understanding of how different EMAs in Europe adopt and use Web 2.0 techniques. Finally, it suggests a set of recommendations for further adoption of Web 2.0 tools for emergency management. This chapter concludes the report by drawing together the findings of the project into a single, coherent whole. The aim is therefore to show that the project provides an integrated, state-of-the-art analysis of how to use Web 2.0 for emergency management and how the work already carried out by EMAs and the public provides practical examples of the bene-

fits and barriers to overcome in using SM. This is the strength of the project findings as the topics covered have in the past, been studied separately, and treated as a communication problem or as a operational and management problem. This chapter will first summarise the key findings described in the earlier chapters. First, we take a step back to revisit the aims and objectives that the team set out to achieve at the start of the project.

7.1 Aims and objectives

The key objective of Disaster 2.0 was to understand how Emergency Management Agencies (EMAs) across the EU are using, or are planning to use, Web 2.0 applications to strengthen public resilience to disasters. This section restates the project's aims and provides brief summaries to explain how these were met.

1. Identify innovative uses of Web 2.0 platforms by emergency management agencies (EMA). Innovative ways of using Web 2.0 platforms in the disaster management area were identified through the literature review, the analysis of past disasters and exploring current practices in the Disaster 2.0 countries. The innovative uses of Web 2.0 technologies have informed the case studies book, this report and the recommendations of Chapter 6.

2. Understand which Web 2.0 practices have worked and the procedures of its adoption within the organisation and in relation with other stakeholders. The results in Chapter 5, provide practical examples of success in the use of Web 2.0 technologies for disaster management. In that chapter, the report also provides procedures for adoption from an organisational point of view, reviewing the drivers and barriers – social, technical, economic and operational — that EMAs faced when adopting SM.

3. Improve information management during disasters and emergencies through improving EMAs' understanding of Web 2.0 platforms. The project provides empirical data showing the benefits of using Web 2.0 technologies and also provides a powerful set of drivers of adoption. These benefits and drivers are summarised in the Section 6.1 "Why use Social Media?".

4. Establish how successful these Web 2.0 platforms have been in mitigating damage to Critical Infrastructure (CI) and building resilience in the public. The lessons in chapter 3, the findings in chapter 5 and the case studies collected in the case studies book, which accompanies this report, focus on successful cases of SM usage. The case studies

also provide strategies and transferable lessons to facilitate the strategies for EMAs wanting to use SM.

5. Determine what problems arise in using these platforms. While reporting successful stories of application the report also paid attention to the problems arising, such as the spread or rumour, inaccurate information or the lack of engagement. This is important as it can lead to developed strategies beforehand to avoid the problems that other agencies have confronted.

6. Provide a road map of how Web 2.0 tools can help information and emergency management, specifically when communicating with the public. Chapter 6 provides a nine-stage model that EMAs can use, not only to develop their strategy for using Web 2.0 technologies and SM, but also to periodically evaluate the strategy adopted.

7. Develop an illustrative list of case studies of EMAs currently using Web 2.0 applications for disaster and emergency management. The illustrative list of case studies is included in the case studies book. However, the report also develops some cases related to specific issues emerging from the findings that the team considered explanatory.

8. Identify transferable lessons which can assist in future adoptions of Web 2.0 platforms. The transferable lessons are identified in each case study. Moreover, they informed the recommendations.

7.2 Research findings

7.2.1 Literature review and previous research

This section summarises the main findings from the literature review which demonstrate they immense significance of Web 2.0 tools and Social Media. The specific “lessons learned” when using social media for emergency management are:

- The need to provide accurate information.
- The value of social media for situational awareness.
- The need to avoid and stop malicious uses of social media during disasters.
- The technological limitations of tools that monitor social media for situational awareness.

