UNIVERSITY OF SOUTHAMPTON
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The Evolving Symbiotic Relationship between Social Media and Emergency Management: An Exploration into the Value of Social Media for Emergency Responders in the UK

by
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ABSTRACT

FACULTY OF ENGINEERING, SCIENCE AND MATHEMATICS
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This thesis contributes to the field of social media within emergency management, helping us to better understand the value of social media for emergency responders.

Social media have become an integral part of emergency management. Opportunities to increase situational awareness, improve emergency communications, and engage the public in preparedness and resilience-building activities are advocated ubiquitously in the literature. However, the impact upon emergency management resulting from emergency responders' social media use is presently inconclusive.

Utilising a mixed methods approach, perceptions of both UK emergency responders and their followers are considered. Emergency responders' objectives and desired outcomes for using social media are explored. The views and motivations of their followers are then provided, offering insights into the possible impacts of emergency responders' social media use upon emergency management. This research demonstrates that social media value for emergency responders depends on a combination of their intentions, online behaviour, and level of engagement from their followers. Future assessments must go further than judging emergency responders' ability to effectively communicate in an emergency. Their ability to influence behaviour and perceptions through social media must be examined. The followers' motivations and perceptions also need to be understood; it emerged that social media are not merely confined to developing relationships between emergency responders and the public, but also between emergency responders themselves. It is recommended that, going forward, research in this field continue to employ a mixed methods approach.

This research proposes a conceptual, multifaceted framework named SMOKE, which could serve two purposes: a guideline for future assessment of emergency responders' social media usage and a training/strategy tool for emergency responders to help guide their social media activity. Further, an abstract model of potential value is presented, which advocates three core roles social media could play in emergency management: from an information hub to an educational platform and, ultimately to a channel of influence and community spirit.

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Declaration of Authorship

Name: Sophie Parsons

Title: *The Evolving Symbiotic Relationship between Social Media and Emergency Management: An Exploration into the Value of Social Media for Emergency Responders in the UK*

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

- This work was done wholly while in candidature for a research degree at this University;
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- Where I have consulted the published work of others, this is always clearly attributed;
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- Parts of this work have been published as: Parsons et al. (in press)

Signature: . . . . . .

Date: . . . . . .

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Chapter 1

Introduction

Technological advances have revolutionised the way that information is accessed and shared, with new modes of delivery and speeds today that were not possible even only a decade ago (Linke and Zerfass, 2013). The Web, defined as a network of documents accessible through a browser, has played a significant role in that change. Initially a place where users could generally only read Web documents, it now allows users to connect, interact and generate content themselves, and in real-time; for example through Web searches, microblogging and push notifications to mobile phones and smart watches. This new era included the arrival of Social Media: an umbrella term for a collection of applications formed of user-generated content made accessible through the Web. Some of the most prevalent social media platforms include blogs (e.g. WordPress), social networks (e.g. Facebook), microblogging (e.g. Twitter) and collaborative documents (e.g. Wikipedia). They offer opportunities to collaborate, communicate, and exchange information on a local, national and global scale. For millions of people, social media have become an integral part of their everyday lives. As of January 2017, it was estimated that 37% of the global population were found to be active social media users (We Are Social, 2017). These pervasive and flexible technologies have over time become embedded in a number of research fields, including Politics, Business, Marketing, Education and, indeed, Emergency Management.

Emergency management is the organisation, planning and implementation of resources and responsibilities for handling emergencies (UN/ISDR, 2009). An emergency refers to any disruption requiring some level of response, support or governance, independent of its type, origin, size and complexity (Rao et al., 2007). This could range from a house fire to multi-vehicle collisions, wide-scale flooding or a terrorist attack. The focus of emergency management is to reduce risk from hazards (a potential source of danger) and minimise or prevent the impacts of an emergency (O'Brien, 2008). It constitutes the actions used to prepare for, respond to, and recover from emergencies. A common framework used as a reference tool by emergency managers is the Emergency Management Lifecycle (EML), depicted in Figure 1.1.

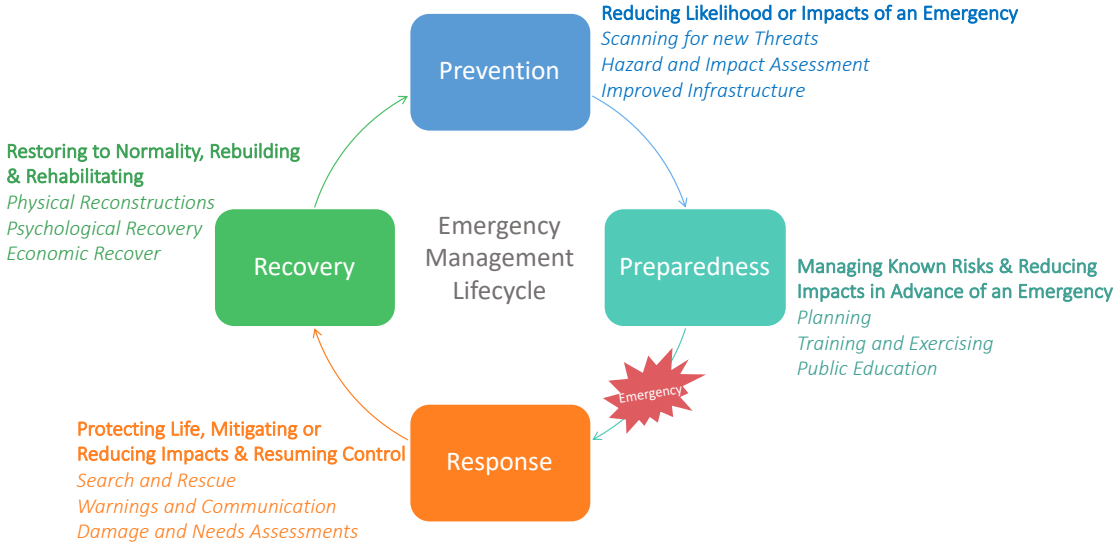


FIGURE 1.1: Emergency Management Lifecycle Representation - Produced based upon the UK's approach to preparing for, responding to, and recovering from emergencies, (Cabinet Office, 2013a)

It models the phases of an emergency (prevention, preparedness, response and recovery) and highlights the necessary operations in each phase (Vasilescu et al., 2008; Faulkner and Vikulov, 2001). The emergence of social media is fundamentally changing the ways in which information is exchanged in each of the phases of the EML. In the words of Keim and Noji (2011):

> *"Traditional emergency management methods have not changed with a 'bang', but with a 'tweet" - Keim and Noji (2011)*

From announcing eyewitness reports to sharing photos and videos and revealing location data, social media have prompted new forms of public participation in emergency management, particularly in the response and recovery efforts (Palen and Liu, 2007). For example, as the devastating mass shooting unfolded on the campus of Virginia Tech, USA, in 2007, students turned to Facebook for self-reporting of their own safety and to identify which of their friends and colleagues were safe and alive (Vieweg et al., 2008). In 2009, individuals local to the US Red River Floods used Twitter to form online communities and distribute information on flood-related matters including evacuation and sandbagging (Palen et al., 2010). Twitter also served as a useful communications tool following the Great Tohoku Earthquake and Tsunami in Japan. People used it to request assistance as phone lines were severed (Acar and Muraki, 2011). These uses are far removed from the founders' initial intentions for social media. For example, Twitter was initially designed to be a service for people to post short updates.

In 2009, however, a U.S Airways Flight successfully landed on the Hudson River following a bird strike. An eyewitness captured a photo of this incident and uploaded it onto Twitter with the message:

> 'There's a plane in the Hudson. I'm on the ferry going to pick up the people. Crazy'

According to Twitter's co-founder Jack Dorsey, this was a significant turning point for the organisation. Twitter aims to support communications between victims, first responders and humanitarian relief efforts, an objective cited within the company's values statement: 'Values: Twitter for Good'[1].

> *"Suddenly the world turned its attention because we were the source of news—and it wasn't us, it was this person in the boat using the service, which is even more amazing." – Jack Dorsey, 2009*[2].

Social media companies are launching new features to their platforms to help satisfy these new needs. In 2013, 'Twitter Alerts' was implemented to support local, national and international institutions with the delivery of important information during a crisis[3]. The feature allows for these organisations to appoint emergency communications such as warnings of imminent danger, evacuation directions or urgent safety messages as a 'Twitter Alert'. These are then emphasised on their followers' timeline and instantly sent to their followers' mobile device as a push notification or SMS text message.
In 2014, Facebook introduced the 'Safety Check' feature for users to let their Facebook friends know that they are safe if they have a location setting in the same area affected by a disaster[4]. Users receive a push notification on their mobile devices asking them to indicate that they are 'safe'. Once the safety status is submitted a notification and news feed story is generated for their friend connections to see.

Recently, social media have been viewed as an opportunity for emergency responders to interact and engage with the public. Emergency responders (a term that refers to both individual officers and emergency organisations) play a key role in emergency management. They are responsible for actions to prepare for, respond to, and recover from emergencies. The ubiquity of social media allows for emergency responders to influence risk reduction (Panagiotopoulos et al., 2016), and their real-time nature enhances situational awareness (Lindsay, 2011) and enables crisis detection and monitoring (Sakaki et al., 2010). More recently, social media have been recognised as

[1] Twitter's Values: Twitter for Good [Last Accessed: August, 2018]
[2] The five year anniversary of Twitter's defining moment (2014) [Last Accessed: Sept. 2018]
[3] Twitter blog post: Introducing Twitter Alerts (2013) [Last Accessed: Sept. 2018]
[4] Facebook blog post: Introducing Safety Check (2014) [Last Accessed: Sept. 2018]

convenient tools to build the capacity of real and online volunteers and are considered helpful for increasing community resilience (Dufty and Stewart, 2016).

Despite the recognition of potential opportunities and benefits, social media are reportedly underutilised by emergency responders (Plotnick et al., 2015). For instance, according to Pew Research Center, in 2012 more than 20 million tweets were posted about Hurricane Sandy between October 27th and 31st October (Guskin and Hitlin, 2012). However, the use of Facebook, Twitter and Nixle by US Fire and Police departments based in the affected regions was limited (Hughes et al., 2014a).
On the other hand, there are examples of social media forming part of an effective strategy for emergency responders. In 2011, two London Police forces actively used Twitter as an outreach channel to communicate with the public (Denef et al., 2013); and in 2013, following the Boston Marathon Bombing, the Boston Police Department used social media for reasons including: keeping the public informed about the status of the investigation, requesting assistance and eye witness reports, and calming people's nerves and concerns (Davis III et al., 2014). However, whether social media are a worthwhile investment for emergency responders is a far more complex question. Social media in emergency management encompasses not only the content that is shared through these technologies, but who it is reaching, how it is used, and if it is effective in achieving emergency responders' goals and objectives.

Associations between social media and political and social changes have been found.
In 2011, social media played a role in the Arab Uprisings, facilitating freedom of speech and forming online activist groups (Cottle, 2011). In 2016, evidence suggested that the results of the US Presidential Election had been influenced by the circulation on social media of false stories about Hilary Clinton (Allcott and Gentzkow, 2017).
Additionally, social media have been attributed to charitable and emergency relief fundraising. According to a CNN Report, the use of social media contributed to the successful $21 Million raised for relief efforts in Haiti following the devastating 2010 Earthquake[5]. In 2014, two similar charity campaigns led to successful fundraising. The 'no make-up selfie' campaign[6], whereby women posted a picture of themselves without make-up on Facebook and Twitter and pledged to make a donation, raised £8 Million for Cancer Research UK. Similarly, the ALS Ice Bucket Challenge[7] raised $115 Million by users posting videos of having buckets of iced water thrown over their heads, again with the promise of a donation.
By contrast, the impact of social media use by emergency responders remains relatively unclear, and the extent of the role that social media actually play in emergency management is yet to be determined.

[5] About Success of Red Cross Fundraising Campaign following Haiti Earthquake 2010 [Last Accessed: August 2018]
[6] No Make Up Selfie [Last Accessed: August 2018]
[7] ALS Ice Bucket Challenge [Last Accessed: August 2018]

Therefore, if emergency responders are to fully embrace social media for emergency management purposes, more definitive conclusions are required about the value they might bring. Accordingly:

> **Thesis Statement:** To determine the value of social media in emergency management requires a systematic assessment. Success criteria for evaluating impact need to be established based upon emergency responders' objectives and desired outcomes, aligned with the expectations of their followers.

1.1 Thesis Approach and Research Questions

Web Science is an emerging field that aims to explore:

> 'How the Web is changing the World and the World is changing the Web.'[8]

To tackle this ambitious agenda Web Science advocates an interdisciplinary approach, calling for the integration of knowledge, methods and theories from various disciplines including mathematics, economics, psychology, law and sociology, to name but a few (Halford et al., 2010).