From the EMAs point of view that means a systematic usage that could include:

- using social media in each phase of the disaster management cycle; preparedness, response, recovery and mitigation;
- monitoring people's activities and postings to establish situational awareness;
- using uploaded audio-visual content to create damage estimates in critical infrastructure;
- engaging in a two-way conversation with the public;
- using social media to receive victim requests for assistance;

7.2.2 Web 2.0 technologies for emergency management communication

The main SM function that EMAs are adopting consists of pushing critical information into the public domain. It delivers a more controlled environment where the EMAs can disseminate the information to its stakeholders. Social media enhances distribution and communication of information. EMAs need to enhance their message and they need to include SM strategies in the wider communication plan. Results show the benefits of going beyond a push strategy and engaging in a conversation with the public and other stakeholders are the following:

- Social media can be used to both communicate directly with stakeholders, including the public, and the media at the same time.
- Use SM as the primary tool for updated information.
- Test and update the SM tools.
- EMAs need to engage social media in daily communication activities.
- EMAs need to build 'follower' communities.
- Build trust and become the authority voice.
- EMAs engage in the SM conversation, this allows rumour management and stopping the spread of fake information. Responding through SM shows the organisation cares what stakeholders think and can be trusted to address their concerns.
- EMAs can reach specific demographics with a key targeted message.
- Incorporate SM and Web 2.0 to the current communication channels.
- Web 2.0 is not a strategy or tactic by itself.

7.2.3 Web 2.0 and Social Media for situational awareness

EMAs need to engage more consistently and systematically monitor Social Media in order to leverage Web 2.0 technologies for situational awareness.

- Social Media can be used for crisis detection through monitoring.
- It is important to monitor consistently, before, during and after events so you can easily detect any change in the activity.
- EMAs need to take the lead in providing information and communicating on Social Media as it will allow them to set-up the hashtags and the Tweet structures that will be useful to monitor during emergencies.
- Usefulness of Web 2.0 mapping tools, visualisations and other decision support tools.

7.2.4 Web 2.0 and Social Media for organisational communication and cooperation

EMAs need to further adopt Web 2.0 tools for internal collaboration and cooperation, as well as for cooperation with other stakeholders.

- SM can support internal exchange, sharing and communication of information in all the phases of the emergency management cycle.
- Web 2.0 services, contain instant message systems, online maps and documents, which allow for teams of emergency managers to share information during emergency operations.
- EMAs can take advantage of the increasingly knowledgable public in the operational use of a willing public who are increasingly knowledgeable of Web 2.0 technology, by organising online volunteers who interact with them to share common goals during emergencies.
- EMAs and volunteering organisations should to work on the logistics beforehand.

7.2.5 Web 2.0 adoption in Emergency Management Agencies

EMAs, besides planning strategically how to use Web 2.0 for emergency management, need to prepare and plan how to adopt and institutionalise their usage within the organisational structure, as well as thinking about the impact and collaboration with other stakeholders. Factors which EMAs should consider:

- Citizens' SM usage during major emergencies is the most powerful driver for adoption.
- SM adoption needs public engagement of the targeted population.
- For a successful adoption, an organisation needs to rely on an "evangelist" or entrepreneur emergency manager.
- Regulations and policies have a huge impact on adoption. EMAs need to broadcast them among staff members where they exist, or create them where they do not.
- Introduce SM strategies in the communication plan.
- Standardise SM actions and strategies for emergency management.
- A more systematic adoption of SM is required.

7.2.6 Recommendations

Section 6.2 has defined a nine-stage model to systematically use Web 2.0 technologies and Social Media for disaster management. It highlights the main reasons for, and benefits of, adopting Social Media and provides a set of guidelines that aims to help agencies in adoption. Figure 7.3 shows the model again.

7.3 Future research and Closing Remarks

Despite the extensive scale of the Disaster 2.0 project, and its successes in transferring knowledge and practical experience, a number of questions remain outstanding. As has been seen, the operational deployment and adoption of Social Media and Semantic Technologies require complex institutional processes and it would be impossible to address every issue surrounding the research topic in a single project. Moreover, the exploratory nature of the project provides us an important insight into the state of the art and successful cases which could guide Emergency Management Agencies in Social Media adoption, but lacks depth understanding of specific questions. The following recommendations for future research are based on the findings and from discussions with emergency management practitioners who generously gave up their time to take part Disaster 2.0.

It remains for us to embed the nine-stage model in an EMA and evaluate it. While parts of the model have had individual influences, research can continue to refine each component to ensure its maximum impact is realised. This will take the form of close working with EMAs to understand the contextual (including specific hazards and socio-cultural aspects of each country and social group) which affect the application of the model to their

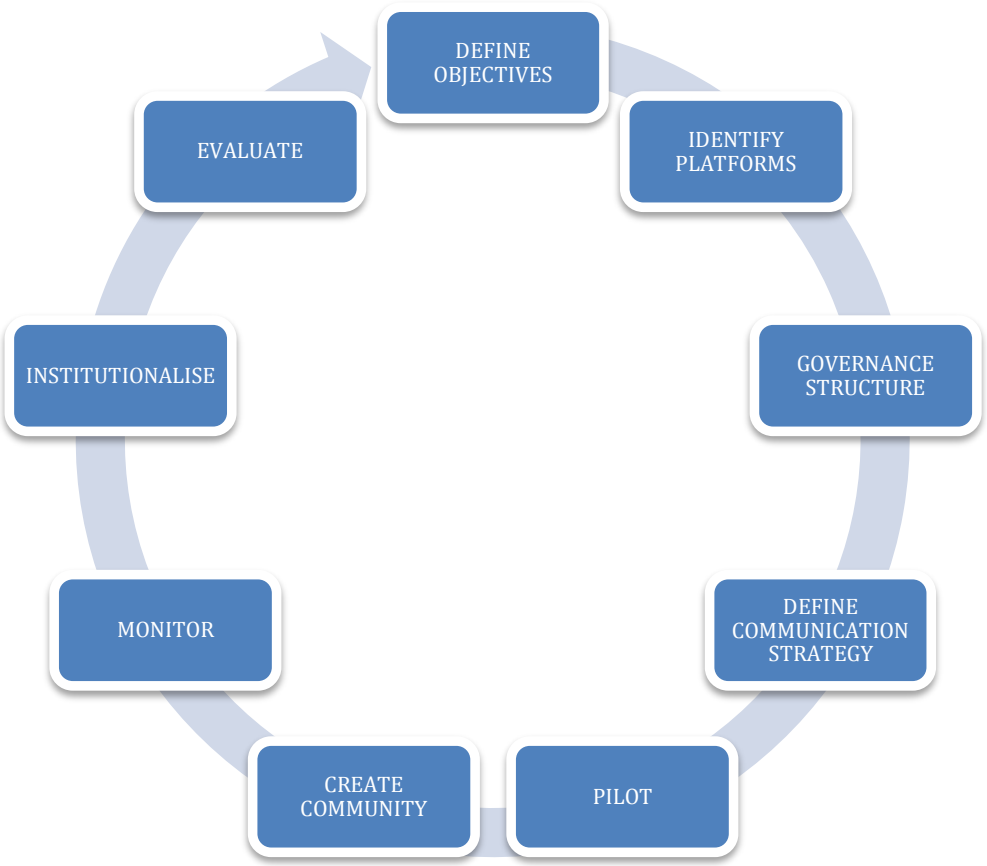

Figure 7.3: Recommendations — Nine stage model for SM adoption to emergency management

situation. We will continue to seek opportunities to fulfil this objective. Consequently, this would lead to the development of alternative models of adoption taking into account the features of each EMA.

It also remains to link these findings with the development of Web 2.0 and Semantic Web applications and services. Although there have been several opportunities to do this - mainly during the project - there are still opportunities to link the findings in technological developments.

The Disaster 2.0 framework for using Web 2.0 technologies to strengthen resilience in the public and mitigating damage to Critical Infrastructure (CI) is intended as a common frame of reference around which developments in emergency management with Social Media can be structured, and also as a basis for further research. The recommendations and the nine-steps model provide flexibility for a practitioner or researcher approaching the topic. This allows an EMA to consider new approaches to emergency management and risk and crisis communication. For example, the model can be used to explore the potential of SM for enhancing the message whatever its content is: educational, informational, evacuation, etc. The intention is for the

Disaster 2.0 model to become a standardised means for starting using and further adopting Web 2.0 technologies for emergency management, and, at the same time, provides an starting point for further research.

The model and the Social Media Adoption Assessment Worksheet (SMAAW) are designed to be a practical development for emergency managers with direct involvement in risk and disaster communication. The worksheet provides a simple list approach for an emergency manager seeking to assess their organisation's preparedness for a using Social Media or further developing its usage.

Chapter 8

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