The overall research goal of this thesis is:

> **Goal:** To explore the potential value of social media for UK emergency responders.

This thesis employs a mixed methods approach, utilising technical approaches from Computer Science with methodology techniques from the Social Sciences and perspectives of Social Media and Emergency Management literature to investigate the research goal above. However, the phenomena of social media and emergency management are broad and vast, due to the extent of geographical impact, degree of social disruption and volume and varying quality of geo-social data that are now available. Therefore, this thesis will only explore social media use by emergency responders based in the UK. Below are the three research questions (RQs) that this research seeks to answer:

> **RQ1:** How, and why, are emergency responders in the UK utilising social media?
>
> **RQ2:** Why do users follow and engage with emergency responders on social media?
>
> **RQ3:** What are the potential impacts upon emergency management in the UK resulting from the use of social media by emergency responders?

[8] Web Science Institute – University of Southampton [Last Accessed: Sept. 2018]

RQ1 was designed to provide a greater understanding as to why emergency responders value social media, what they intend to achieve and the strategies that they employ. **RQ2** was devised to gain an insight into the reasons why users on social media choose to follow emergency responders and the perceived benefits that they gain. The value of social media is dependent upon the effectiveness by which emergency responders can fulfil their objectives, whilst satisfying the needs of their follower community. Therefore, **RQ3** was developed to produce evidence that would help identify the possible impact upon emergency management resulting from the use of social media by emergency responders.

For contextualisation, the next section introduces the core principles of emergency management with a focus on the deployment of key terms used in the UK.

1.2 The Core Principles of Emergency Management

In the field of emergency management, a variety of terms are used, but many definitions are not internationally agreed upon (Smith, 2013). It is important to distinguish between the terms disaster and emergency. They represent different phenomena, but are often used interchangeably (UN/ISDR, 2009). The Emergency Management Lifecycle is summarised, and an outline of the key guiding principles of UK emergency management follows. Here, the section will include an overview of the responsibilities and duties of emergency responders based in the UK. Together, this section will provide the foundations upon which this research is based.

1.2.1 Disaster vs. Emergency

The United Nations Office for Disaster Risk Reduction defines a disaster as:

> *"A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts." UN/ISDR (2009)*

The general perception of disasters is that they are widespread, long lasting events (Smith, 2013). In contrast, emergencies are often considered as small, 'every day' routine incidents such as a medical emergency or road accident (Rao et al., 2007). Disasters often require a response that encompasses numerous, and sometimes unfamiliar, groups of people (ranging from professionals and authorities to volunteers and public citizens). A response to an emergency, in most cases, can be handled within the operational limits of emergency organisations (Quarantelli, 2000).

However, in the UK, the term emergency is defined under the Civil Contingencies Act (2004) as:

> *"an event or situation that threatens serious damage to human welfare in a place in the UK; serious damage to the environment in a place in the UK, or war, or terrorism, which threatens serious damage to the security of the UK." - (Civil Contingencies Act, 2004)*

As this research is based on UK findings, the term emergency is used herein. This is consistent with terminology that underpins the guiding principles of emergency management in the UK. However, it should be noted that relevant literature using the term disaster might be drawn upon to help inform this research.

1.2.2 Emergency Management Lifecycle

The Emergency Management Lifecycle (EML) is a common framework used as a reference tool by emergency managers, (see figure Figure 1.1). It models the phases of an emergency and highlights the necessary operations in each phase (Faulkner and Vikulov, 2001).

A generic representation of the UK EML includes four key phases: Anticipation and Prevention, Preparedness, Response and Recovery:

Anticipation and Prevention: crucial both before and after emergency phases. Processes to scan for new threats or hazards that may cause potential emergencies are carried out. Planning and assessment are required to understand the likelihood of occurrence, impact and necessary actions required. Actions carried out focus on reducing the likelihood or impacts of an emergency (Cabinet Office, 2013a).

Preparedness: the process of preparing to manage known risks, and the actions taken in advance of unforeseen events or situations. Actions include planning of response, training and exercises, and public education (Cabinet Office, 2012b).

Response: the decisions and actions carried out in immediate reaction to an emergency, with the aim of protecting life, mitigating or reducing impacts and resuming control. It includes the issuance and dissemination of predictions and warnings immediately before an event, search and rescue, and damage and needs assessments (Cabinet Office, 2012b).

Recovery: process of restoring normality, rebuilding and rehabilitating the community following an emergency. This includes both physical reconstructions and psychological recovery (Cabinet Office, 2012b).

It is important to note that whilst some activities are unique to their particular phase, different phases of an emergency can overlap. Furthermore, the timescales of each phase vary according to the type and severity of the disaster (Vasilescu et al., 2008).

1.2.3 Emergency Management in the UK

Emergency management in the UK involves an all-hazard approach, reducing risk from civil, natural, technological, biological and instrumental disruptions. The primary objective is to restore conditions to what they were prior to an emergency (O'Brien, 2008). In the late 1980s the UK experienced the impacts of a number of major incidents including the Bradford City Stadium Fire in 1985, Clapham Rail Crash in 1988, Kegworth Air Crash in 1989 and Hillsborough Disaster in 1989. Consequently, issues within UK Emergency Management were exposed, namely a lack of readiness, unclear ownership of tasks and responsibilities, and insufficient planning and communication. Despite that, it was concluded unnecessary to restructure or reform emergency planning and response processes (O'Brien, 2005). In the new millennium, however, incidents including the Floods of 2000 and the Foot and Mouth outbreak of 2001, along with the 9/11 Terrorist Attacks in New York, initiated another widescale review to improve UK emergency management (O'Brien, 2005). This led to the creation of the Civil Contingencies Act (2004), an Act of Parliament that establishes a framework for civil protection in the United Kingdom.

As a requirement of the Civil Contingencies Act (2004), Local Resilience Forums (LRFs) were developed. LRFs are multi-agency partnerships, made up of emergency responder representatives and other agencies including military and private infrastructure suppliers, defined by the boundaries of Police Areas across the UK (see Figure 1.2). LRFs focus on identifying risks and planning and preparing for a range of emergencies, with the goal of preventing or mitigating possible consequences to their local communities (Cabinet Office, 2014a). Further details concerning the LRFs can be found on the UK Government website[9].

In 2013, the National Resilience Capabilities Programme (NRCP) was launched. Its aim is to *"increase the capability of the UK to respond to and recover from civil emergencies"* (Cabinet Office, 2014b). It focuses specifically on building resilience to emergencies across all parts of the UK. With links to the duties and regulations of the Civil Contingencies Act (2004), the motive behind the NRCP is to ensure that there is a robust infrastructure in place to deal effectively with a wide range of emergencies (Cabinet Office, 2013a).

[9] Local Resilience Forums Contact Details, (2017) [Last Accessed: Sept. 2018]

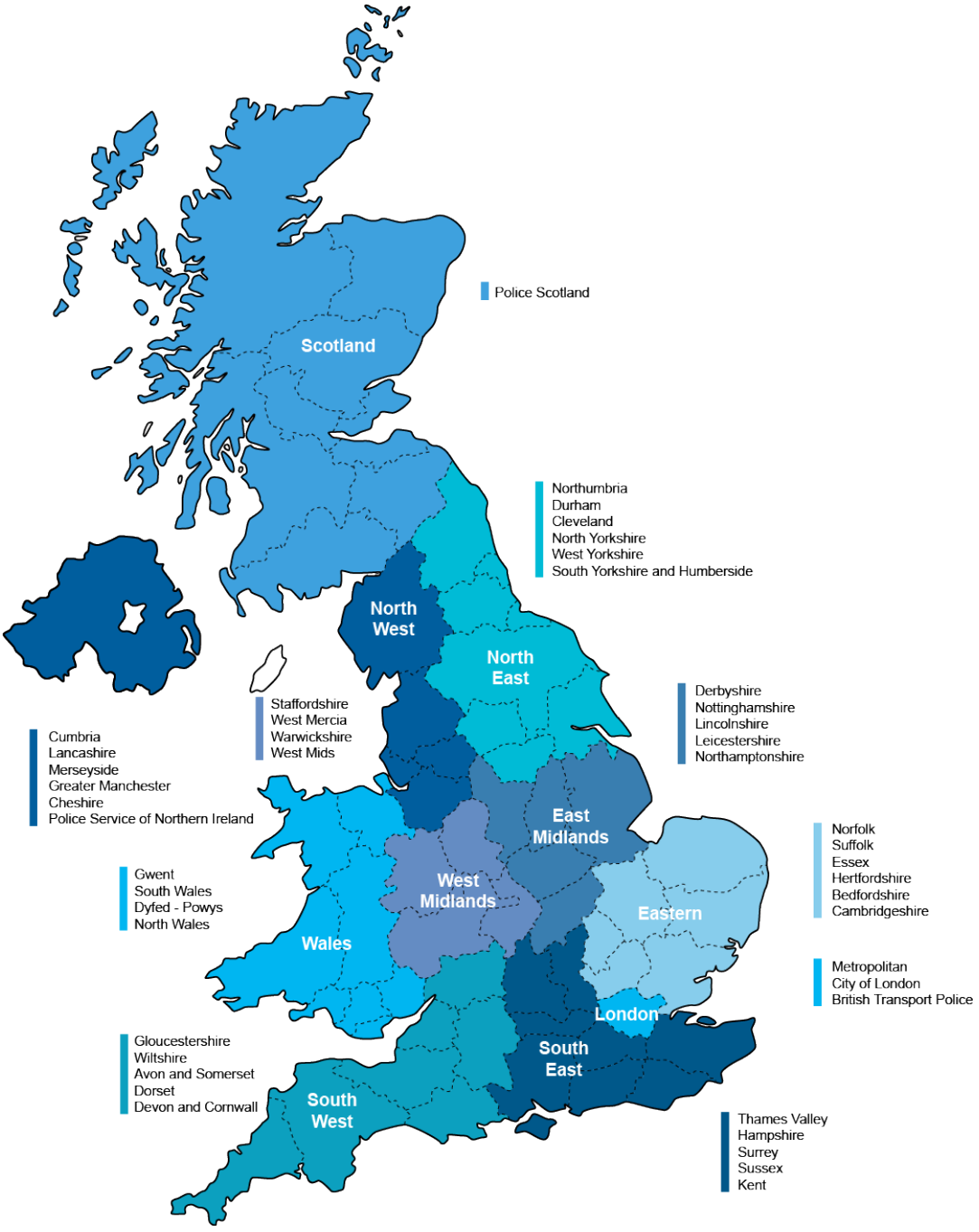


FIGURE 1.2: Map of LRFs defined by boundaries of Police Areas Across UK, Sourced from: www.grtpa.com [Last Accessed: Sept. 2018]

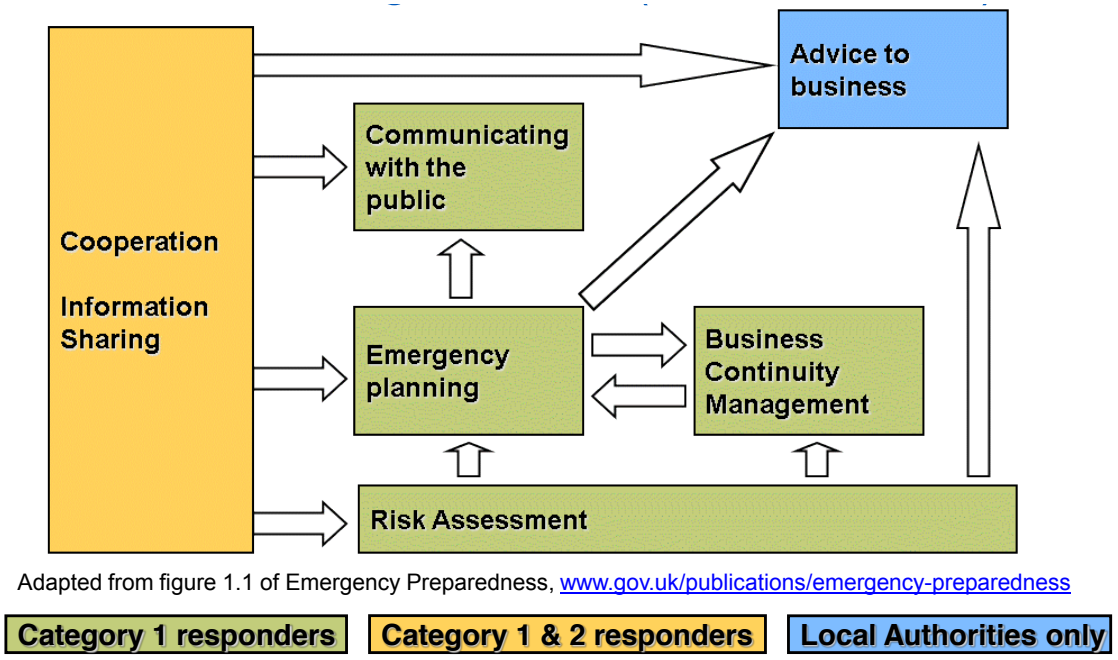


FIGURE 1.3: Responsibilities of Category 1 and 2 emergency responders, Sourced from: Civil Contingencies Secretariat [Last Accessed: Sept. 2018]

The structure of emergency management in the UK is decentralised. Under the Civil Contingencies Act (2004)(Part 1 of Schedule), emergency responders are responsible for emergency management practices[10], and are classified as either Category 1 or Category 2 responders (see Figure 1.3). However, in some instances the scale or complexity of an emergency requires Central Government support or co-ordination. Figure 1.4 represents the process of involvement of Central Government based on impact and geographical spread of an emergency (Cabinet Office, 2013a).

Category 1 Responders are those organisations at the core of emergency management (see Table 1.1), and are the focus of this research. They are responsible for creating and enforcing emergency plans, sharing information with other responders to enhance co-ordination, and assessing the risk of emergencies occurring. Generally, the Police take the lead in most emergency situations (Cabinet Office, 2013a). Category 2 Responders are private sector bodies, such as gas and electricity distributors, telecommunications providers, and water and sewage companies. They are not typically involved in core multi-agency emergency response and recovery work, but can have an important role if their sector is affected during an emergency (Cabinet Office, 2013a).

[10]Note: The Civil Contingencies Act (2004) places no statutory responsibility on the Ministry of Defence to plan and prepare for emergencies. Whilst the Armed Forces can be brought in to deal with a range of situations including emergency response or maintaining essential services, this is captured under the Military Aid to the Civil Authorities.

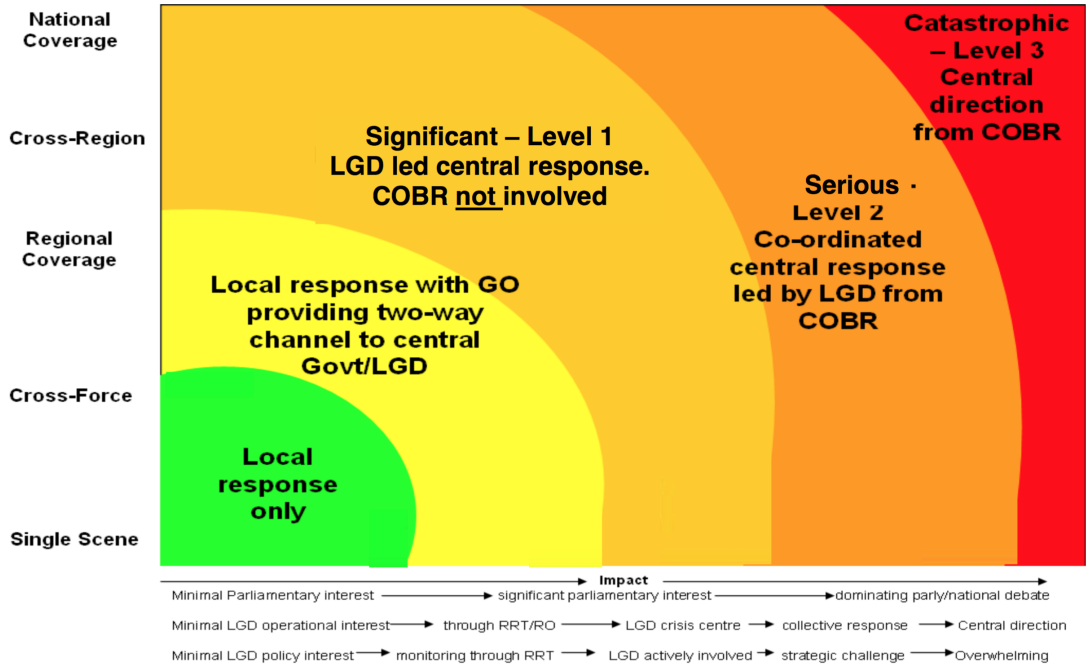


FIGURE 1.4: Representation of Involvement of Central Government for Emergencies in the UK, sourced from: Cabinet Office (2013a)

Category 1 Responders in the UK

Emergency Services	
Police Forces	Fire Services
British Transport Police	Ambulance Services
HM Maritime and Coastguard Agency	
Local Authorities	
County Councils	District Councils
Metropolitan Districts	Unitary Authorities
London Boroughs	
Health Bodies	
Public Health England/Wales	NHS Primary Care Trusts
Health Protection Agency	Port Health Authorities
Acute Service Providers	NHS England/Wales
Government Agencies	
Environment Agency	Cabinet Office

TABLE 1.1: List of Category 1 Emergency Responders in the UK

The Civil Contingencies Act (2004) outlines the roles and responsibilities of the UK emergency responders. 'Warning and Informing' and 'Resilience-Building' are two key duties, relevant to this research, that are central to the NRCP. Warning and informing (communicating with the public about emergencies) is a legal requirement for Category 1 responders. They must advise the public of risks before an emergency, and execute processes to warn, and keep people informed, in the case of an emergency (Cabinet Office, 2013a). Under the Civil Contingencies Act (2004) it is acceptable practice to elect a lead emergency responder with responsibility for carrying out these tasks. Often in the UK such responsibility rests with the Police Force. It is imperative that warning and informing arrangements are thoroughly planned and tested in training (Cabinet Office, 2012b).

Resilience has become central to policy-making and is one of the guiding principles of policy governance (Chandler, 2014). The term is employed ubiquitously, yet approaches to it vary across policy and academic fields (Chandler, 2014). It could arguably be considered as just a buzzword (Boin et al., 2010). Definitions of resilience vary: the field influences how it is inferred and used. In the field of emergency management, it is an ambiguous term; it is unclear as to what it actually is, how it operates, and how it should be considered (Chandler, 2014). Hence, resilience has been subject to much debate. However, it is essential to note that this research is ***not*** entering the debate on resilience.

Using the term resilience in this thesis is merely to keep in line with UK Emergency Management Policy. Outlined by the UK Government, it is defined as: *"the ability of the community, services, area or infrastructure to detect, prevent, and, if necessary to withstand, handle and recover from disruptive challenges"* (Cabinet Office, 2012b). Furthermore, as a requirement of the NRCP, LRFs are encouraged to focus on increasing the following three aspects of resilience: 1) Community Resilience, whereby communities use local resources and knowledge to support themselves during an emergency (Cabinet Office, 2013a). 2) Infrastructure Resilience, by which the public and private sector organisations improve the durability of their infrastructure, supply and distribution systems from hazards (Cabinet Office, 2013a). 3) Business Continuity, a process to help ensure the continuity of critical functions and effective recovery within organisations in the event of an emergency (Cabinet Office, 2013a).

1.2.4 Social Media for Emergency Responders in the UK

The utilisation of social media is not stipulated within the job descriptions of emergency responders based in the UK. Nevertheless many, if not all, have accounts on various social media sites, and have been found increasingly to use social media for emergency management activities. During the London Riots in 2011 the Police used social media, particularly Twitter, to engage with the public during the crisis (Denef et al., 2013).

Over the summer months of 2013 the UK experienced a heatwave. British emergency responders used social media to disseminate important information and took part in two-way communications to request information from the public (Watson and Finn, 2014). More recently, warnings to the public regarding safe movement were issued through social media channels as Storms Desmond, Eva and Frank hit the UK between November 2015 and March 2016 (Gray et al., 2016).

The UK Government have produced documents to support UK emergency responders in the use of social media for emergency management. In 2012, the Defence Science and Technology Laboratory (DSTL) was commissioned to produce a guidance document for emergency responders on how to use social media for emergency management: Using Social Media in Emergencies: Smart Practices[11]. Whilst such guidance is available, there is a lack of evidence to support how this guidance translates into practice and what impacts and benefits are thus generated through these tools. Only then can justifications be made for emergency responders to invest time and effort into the integration of these platforms for emergency management. It is this space that this thesis seeks to explore.

1.3 Scope and Limitations of this Thesis

This thesis seeks to contribute to the general body of knowledge in the field of social media and emergency management. Primarily, it is concerned with the use of social media by Category 1 emergency responders based in the UK. However, to provide depth and emphasise context to some of the methods included in this research, a case study was chosen: the UK Winter Floods of 2013/14. The study focused upon emergency responders based in the Southern Regions of the UK, which were the main areas affected by the flooding. It is also important to note that while Category 2 Responders (private sector bodies) are beyond the scope of this thesis the findings presented may be relevant to them. At its outset this piece of research was not intended to focus on the content generally shared on social media in times of crisis. Rather, it explores the role social media plays specifically between emergency responder and their followers.

The intention of this thesis is not to assess differences of social media use between types of emergency responder (i.e. police vs fire), or to compare which forms of social media (i.e. Facebook vs Twitter) are better suited for emergency management. Instead, this research seeks to gain a collective insight into the general reasons and objectives for social media adoption, which resonates with plans of UK Emergency Management which seeks multi-agency collaboration between emergency responders (Cabinet Office, 2012b). In spite of that, only data from the social media platform Twitter are considered for the quantitative research methods. This is due to the nature of its Application Programming

[11]UK Government Guidance Document for Category 1 Emergency Responders: Using Social Media in Emergencies: Smart Practices [Last Accessed: August 2018]

Interface (API): it is open and free for researchers to access and harvest large volumes of data from Twitter's database. As such, the quantitative data samples in this research may not be considered to be a comprehensive representation of social media use by emergency responders, but the methodological decision to employ a mixed methods approach (which will be discussed in Chapter 3) will help mitigate this limitation.

1.4 Thesis Outline

This introduction has provided the context of this research. Specifically, it will focus on identifying the potential value of social media for emergency responders, considering the perspectives of both emergency responders and their followers. The remainder of this thesis is organised as follows:

Chapter 2 acknowledges literature relevant to this field of study and that is fundamental to answering the research questions of this thesis. Specifically, it reports on the evolution of social media for emergency management, together with the challenges and opportunities that are faced. Additionally, a review of the research provides an insight into the ways in which emergency responders have adopted social media. This thesis intends to highlight and address significant gaps that exist within the literature.

The methodology design is outlined in **Chapter 3**. The Mixed Methods approach is explained, along with the reasons as to why it was chosen for this research. A summary of the methods used to collate the various data required for this research is given, followed by a brief synopsis of the Winter Floods 2013/14 case study.

Chapter 4 reports on the first set of key findings of this thesis. The results of two studies uncover the reasons as to why emergency responders use social media, and what they aim to achieve, answering RQ1 of this research. These key findings lead to the development of a proposed conceptual framework for the emergency responders' key objectives and desired outcomes.

In **Chapter 5**, focus shifts to the perceptions of those that choose to follow UK emergency responders on social media, answering RQ2. Combining the results of a Follower Network Analysis with Survey Responses, this chapter contributes to an overall understanding of the role social media plays between emergency responder and follower, and helps to elicit what value emergency responders' use of social media could be creating and for who.

Results of statistical analyses and a survey were drawn upon in **Chapter 6**, thus providing evidence about the possible impacts upon emergency management resulting from the use of social media by emergency responders and answers RQ3.

In accordance with the methodology of this thesis, **Chapter 7** integrates the key findings of chapters 4, 5, and 6 to discuss the overall potential value of social media for UK emergency responders, which is the goal of this thesis. A model of potential value is presented, which advocates three core roles social media could play in order to produce value for emergency management.

Finally, **Chapter 8** summarises the key findings identified in this research. The contributions made in this thesis are listed, which leads on to a collection of recommendations that intend to assist emergency responders with maximising the full potential of social media for emergency management in the UK. Proposals for future work are presented and the final concluding statement is then made.

Chapter 2

The Evolution of Social Media in Emergency Management

This chapter reports on the evolution of social media in emergency management synthesising significant literature that is fundamental to answering the research questions of this thesis (previously outlined in Section 1.1). It includes a detailed overview of social media and how it was first adopted by the public in emergency situations. The challenges and opportunities offered by social media, specifically for formal emergency management, are then addressed. Historical literature, focusing on the foundations and the early impact of social media development in the arena of emergency management, is examined. Impact is defined as having desired effects on individuals, exerting influence and shaping decision-making. The chapter continues with a rigorous review of the publications that discuss the emergency responders' perspective, particularly the ways in which emergency responders have been found to use social media. It concludes by highlighting the gaps in the literature that this thesis intends to address.

2.1 Social Media and their Emergence as Research Tools

Social media are freely available tools that facilitate a place for communication, discussion, collaboration and opinion sharing, on a local, national, and global scale. Evidenced by Figure 2.1[1], as of January 2017, Facebook dominated the global use rankings with an estimate of 1.871 Billion monthly active users, while approximately 317 Million users accessed Twitter (We Are Social, 2017).

[1]QQ, WeChat, QZone are social media platforms based in China.

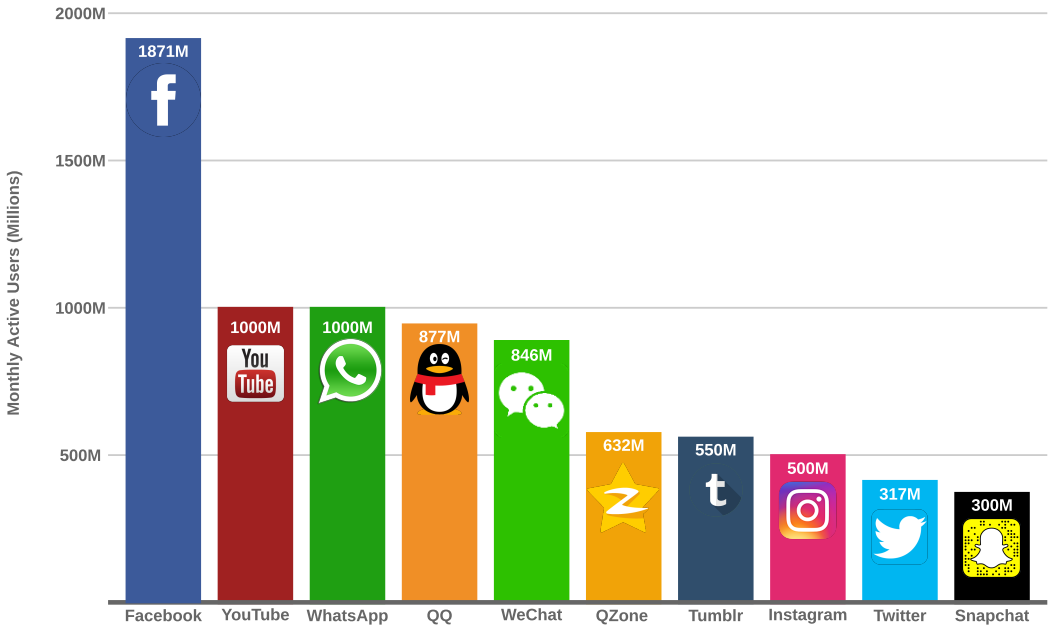


FIGURE 2.1: Global use of Top 10 Social Media Platforms as of January 2017, reproduced from: We Are Social (2017)

Producing data in such high volumes and on a large numbers of users, it comes as no surprise that social media data has attracted widespread interest from researchers. It provides opportunities to evaluate users' perceptions, characteristics and behaviours, both quantitatively and qualitatively. In this research perception is defined as an understanding of reality and experiences which is influenced by individuals' views, judgements, and opinions (Munhall, 2008). Characteristics and behaviours are defined as the manner in which individuals conduct themselves and the actions they carry out. Users of social media include individuals, companies and organisations. Accessible by a variety of computing devices such as desktop or laptop computers, tablets, smart/mobile phones, and smart watches, users can develop profiles about themselves, form connections with other users, post updates, share photos and videos, and distribute messages either publicly or privately.

The network structures of social media platforms varies; some rely on two-way reciprocation, which requires users to both approve the connection before they can view each other's content (e.g. Facebook), whilst other platforms are one-way; no reciprocation is required (e.g Twitter). These characteristics enable registered users to share and access timely information, reach large audiences, and gather intelligence, which make social media attractive tools for emergency management (Vieweg et al., 2010; Simon et al., 2015; Plotnick et al., 2015).

While the opportunities of social media for emergency management have been recognised, and despite Facebook being used more extensively, research in the field of emergency management focuses heavily on Twitter (Sutton et al., 2008; Palen et al.,

2010; Vieweg et al., 2010; Vis, 2012; Bruns et al., 2012; Parsons et al., 2015; Chauhan and Hughes, 2015; Dufty and Stewart, 2016; Panagiotopoulos et al., 2016). This raises the question: why does research focus primarily on Twitter? In order to answer this question, we will explore below the fundamentals of Twitter. However, it is important to emphasise that unlike the papers cited above, this research will extend beyond Twitter and explore how multiple social media platforms might be used for emergency management.

Twitter is a microblogging service; a medium that offers users the opportunity to post short messages restricted by a character or word limit. It was launched in 2006 originally as a tool for friends to provide each other with updates of their activities. Its unique characteristics, however, also make it an attractive tool for emergency communications and research. Registered Twitter users can create profiles (consisting of a picture and short description about themselves) and post short updates up to 140 characters, known as tweets[2]. Four pictures or one video or GIF can be included in the tweet, as well as a location. As of December 2016, a new feature was introduced which enables users to tweet live video. User profiles are either publicly available or private (also called protected). Private accounts require authorisation before another user may follow them. Unlike Facebook, users of Twitter may follow other users and no reciprocation is required. This 'one-to-many' communication structure is also a requirement for emergency communications systems (Mills and Chen, 2009). Thus, Twitter is often considered advantageous for delivering short 'news headlines', in real-time, to a large audience (Dufty and Stewart, 2016).

Users can follow other users' profiles, which allow them to view and interact with those users' tweets; each user has a *timeline* of tweets posted by users they follow. Forms of interaction between users on Twitter include: notifying a specific user of a tweet through *Mentions* (indicated by the use of '@' followed by that user's username), sharing other users' posts, which is referred to as *retweeting*, participating in conversations using the reply button, and expressing an interest or appreciation for a tweet by using the *like* button (rebranded from *favourite* in 2015).

Compared with Facebook, where message visibility is more complex, Twitter allows for greater networking opportunities through such interactions. According to Dufty and Stewart (2016), retweets and replies during emergency situations can benefit *"those experiencing the event, those wanting to know more about it, and those wanting to help including emergency responders"* (Dufty and Stewart, 2016).

Another key feature of Twitter is *Hashtags*. These are keywords or phrases prefixed with the symbol '#' in a tweet. They categorise a tweet, which makes it visible within a group of tweets containing the same hashtag (unless the owner of the tweet has a private

[2]Note: as of 2017 Twitter doubled the limit from 140char to 280. However, the research covered in this thesis is based on Tweets with a limit of 140char.

account). Using hashtags not only groups information, it also enables users interested in a specific topic, who may not already follow each other, to find and share relevant posts, and participate in conversations visible to all registered and non-registered Twitter users (Bruns and Liang, 2012). In the context of emergency management, hashtags allow for emergency responders and public citizens to quickly label and locate tweets relevant to a crisis (Vis, 2012). For example, '#qldfloods' became a leading label for coordinating flood-related activity on Twitter during the Queensland Floods of 2011 (Bruns et al., 2012).

As part of their business model, Twitter promotes ease of access to Twitter data and makes its "data banks" available through Application Programming Interfaces (APIs). An API is a back-end interface of a computer program that allows software to interact with each other (Lomborg and Bechmann, 2014). In the case of Twitter, by running small software scripts that access Twitter's API, researchers can harvest large volumes of data from Twitter's database (see Figure 2.2). These data, left by Twitter users, can help to form theories about what people say and do over a given period of time. This is particularly valuable for emergency management research as, unlike Facebook, available Twitter data concerning a specific emergency can be collected in real time, as the event unfolds.

This thesis is concerned with emergency responders' social media usage for emergency management. However, given such clear advantages, there will be a particular emphasis on Twitter which is discussed in Chapter 3 (Section 3.3.1).

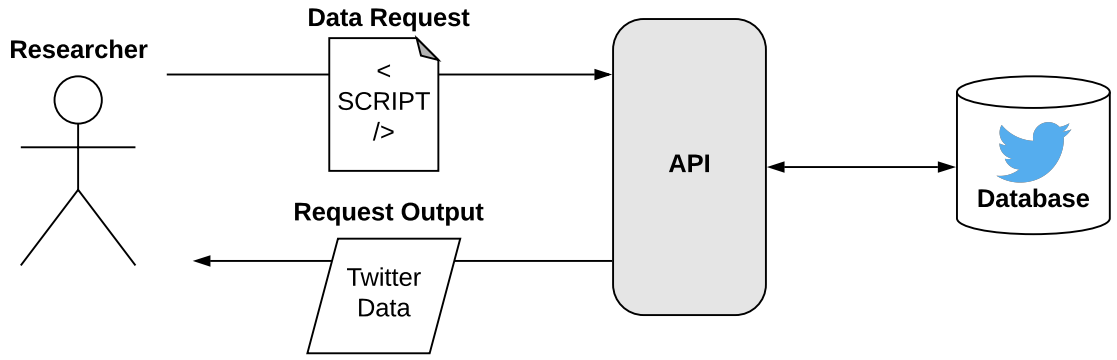


FIGURE 2.2: Visualisation of Architecture for Harvesting Twitter Data

2.2 The Rise of Social Media in Emergency Management

The benefits of social media in times of crisis were first explored and utilised by the public (Simon et al., 2015). As disasters and emergencies unfold, people seek information and are keen to provide intelligence as a means to assist in the general response efforts of emergency responders (Boyle et al., 2004; Hughes et al., 2008). Early research in this field discovered that social media offered new ways for members of the public to be involved with, and participate in, emergency response and recovery efforts (Palen and Liu, 2007).

Social media have changed, and continue to change, the ways in which people communicate and behave during disasters and emergencies. They have been used to access and share information, express opinions and feelings, search for support, and provide help to those in need (Terpstra et al., 2012). For example, an online ethnography study (also referred to as Netnography) by Palen and Liu (2007) of the Virginia Tech shootings of 2007, found students using Facebook for self-reporting of their safety and people contributing new information about the crisis on a dedicated Wikipedia page. Also, the public were seen to be conducting their own problem-solving activities to determine the victims of the crisis. Another example was the use of social media by affected individuals and communities during the Southern California Wildfires crisis of 2007. The results of an online survey distributed to those affected by the crisis showed that social media facilitated a place for emergency communications between members of the public; users of Facebook and Flickr were able to exchange emergency-related information that was not otherwise easily attainable during the crisis (Sutton et al., 2008). The public were also found to exploit social media to supplement, or replace, other communication channels when those traditional systems have either been damaged or are unable to withstand a sudden increase in high demand. For example, during the Japanese Great Tohoku Earthquake and Tsunami (2011), phone lines were severely damaged: individuals turned to Twitter to request assistance (Acar and Muraki, 2011). These papers show that whilst social media was in its infancy users recognised a benefit within emergency management. Such uses of social media have led to a situation whereby the control of information exchange in times of crisis can no longer be managed solely by emergency authorities and Government (Haataja et al., 2016).

Whilst there is an abundance of research on 'public-to-public' emergency communications, it is imperative that we also understand how social media could impact upon formal emergency management and identify what role it might play between emergency responder and the public. The motivations that drive emergency responders and their followers towards social media require investigation; similarly the techniques that both user groups deploy in order to harness the potential of social media need examination. This thesis intends to explore these spaces.

New forms of public participation through social media prompted research into what these tools may offer for formal emergency management. Three dimensions of the Emergency Management Lifecycle (EML) that social media could potentially enhance include: situational awareness, emergency communications, and community preparedness and resilience, which are discussed in the three subsections below.

2.2.1 Contributions to Situational Awareness

Situational awareness is a vital component of emergency management, particularly during the emergency response phase of the EML. It refers to the translation of data and information into knowledge, which is then processed in light of experience, judgement and training, thus creating an understanding of an emergency and indicating the appropriate action (Harrald and Jefferson, 2007). This process is represented in Figure 2.3. Situational awareness supports strategic coordination between emergency responders, aids decision making and projects the potential impacts and consequences (Cabinet Office, 2013a,c).

Social media present an ideal opportunity for emergency responders to enhance their situational awareness (Lindsay, 2011; Vieweg et al., 2010; Parsons et al., 2015). It facilitates an avenue by which individual users can broadcast 'first-hand' accounts of an emergency from the ground, in real-time and with the option to include video and photo imagery. These online reports can help emergency responders to understand and assess the 'common operating picture' of an emergency as it unfolds, and assist with decision making. For example, during the Haiti Earthquake 2010 social media data evolved as a critical knowledge resource for emergency responders (Yates and Paquette, 2011; Meier, 2015). On the other hand, exposure to such vast quantities of data, which may be irrelevant or not critical, could heighten a common obstacle to situational awareness: information overload (Harrald and Jefferson, 2007).

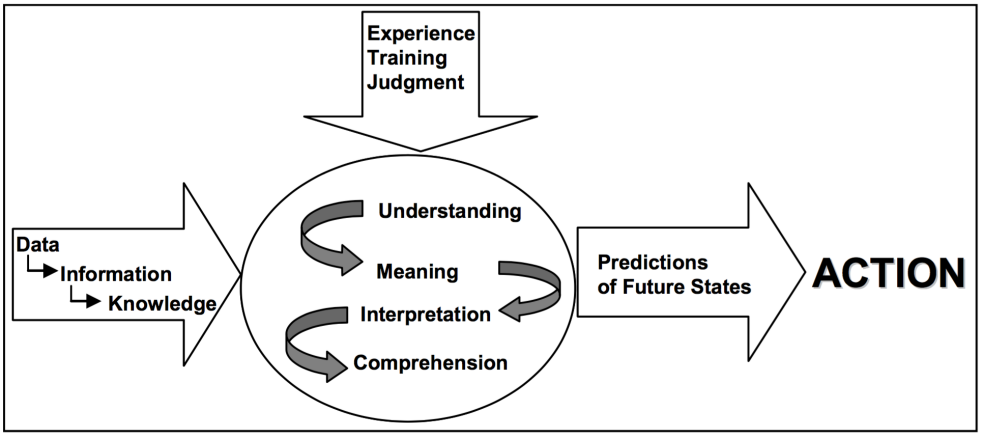


FIGURE 2.3: Situational Awareness - Process of Transforming Data into Actionable Information that Contributes to the Understanding of Emergency Management, sourced from: Harrald and Jefferson (2007)

The handling, interpreting, organising and acting upon information generated by social media users can be a difficult and time-consuming task (Latonero and Shklovski, 2011) which could hinder or slow response efforts (Lindsay, 2011). To provide context, during the events of Hurricane Sandy in 2012, Simon et al. (2015) reported that *"approximately 20 million tweets on Twitter were published and about 10 photos related to the storm were uploaded to Instagram every second"*. Finding solutions to the problem of information overload is a common goal for researchers. Efforts have been directed towards the creation of frameworks that can support the automatic extraction of features from social media posts associated with situational awareness (Vieweg et al., 2010; Parsons et al., 2015). Others have endeavoured to develop such systems. For instance, Cameron et al. (2012) trialled a platform that makes use of automated web mining techniques to identify useful data and increase situational awareness from tweets published as an emergency unfolds. Imran et al. (2013) developed a system that utilises machine-learning techniques to extract and classify relevant information from microblog posts during the event of a disaster. More recently, in response to the Nepal Earthquake 2015, researchers proposed a move towards artificial intelligence (AI) to examine the data that emerge during disasters and thus support emergency responders (Meier, 2015). However, such systems remain under development and are not ready for large-scale deployment.

In the interim, to reap the benefits of social media for enhancing situational awareness it is recommended that emergency organisations should dedicate social media practice to professionals with communications and technology expertise (Latonero and Shklovski, 2011; Yates and Paquette, 2011). However, it is unclear from the literature as to what extent emergency responders use social media for the purpose of situational awareness. There exists a lack of clarity as to who are using social media, whether appropriate training is given and if adequate governance exists. It was gaps such as these that were great drivers for establishing the research questions of this thesis.

2.2.2 Enhancing Emergency Communications

Emergency communications: informing, updating and exchanging information with stakeholders affected by, or involved in, an incident are integral to the success of emergency response. Not only can the effective communication of accurate information be the difference between life and death, it can also satisfy curiosity, provide reassurance, build confidence in emergency responders, and mobilise volunteers (Boyle et al., 2004; Palen and Liu, 2007; Hughes et al., 2008; Stiegler et al., 2011). Traditionally, emergency communications favoured a 'top-down' approach: a system whereby information flows from emergency responder to the public. However, social media offer the opportunity of multidirectional emergency communications, bypassing the traditional intermediaries i.e. journalist, newspapers and TV reports etc.

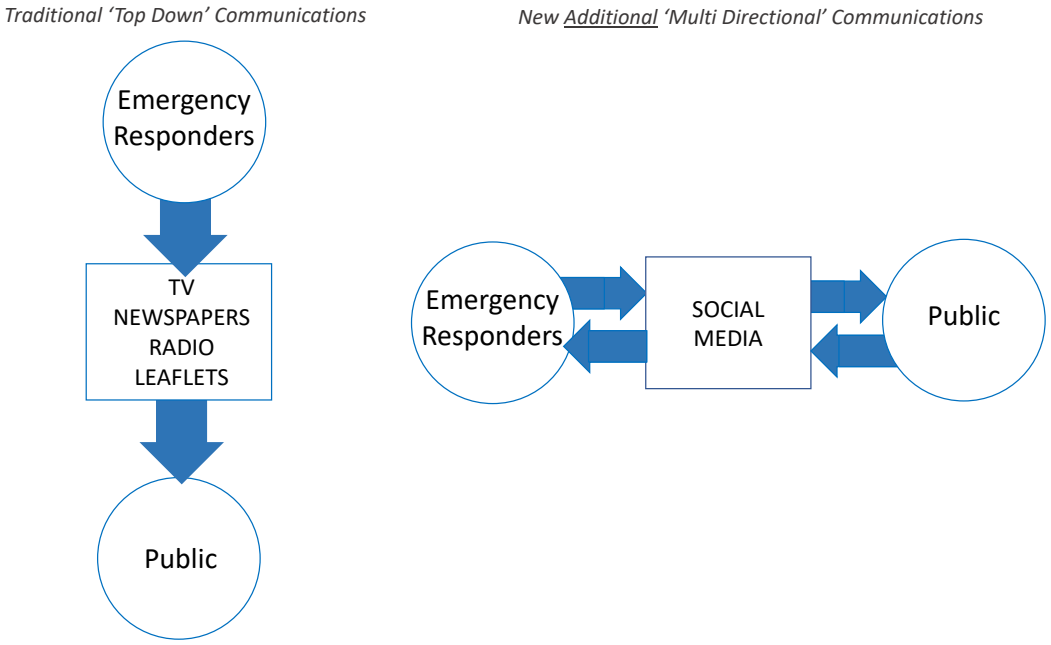


FIGURE 2.4: Representation of the Traditional 'Top-Down' and Multi-Directional Communications

These communication approaches are illustrated above (Figure 2.4[3]). This evolution of emergency communications would appear to align with the focus of the National Resilience Capabilities Programme (NRCP) which aims to reform UK emergency management and seek less hierarchical solutions (Cabinet Office, 2013a, 2014b).

The network structures and mechanisms of social media allow for content sharing (eg. through retweets on Twitter or shares on Facebook) and directing users towards content (e.g. by user tagging on Instagram or Mentions on Twitter), presenting excellent opportunities to distribute emergency information rapidly and to potentially large numbers of users (Kwak et al., 2010; Zhu et al., 2011). In some instances, reports through social media channels have appeared more rapidly than other news sources. For example, in 2008 feelings of earthquake tremors were reported on Tianya (a popular online forum in China) less than a minute after the 2008 Sichuan Earthquake, China occurred (Qu et al., 2009). However, social media are dependent on other technologies and network infrastructure. Access relies on electricity and an Internet connection, which can be difficult in rural areas with low availability of electricity (Leetaru et al., 2013) and could present an obstacle during emergency response. In times of crisis, regardless of the type of emergency, whether it be a cyber-attack, natural disaster or terrorist attack, it can be difficult to stay online. Power disruptions and blackouts can occur and network congestion can be a problem if too many people attempt to use their mobile devices. Damaged aerials, phone masts and cables can

[3]Note: This figure does not imply that social media are replacing, or should replace, traditional emergency communications. Instead, it illustrates how they are being utilised in conjunction with traditional methods and highlights the difference between the top-down approach and multidirectional communications.

wipe out access to mobile or landline telecommunications and the internet which, depending on the extent of damage, can last for long periods at a time (Lindsay, 2011). This limitation of social media is often ignored in the literature. For example, Hughes et al. (2014a) were one of the first to publish an analysis that compared how four online media sites (Facebook, Twitter, Nixle and Organisations Websites) were used by 568 US Fire departments and 272 US Police departments during Hurricane Sandy, 2012. Social media and Website use was categorised based on content and level of engagement (Inactive, Non-Sandy Active, and Sandy Active). The results alluded to a significantly low overall use of these technologies during the event and the suggestion was made by Hughes et al. (2014a) that: *"emergency management use of these media is not well understood"*. This is perhaps an unfounded assertion, given the widespread power outage during the storm, which lasted days. Judgements regarding emergency responders' social media performance cannot be made in isolation. Understanding the physical consequences of an emergency and exploring emergency responders' experiences are vital in this field of research.

It is asserted in the literature that, compared with traditional forms of communications, one of the most attractive opportunities of social media for emergency management is their potential to facilitate interactions and two-way communications between emergency responders and the public (Hughes et al., 2014a; Simon et al., 2015; Haataja et al., 2016). As an example, Denef et al. (2013) studied the use of Twitter by two Police Forces in the run-up to, and during, the London Riots of 2011. Two-way communications were observed, whereby both forces sought or provided information. Watson and Finn (2014) identified emergency responders asking members of the public for information via social media during the UK Heatwave of 2013. In some cases, social media have facilitated a medium by which emergency responders could hold discussions among themselves, as discovered by Simon et al. (2014).

On the other hand, social media for emergency communications can impose an additional burden on emergency responders at a time when they are already under intense pressure and expectations (Wukich and Mergel, 2014). Malicious and unintentional misuses of social media can range from the propagation of fake news, hoaxes and rumours to the spread of inaccurate and incorrect information and acts of terrorism (Lindsay, 2011). As an example, during Hurricane Sandy 2012, social media users distributed photo-shopped images of flooded subway stations with sharks, and 'doomsday' clouds circling around the Statue of Liberty (Wukich and Mergel, 2014). The effect of 'Fake News' in social media extends beyond the bounds of emergencies and disasters, however. A crisis erupted during the recent American Election of 2016; there were concerns that the results of the election had been influenced by the false stories that were circulated on social media leading up to the event (Allcott and Gentzkow, 2017). Accurate and up-to-date emergency information can take time to confirm, thus social media users have been found attempting to 'fill in the blanks' and improvise news (Liu et al., 2014). Other users retweet fake/inaccurate information on the basis that they believe the message

to be true and that they are being helpful. What is more, due to the ubiquitous and real-time nature of social media, information shared can quickly become invalid (Liu et al., 2014). This was the case during the Japanese Earthquake in 2011: tweets for assistance continued to be retweeted after victims had been rescued (Acar and Muraki, 2011).

Social media are powerful tools and the misuses cited above, whether intentional or otherwise, could be detrimental to emergency response by confusing, complicating, or disrupting response efforts (Lindsay, 2011). Consequently, whilst the complexity and size of the topic of fake news is being addressed by both social media companies[4] and researchers (Reuter et al., 2017), clarification is required regarding the scope and extent of social media training needed by emergency responders. Emergency responders must be able to 1) assess and identify the credibility and reliability of information before choosing to act, or not to act, on information, and 2) constantly monitor and react quickly to prevent misleading information and rumours from spreading (Wukich and Mergel, 2014). With adequate training and effective governance that align with best practices, social media could offer significant benefits for emergency communications. However, Government policy regarding social media usage for emergency communications remains unclear. Further, the practicality of social media use for emergency responders during a crisis remains in question, a subject that is explored within this research.

2.2.3 Increasing Community Preparedness and Resilience

The engagement of the public via social media has been shown to benefit two key areas of emergency management: emergency communications and situational awareness. More recently, however, research has examined the opportunities of social media for public engagement to help improve community preparedness and resilience (Dufty, 2012, 2015; Panagiotopoulos et al., 2016; Dufty and Stewart, 2016).
Community preparedness and resilience, in the context of UK emergency management, refers to the community's ability to prepare for, withstand, and recover from adverse situations, which includes the undertaking of measures to reduce risk (Cabinet Office, 2012b). The ability to include links to websites, add images and infographics, and tag campaign messages on social media posts makes for attractive tools to promote preparedness and resilience campaigns (Dufty and Stewart, 2016). Whether emergency responders in the UK share a similar perspective is yet to be established.

[4]In June 2018, Facebook released a blog post [Last Accessed: August 2018] which detailed their increasing efforts to address the topic of False news. Over the last two years they have been focused on developing a 'fact-checking' system and removing fake accounts. Going forward they aim to improve the 'fact-checking' techniques used, test and remove fake photos and videos, and take action against repeat offenders.

Based on a review of early literature (Dufty, 2012) proposed a framework depicting the 'goals and ways that social media could help build community disaster resilience', namely: 1) minimisation of residual risk, 2) safe communities through shared responsibility, and 3) formation of social capital for disasters. However, translation of these goals and uses into practice remains unproven.

Building upon their earlier work, Dufty (2015) identified public awareness strategies that could be implemented through social media specifically aimed at disaster risk reduction. Their findings indicated that social media had been used by emergency responders to guide users towards informative websites, give practical advice, communicate risks, and influence preparation and safety behaviours. For example, a USA campaign: 'PrepareAthon![5]' aimed to increase preparedness and resilience for a variety of potential emergencies. It had a strong social media presence, with the platforms Facebook and Twitter being used to encourage individuals and communities to conduct practice exercises, such as evacuation drills (Dufty, 2015). In Australia, social media were employed by emergency agencies including the Victoria Police, Metropolitan Fire Brigade and Country Fire Authority, to distribute preparedness messages related to their 'Summer Fire Campaign[6],' such as *'leave early if fire threatens'* (Dufty, 2015). In Indonesia, social media were used to promote messages associated with a campaign: 'Build Back Better[7]'. The aim was to educate homeowners on the necessity to earthquake-proof their homes (Dufty, 2015). However, whilst (Dufty, 2015) has discussed how social media have been used as a tool to propagate messages of preparedness and resilience-building activities, the actual reach of these communications has not as of yet been considered. There exists a need for clarification as to whether emergency responders' social media posts are actually reaching the target audience, and to identify who engage with their activity. These limitations played key roles in establishing **RQ2** and **RQ3** of this thesis.

The use of social media for encouraging resilience activities could raise ethical considerations. There are dangers that by using social media to promote and influence resilience it may serve to augment *the digital divide:* the gap between users and non-users of social media, usually for reasons of economics, location, disability, age, or even choice (Rizza and Pereira, 2014; Alexander, 2014). This was evidenced in a study by Madianou (2015). Following a long-term ethnography study with affected communities recovering from Typhoon Haiyan in the Philippines, 2013, digital inequalities were revealed. Participants with access were often able to reap the benefits of social media, while 'low-income' participants were found to have diminished social media opportunities and a significantly delayed recovery. Relying on word of mouth to share information within disadvantaged communities only partially compensates for

[5]Visit: PrepareAthon! Website for more details. [Last Accessed: August 2018]

[6]Visit: Summer Fire Campaign Website, launched via the Fuel Agency, for more details. [Last Accessed: August 2018]

[7]See: Build Back Better Campaign Info Package for more details. [Last Accessed: August 2018]

this issue. Whilst a discussion of *the digital divide* is beyond the scope of this work, the results that emerge from this thesis could prove useful to government in their continued efforts to formulate future policies.

The literature reviewed thus far has demonstrated areas of emergency management that social media have reached. The opportunities and benefits afforded to emergency responders by social media include: reaching larger crowds, coordinating knowledge and actions, and conducting risk assessments (Lindsay, 2011; Hughes et al., 2014b; Simon et al., 2015).

Alexander (2014) reviewed the actual and potential uses of social media and discussed seven ways in which they serve a purpose for formal emergency management: 1) listening to public debate, 2) monitoring situations, 3) extending emergency response and management, 4) crowd-sourcing and collaborative development, 5) creating social cohesion, 6) furthering causes (including charitable donation) and 7) enhancing research (Alexander, 2014). However, evidence of use was based upon 'success stories' and 'accounts of negative activity' (such as disseminating rumours, undermining authority and promoting terrorist acts).

There has been a lack of consideration given to the emergency responders' perspective in the existing literature until recently, with the majority of research being focused on examining the social media activity conducted by emergency responders. Exploring emergency responders perceptions is important because we cannot measure the impact and value of social media for emergency management until we first establish criteria by which success will be judged. In this research 'value' is defined as the importance, worth and usefulness of social media. Additionally, the impact of emergency responders' social media use is ambiguous, with limited understanding of who are following emergency responders, and why. Such insights would allow for similarities and differences in judgements of social media, from the perspectives of emergency responder and follower, to be identified. This thesis endeavours to bridge this space.

The next section will discuss the literature that has focused on emergency responders and their social media use.

2.3 Social Media: New Tools for Emergency Responders

Emergency responders are considered to have been slow in adopting social media for formal emergency management (Hughes et al., 2014b). One of the first studies to explore social media adoption by emergency responders was published in Sutton (2009). An examination of public officials' social media use during the US 2008 Democratic National Convention was carried out, which revealed that emergency managers had a tendency to fall back upon standard operating and communication procedures and use traditional media monitoring (e.g. television and radio broadcasting). The events of the 2010 Haiti Earthquake are considered to be a significant turning point, with emergency responders beginning to lend more credence to the potential benefits of social media for enhancing situational awareness, emergency communications, and community preparedness and resilience (Meier, 2015; Hughes et al., 2014b).

In the aftermath of the massive 7.0 magnitude earthquake that struck Haiti, January 2010, a new form of emergency response was ignited (Meier, 2015). Patrick Meier[8] pioneered the field of crisis mapping. Crisis maps are platforms that display eyewitness reports (submitted via social media in this instance), which have been plotted on interactive maps, providing a geospatial record of events in real-time (Meier, 2015). Initially endeavouring to locate a family member, Meier and a small group of friends began to map urgent tweets. Within a couple of days, through the use of crowdsourcing techniques, several *Digital Humanitarians* were collating and manipulating social media data to create crisis maps on Haiti – see Figure 2.5. Crowdsourcing, a term coined by Jeff Howe, describes the methodology of drawing upon any Web user who is interested and available to collect content, conduct required services and perform specific tasks (Meier, 2015). This use of social media data to create crisis maps quickly developed, and emergency responders' presence on social media has since been more notable. This is evidenced by the increase of publications reviewing emergency responders' social media usage in times of crisis (see Figure 2.6), though there is significant favour towards examinations of the types of messages distributed on social media by emergency responders.

[8] iRevolutions Blog by Patrick Meier. Topics range from big data to crisis mapping, disaster resilience and social media.

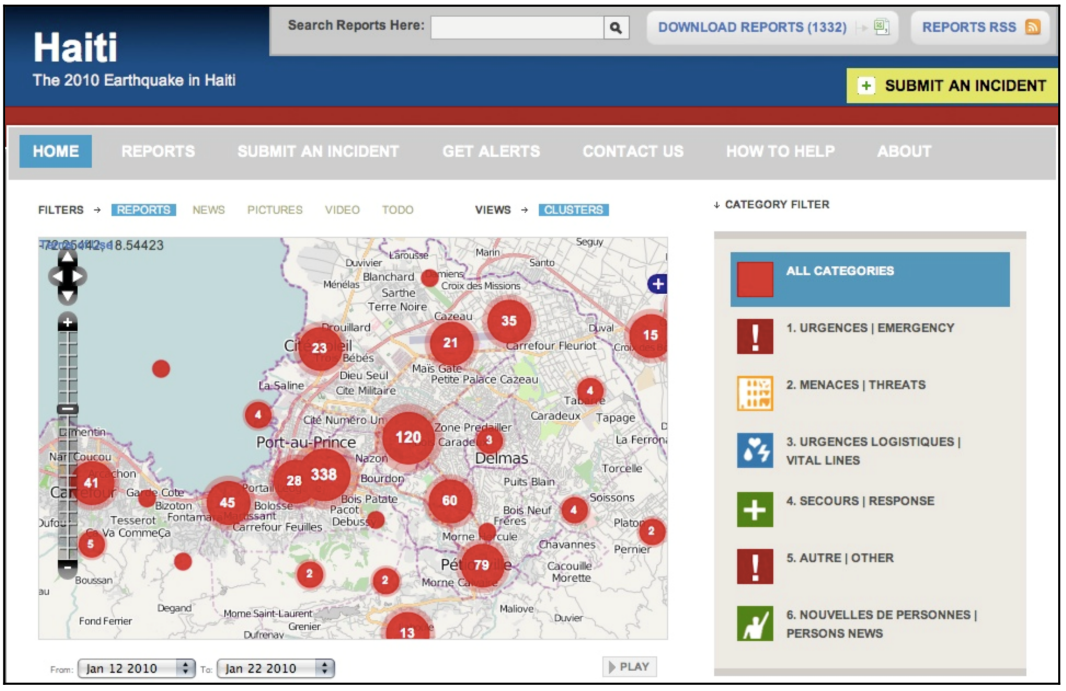


FIGURE 2.5: Screenshot of the Haiti Crisis Map produced by social media monitoring and satellite imagery analysis, sourced from: iRevolutions Blog by Patrick Meier [Last Accessed: August, 2018]

By using various social media analyses, early research aimed to identify the types of activity that emergency responders have engaged in. Heverin and Zach (2010) utilised content analysis to determine the types of messages that US Police departments published on Twitter. Findings showed that it was primarily used to distribute information about crimes and emergencies; conversational aspects of Twitter, such as replying to other users, was rare. Ehnis and Bunker (2012) obtained similar results, gleaned from a study based on Facebook usage by the Australian Queensland Police Service (QPS) during the Queensland Floods of 2011. By using Genre Analysis to identify and define the types of Facebook messages shared by QPS, findings indicated that one-way messages were the most common form of Facebook post shared by QPS.

Contrary to the findings of Section 2.2, which assert that conversational aspects of social media are a key benefit available to emergency responders, these papers do not corroborate such hypotheses. Rather, the responders' strategies appear to be focused on broadcasting information and situation updates, much like a news outlet. However, this observation could be indicative of the methods that have been employed by Heverin and Zach (2010) and Ehnis and Bunker (2012). In respect of the data collected the choices were subjective. For example, Ehnis and Bunker (2012) collected only those Facebook Notes posted in the response phase of the Queensland Floods (January 2011 and first day of February). Heverin and Zach (2010) chose to review only the content shared through Twitter by 30 US Police Twitter accounts. Another study published in Hughes et al. (2014a) reviewed activity on four online media sites: Facebook, Twitter, Nixle and

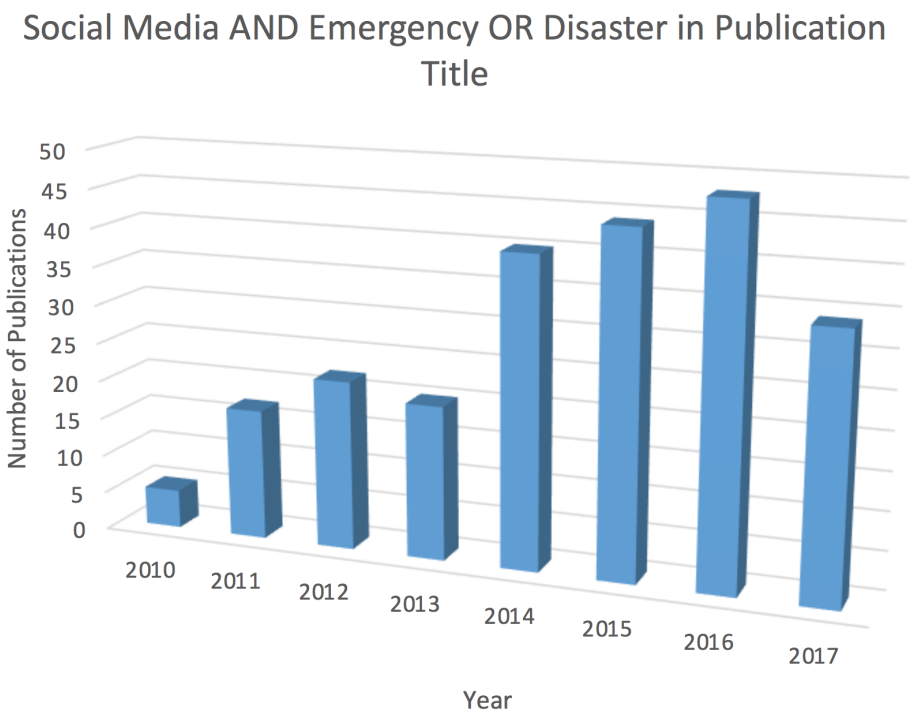


FIGURE 2.6: Number of Publications by year with "Social Media" AND "Emergency" OR "Disaster" in Publication Title – figures retrieved from Google Scholar. [date: August, 2018]

Organisations Websites, by 568 US Fire departments and 272 US Police departments during Hurricane Sandy, 2012. Using an open coding approach, social media and website use were categorised based on content and level of engagement (Inactive: no account or not used; Non-Sandy Active: account used but no activity found about Hurricane Sandy; Sandy-Active: account used to communicate information related to Hurricane Sandy). Their findings suggested that few departments used these online channels, and communication methods differed significantly between fire and police departments and across media type (Hughes et al., 2014a). Of the four mediums, Facebook use averaged higher overall but Police Departments were found to be more active than Fire Departments. The most frequently occurring categories of information regarded 'closures', 'safety instructions', and 'weather updates' (Hughes et al., 2014a). Although, these results are merely observations of use without evidence to support *why* the Police were more active or *why* Facebook use was found to be higher.

A limitation of the papers cited thus far in this section is that they have focused on how the respective emergency responders appear to have used social media in practice, and not given consideration as to what their social media goals were. Did the responders merely intend to disseminate information and report crimes, road closures and status updates, or did they want to engage and collaborate with their audience? Did any consequences of the respective emergencies (studied in Ehnis and Bunker

(2012) and Heverin and Zach (2010)) inhibit their social media use to some degree? Perhaps the emergency responders' involvement did not allow time for the use of social media? These unknowns drive a need to explore how emergency responders' social media usage might be dependent upon their motivations, objectives and experiences. The value of social media that might exist for emergency management cannot be determined and guidance/strategy recommendations cannot be stipulated until the reasons and motivations that underpin the observed online behaviours are better understood. Thus **RQ1** of this thesis evolved.

In stark contrast to the aforementioned papers, members of the American Red Cross, when interviewed, stated that they primarily use two-way dialogue to build relationships with the public, generate more media coverage, and elicit feedback to improve the organisation (Briones et al., 2011). This highlights a benefit of using interviews to collect subjective perception. The results that emerged from Briones et al. (2011) suggest that utilising conversational aspects of social media may depend on the motivations of the emergency responder under examination. Being a charitable organisation supported by public donations, the American Red Cross are clearly more inclined to use social media as a tool to collaborate and build relationships with the community. Although Briones et al. (2011) considered the objectives of the American Red Cross, the work did not examine whether these objectives were achieved in practice. Further, this paper probes only one organisation – research into the perceptions of *multiple* emergency responders is required.

Latonero and Shklovski (2011) discusses the use of social media from the emergency responders' viewpoint following an in-depth longitudinal case study of an employee of the Los Angeles Fire Department (LAFD). It was suggested that LAFD's adoption and use of social media was attributed to having an *"evangelist"* (i.e. a social media champion) within the organisation, but without support from management or the organisation as a whole. Latonero and Shklovski (2011) argued that the notable use of social media reported was, at that point, unusual for emergency organisations (Latonero and Shklovski, 2011). Similar findings were claimed by Meaton and Stringer (2013). Results of a survey completed by 63 members of UK Local Resilience Forums revealed that social media usage was primarily to broadcast information and relied on *"social media champions"*. Such use was described by Meaton and Stringer (2013) as sporadic and underutilised. However, the survey was limited to a few questions about *how* the organisations use social media. They did not establish what the organisations' overall goals of social media were, why they might value social media, or what might be inhibiting their use. This limitation could have been a result of the method adopted, that being a survey. Research that aims to understand perceptions requires data rich in content. Unlike surveys, which have pre-defined questions, interviews allow the researcher to strategise and tailor their investigation based upon the interviewees' initial responses. The latter methodology is a process of evolution and can provide

greater scope for meaningful semantic data (Bryman, 2012). Nevertheless, the potential to reach a greater number of participants makes surveys a popular method for research (Bryman, 2012).

Haataja et al. (2016) reported on results of a questionnaire distributed in 2012, which gathered the perceptions of 29 emergency management experts about social media use in emergency management. Building on Meaton and Stringer (2013)'s study, they found that nearly all participants believe social media are beneficial for monitoring public discussion as well as providing information about emergencies to the public, but barriers to the practical integration of social media exist. Examples include social media being too time consuming, organisational culture, trustworthiness of information, and the perception that the target audience does not use social media (Haataja et al., 2016). However, the objectives of the survey used by Haataja et al. (2016) were extensive, and not merely confined to an investigation of social media. Only one small section, consisting of 5 questions, collated data on emergency responders' perceptions of social media. A later study by Plotnick et al. (2015) proposed a curriculum for an educational program in emergency management that includes information systems. Using a survey, the responses from 241 US emergency managers were captured. Plotnick et al. (2015) found that a substantial number of participants were generally opposed to the idea of information systems in emergency management (Plotnick et al., 2015). Of the courses proposed, one founded upon social media was the most popular. However, the course syllabus remained a concern for survey participants.

Clearly, emergency responders' perceptions and views of social media vary considerably. Research rarely expands upon the opportunities of social media use to identify the extent of their application in emergency management. A similar observation was made by Plotnick et al. (2015), concluding that: *"fundamentally we need to* ***listen*** *to Emergency Management professionals to be able to understand the reality of disaster situations and how information systems can be designed to effectively serve emergency managers"*. Therefore, there is a need for more research that involves emergency responders to confirm who are using social media, why they are using it, and whether their social media goals are feasible.

Crucially, Denef et al. (2013) were one of the first to utilise both quantitative and qualitative data. Using an open coding approach, they first reviewed Twitter activity by two UK police forces – London Metropolitan Police (MET) and Greater Manchester Police (GMP) – during the UK Riots of August 2011. Tweets were analysed on three dimensions: content, function (i.e. purpose) and style. Their findings revealed that MET adopted an *"Instrumental usage"* approach: seeking or providing information. GMP, however, ostensibly had objectives beyond the mere distribution of emergency communications and sought to create closer relations with the public, defined as the *"Expressive"* approach (Denef et al., 2013). The researchers then conducted interviews with communication officers at GMP. The results not only corroborated the Twitter

analysis but also uncovered that the public demand for a quick response and the limited availability of resources were key challenges in managing social media communications during the crisis (Denef et al., 2013). This finding reinforces the argument for eliciting emergency responders' experiences of social media as part of an examination into the effectiveness of their social media use. However, the interview data encapsulated only the perceptions of officers based at GMP. It is important that future investigations extend beyond social media use by Police Forces; its use during phases other than emergency response warrants exploration. A similar study, by Gorp et al. (2015), utilised qualitative data (interviews) and quantitative data (Facebook Posts) to explore social media use. The results revealed a variety of social media activity including efforts to: promote the organisation, provide preparedness advice, and distribute information in emergency response (Gorp et al., 2015). However, the interview study only encapsulated perceptions of three US emergency responders and had not considered social media use across multiple platforms. Nevertheless, the papers by Denef et al. (2013) and Gorp et al. (2015) demonstrate the benefit of combining qualitative and quantitative data to explore social media value. Both types of data will thus be considered in the Methods Chapter (Chapter 3) to address **RQ1**.

Research has often focused on examining the use of social media in the context of emergency response. As a result, conclusions cannot be drawn as to whether emergency responders fully capitalise upon social media throughout the emergency management lifecycle. Recently, researchers have made efforts to address this limitation by analysing the social media activity of emergency responders for preparedness and recovery activities. Panagiotopoulos et al. (2016) explored the notion of influencing risk reduction through the use of social media. Using content analysis, the authors analysed 10,020 tweets posted by UK Local Government Authorities (councils) during two emergencies: the heavy snow in 2010 and the UK Riots of 2011. The results indicated that messages aimed to communicate and manage risks, for example by providing official updates, encouraging protective behaviour and guiding public attention to mitigating actions (Panagiotopoulos et al., 2016). A similar study by Guidry et al. (2017) investigated social media use for communicating health-related issues. Content analysis of Instagram and Twitter posts published by three health organisations was carried out. Results demonstrated that these tools were used to promote messages of risk, distribute advice, and communicate health and safety tips during the Ebola outbreak between 2013 and 2016. These papers go some way to demonstrating that social media have been used by emergency responders in phases other than emergency response, particularly for preparedness and risk awareness. Whilst this begins to help build a picture of the social media objectives for emergency responders, these papers only report on processes of use and have been based on specific emergency responders – Councils and Health Organisations. Do other emergency organisations use social media for preparedness and risk communication? Do emergency responders adhere to outlined strategies to mobilise the public before,

during and after emergencies? Do these messages effectively encourage preparedness activity?

A paper by Kaminska and Rutten (2014) collated emergency management experts' perceptions on social media. They reported on findings from consultations with Canadian emergency management experts and carried out a subjective case study analysis. Opportunities of social media for a range of activities across the emergency management lifecycle were discussed. Three main areas of emergency management for which social media were considered favourable included: 1) Public Information; 2) Situational Awareness; and 3) Community empowerment and engagement (Kaminska and Rutten, 2014). A 'Social Media in Emergency Management Maturity Model' was formed to represent the elements and characteristics that would enable the implementation of effective social media use by emergency responders. Whilst this paper goes some way in demonstrating that emergency responders envisage social media bringing value to certain key areas of emergency management, the paper does not go as far as exploring whether value is indeed created. Despite the efforts of Panagiotopoulos et al. (2016), Guidry et al. (2017) and Kaminska and Rutten (2014) it remains unclear as to whether the impacts and outcomes, as intended by the emergency responders themselves, are achieved. This observation supports the need for **RQ3** of this thesis.

Few studies have explored the effectiveness of emergency responders' social media usage. Researchers often focus on what types of messages are distributed online and the number of interactions that occur (e.g. follows, likes and retweets). Rarely do they look *beyond* basic reach and consider the extent of the reactions that such messages generate.
Evaluations of social media use are driven by the sheer volume of user-generated content and interaction data made available through these platforms (Stieglitz et al., 2014). Indeed, such measures can be useful to provide insights into the levels of engagement between emergency responder and follower online (Davis III et al., 2014). For example, a metric was proposed by Zamparas et al. (2015) to determine the influence of a Twitter user. Zamparas et al. (2015) described *likes* as a way of measuring how much a post has been seen and appreciated by social media users and *mentions* as an indicator of potential reach. The number of *comments* and *replies* are considered as a way of gauging the proportion of a population that have registered some form of interest in a post. Zamparas et al. (2015) thus expressed influence as a user's ability to ascertain a level of interest from their followers through likes, mentions, replies and retweets. While a metric such as this could be used to estimate the influence of emergency responders on Twitter (and potentially, other social media platforms), it relies upon only the visible online interactions that take place between user and follower. In isolation, measuring such data is not necessarily meaningful for assessing outcomes (the actions and perceptions that are a consequence of social media activity); they merely represent processes of use, indicating only possible impact.

One study, by Bruns et al. (2012), explored the impact of the Queensland Police Service (QPS)'s role on social media during the Queensland Floods of 2012 by examining a sample of tweets with the hashtag '#qldfloods' sent from *and* to QPS. Based on content, they found that the majority of sampled tweets were either to share or request information. Additionally, by calculating the average *retweet* rate, the tweet categories considered to contain the most important information (situational information, advice and media stories and updates) had high retweet rates, suggesting a large reach beyond QPS' immediate audience (Bruns et al., 2012). A shortcoming of this study, however, is that without distinguishing between those tweets that had been posted by QPS from those that were sent to QPS, it is unclear as to what role QPS actually played, who the other types of users were that responded, or who these messages were actually reaching. Whilst the number of retweets can be an indicator of potential 'reach' on Twitter (Kwak et al., 2010), it can also be a misleading statistic. As explained by boyd et al. (2010), there are a diverse set of motives for *'retweeting'* a social media post, from *'publicly agreeing with someone'* to *'an act of friendship or loyalty'* or *'for self-gain, either to gain followers or reciprocity from more visible participants'*. Moreover, bots are common on social media sites (Chu et al., 2010). Bots deceive the public by appearing to be a real user, but are actually algorithms running automated tasks. For example, spammers use bots to push spam to numerous accounts (Chu et al., 2010). Along with the prevalence of fake and redundant accounts, these metrics can implicate measures of reach such as retweet/share rates (Ferrara et al., 2016). In light of boyd et al. (2010), Chu et al. (2010), and Ferrara et al. (2016), the QPS study (Bruns et al., 2012) should go on to examine which parties were participating by retweeting and whether the posts reached the target audience.

Guidry et al. (2017) explored public response to, and engagement with, a sample of Twitter and Instagram posts distributed by three health organisations over three months in 2014 (September-December). This was the period during which patients were beginning to be diagnosed with Ebola in the US. By measuring four engagement variables: *Likes/ Comments* (Instagram) and *Retweets/Favourites* (Twitter), Guidry et al. (2017) found that posts on Instagram tended to elicit more engagement than on Twitter. According to Guidry et al. (2017), this suggests that Instagram is a more suitable platform not only for reaching the public but also for establishing interactive communications. However, a flaw to this approach is the equating of the number of likes and comments to denote levels of engagement. As explained by Meier et al. (2014), motives behind *'liking'* a social media post are extremely heterogeneous. Users apply a *'like'* for a range of functions and communication mechanisms from 'bookmarking' to supporting a personal relation (e.g a friend or family member) and to indicating their judgement of the content being informative (Meier et al., 2014). Thus, a mere count of likes could be misconceived as an indicator of impact. Without insight into the content of comments received, or without knowledge of which users interact

with emergency responders' posts, the context of a response is unclear (Stieglitz et al., 2014).

Crucially, a limitation of the methods utilised by both Bruns et al. (2012) and Guidry et al. (2017) is that they do not encapsulate the value that might be created by those users that might view but choose not to interact with emergency responders' activity. As explained by Li et al. (2007), the levels of participation by users of Web Technologies range significantly, from those that primarily read or listen to content (referred to as the *'Spectators'*), to those that produce content and actively participate in interactions (*'Critics'* and *'Creators'*). Identifying which users choose to follow emergency responders on social media is important; investigating their motives and the extent of their engagement will provide context for the measurements of interactions. Here, the term engagement is referred to as levels of participation and involvement on social media. These gaps incentivised **RQ2** and **RQ3** of this thesis.

Bird et al. (2012) looked beyond basic reach. A survey was distributed on Facebook during the Queensland Floods of 2010/11, to investigate the value of social media. This survey sought to uncover how people found and used Facebook pages during the incident. Several participants referenced the use of QPS' Facebook page, whereby several open responses and comments emerged, praising QPS's ability to help correct false and inaccurate information that had been generated elsewhere (Bird et al., 2012). While this uncovered an interesting finding that was participant-generated, the survey was confined to the Queensland Floods, with few questions tailored to acquire followers' feedback on emergency responders' social media usage. Nevertheless, it demonstrates the importance for exploring followers' perceptions when evaluating the impacts of social media. Using surveys can help to objectively support or reject hypotheses and yield responses unanticipated by the researcher; a similar approach will be considered in the Methods Chapter (Chapter 3) for **RQ2** and **RQ3**.

2.4 Policy on Social Media use for UK Emergency Management

The Civil Contingencies Secretariat (department of British Cabinet Office responsible for emergency planning) strive to increase the capabilities of the UK to prepare, respond to and recover from emergencies (Cabinet Office, 2013b). Under the Civil Contingencies Act (2004); a framework for civil protection in the UK, emergency responders are obligated to inform, advise and educate communities about potential risks and the steps they can take to mitigate them. Further emergency responders must also provide information and advice as necessary at the time of the emergency based on the premise that a well-informed public is better able to respond to an emergency and help to minimise the possible consequences (Cabinet Office, 2013a).

Such advice ranges from direction on how to acquire help and assistance to recommendations of precautionary safety measures and guidance on how to stay health and avoid health hazards (Cabinet Office, 2013a).

> *"Emergency responders' shall: (g) maintain arrangements to warn the public, and to provide information and advice to the public, if an emergency is likely to occur or has occurred."* Civil Contingencies Act (2004)[9]

Social media have been adopted by emergency responders across the UK as reported Cabinet Office (2013a): "The news media (radio and TV broadcasting and print) remain the primary means of communication with the public. Digital and social media are also being used widely to provide a further source of information and advice for the public" (Cabinet Office, 2013a). For example Kirklees council begun using social media to improve the public's health. A campaign targeting areas of the borough with high rates of smoking led to an increase in the number of people accessing help. Adverts on Facebook, Instagram, websites and other mobile apps were created focusing on clinic locations and reasons for people to stop smoking altogether[10].

Outlined in their Business Plan 2017-18 the Metropolitan Police (the Met) use Twitter to inform the public of police related news, events, online facilities and major incidents with early analysis suggesting that it has helped increase support to deaf and hard of hearing communities (Metropolitan Police Service). However, current guidance and policy for online social media use is limited and relatively outdated. The National Risk Register (NRR) is an official document produced by Government. It explains Government assessment of potential risks and major emergencies that could affect the UK (Cabinet Office, 2017). Yet, whereas social media are listed as tools that emergency responders should use for emergency communications in Cabinet Office (2013a), under Communications and Public Awareness of the NRR there is no reference to social media and what information or advice can be expected to be shared on these platforms.

In 2012, the Defence Science and Technology Laboratory (DSTL) was commissioned to produce a guidance document for emergency responders on how to adopt and make use of social media for emergency management: Using Social Media in Emergencies: Smart Practices[11]. It merely provides tips and basic advice on how to implement social media, particularly for emergency response. It is noteworthy that the information produced by DSTL continues to be the main resource referred to in Government non-statutory guidance for emergency responders. For example, it is referenced in the 2018 non-statutory guidance 'Resilient Communications', which aims to serve as a

[9] c36, Part 2; 1(g)

[10] Using digital technology to improve the public's health: A guide for local authorities, (2018) [Last Accessed: Jan. 2019]

[11] UK Government Guidance Document for Category 1 Emergency Responders: Using Social Media in Emergencies: Smart Practices [Last Accessed: August 2018]

reference document for supporting emergency responders in reducing risks of communication disruptions during emergencies (Cabinet Office, 2018).

Another Government document: 'Emergency Preparedness' provides guidance on part 1 of the Civil Contingencies Act 2004, its associated regulations and non-statutory arrangements. Chapter 7: 'Communicating with the Public' was last updated in 2012 and references social media to some extent; briefly outlining key risks if used for emergency management and summarising a few examples of social media usage by emergency responders (Cabinet Office, 2012a). However, it lacks detailed advice on how emergency responders can reap from the potential benefits, best practices, and social media governance. Instead, LRFs and emergency organisations are notably relying on communication experts within their organisations to produce their own policy and guidance for social media use. For example, Wiltshire Police implemented a 'Social Media and Internet Messaging Policy and Guidance' document[12] to "provide structure and clarity in the use of social media and internet messaging forums by emergency responders and volunteers of Wiltshire Police" (Wiltshire Police, 2018). The document is reviewed and updated every two years (last updated in 2018). North Yorkshire Fire and Rescue also published a short Social Media Policy document[13] that they review yearly, which aims to "provide guidance to staff that use social media corporately or personally to ensure they act in a way that reflects the values and reputation of the service" (North Yorkshire Fire and Rescue, 2018).

Digital Policing is the Met's technology function who strive to implement the best technologies to support the evolution of policing and enhancing Police Forces' ability to respond, handle and adapt to the increasingly digital world and changing demands of the public[14]. Four objectives the Met have defined as key areas of transformation support by technology including social media are (Metropolitan Police, 2017):

- Prevention and reduced demand
- Smarter and more productive ways of working
- Collaborating in Policing with partners and the public
- Equipped and empowered people

However, the Digital Policy Strategy document that outlines the Met's digital vision barely references social media and lacks a set of principles or procedures to help guide usage and achieve desired outcomes. Ostensively, the predicted value generated by UK emergency responders' social media use remains relatively inconclusive and case studies serve as the foundations for justifying and promoting social media use. There is a lack

[12] Wiltshire Police Social Media Policy (2018) [Last Accessed: Jan. 2019]
[13] North Yorkshire Police Fire and Rescue Social Media Policy (2018) [Last Accessed: Jan. 2019]
[14] National Police Chief's Council [Last Accessed: Jan. 2019]

of policy and guidance to support how social media use could translate into practice and what impacts and benefits could thus be generated through these tools. Only then can justifications be made for emergency responders to invest time and effort into the integration of these platforms for emergency management. An area that this thesis intends to fulfil.

2.5 Research Gaps

This chapter has detailed the ways in which social media have increasingly played a role in emergency management. They allow two-way and interactive communications while offering a place to share and access timely information. They provide an ability to reach large audiences and gather intelligence, which together make social media particularly attractive and promising tools for emergency responders.

Social media facilitates new opportunities for emergency responders to increase situational awareness, improve emergency communications, and encourage public engagement in preparedness and resilience building. These themes are advocated ubiquitously in the literature. However, whilst the literature has gone some way in demonstrating that emergency responders are increasingly adopting social media for emergency management, there has been a lack of consideration given to the emergency responders' perspective until recently. The extent of their social media use is unclear and there exists a lack of clarity as to who are using social media, whether appropriate training is given and if adequate governance exists. It should be noted that many papers referenced report on social media usage by emergency responders based in specific countries, particularly the US, and focus on its use in specific, historic cases.

Additionally, this chapter has shown that there is considerable ambiguity as to what impacts upon emergency management are achieved as a consequence of emergency responders' social media use. Success criteria for evaluating emergency responders' social media use have not been defined. The implications for measuring social media data in insolation, particularly interactions, can be misleading. They are not necessarily meaningful indicators of reaching the target audience and influencing a user to act or behave in a particularly way.

This thesis seeks to address the gaps cited above. It aims to elicit the underlying motivations *and* strategies for social media use by UK emergency responders (**RQ1**); seeks to identify and explore the perceptions of those that follow emergency responders on social media (**RQ2**); and provide insights into the potential impacts that emergency responders might be generating through social media use (**RQ3**) (see Figure 2.7).

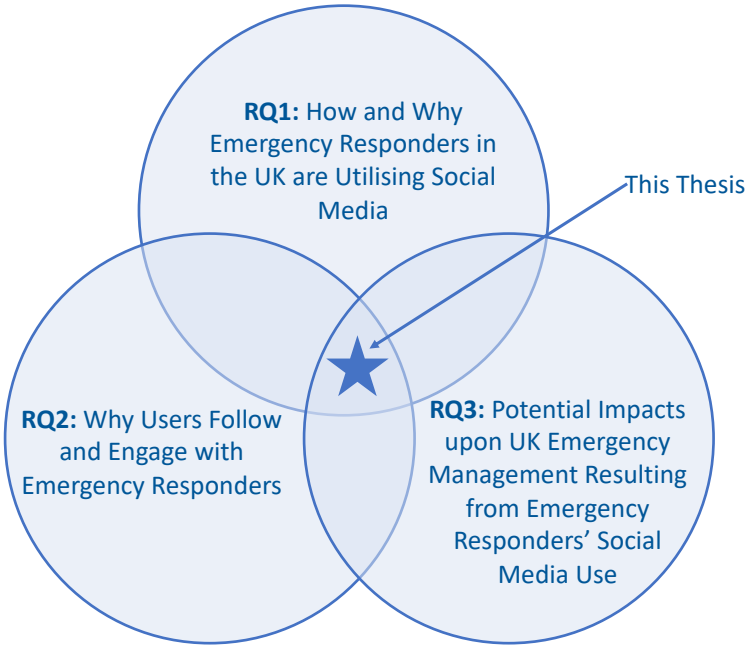


FIGURE 2.7: Representation of the RQs of This Thesis

2.6 Chapter Summary

This chapter has reported on the existing literature that discusses social media use for emergency management and provides the foundations for answering the research questions of this thesis. Whilst current research has gone some way in demonstrating that emergency responders are increasingly adopting social media for emergency management, the extent of their social media use is unclear and there is considerable ambiguity as to what impacts upon emergency management are achieved as a consequence of their social media use. This thesis seeks to address these gaps.

The following chapter moves on to discuss the methodological decisions made in order to design an approach that would acquire and shape the necessary insights so as to answer the research questions of this thesis.

Chapter 3

Exploring the Use of Social Media by UK Emergency Responders: A Mixed Methods Approach

To progress with this research an investigative approach is required (Bryman, 2012). The research foundations are based on the limited understanding of what value is actually produced by emergency responders' social media usage, as discovered during the literature review. The opportunities that quantitative and qualitative methodologies respectively offer were first considered. Quantitative methods test theory and concepts, takes the view of the researcher, and provide *"hard, reliable data"* (Bryman, 2012). Whereas, qualitative methodologies analyse concepts and theories that emerge from the data, considers the view of the participants, and the data are generally rich and deep (Bryman, 2012). For this research, a quantitative approach would enable the measuring and analysis of metrics, thus demonstrating how emergency responders have used social media. However, the perceptions and values that actively shape these uses need to be understood. Therefore, this research requires a deeper understanding of behaviour, values and beliefs, which would not necessarily be observable on social media. Researcher bias and the making of assumptions would also be difficult to avoid, or control, while attempting to deduce meaning from the results. A qualitative approach can help to address this matter and also enables participants to have a voice. It was, therefore, evident that the use of both methodologies for this research would be valuable. The quantitative approach can provide benchmarks for analysing the use of social media, whereas the qualitative data can provide a comprehensive understanding as to why emergency responders and followers use social media and their attitudes and experiences towards its application for emergency management. Thus, a Mixed Methods approach is required.

This chapter will continue by firstly explaining the Mixed Methods approach and how it is applied in this research, followed by an overview of the methodology design followed. Next, a summary of the methods used to collect the variety of data required for this research is given, followed by a brief synopsis of a case study used in this research: the UK Winter Floods of 2013/14.

3.1 Mixed Methods

Mixed Methods involve the integration of quantitative and qualitative methodologies, and encourage this mixing throughout all phases of the research process; from the outset through data collection, the analysis and finally, the formation of the conclusions (Creswell and Plano, 2007). However, merely using multiple research strategies does not constitute a Mixed Methods approach, the data deriving from the research should be *"mutually illuminating"* (Bryman, 2012). Creswell and Plano (2007) described various motivations that encourage the choice to employ a Mixed Methods approach, for example *"to support a data source that is insufficient"* or *"to explain initial results"* or *"to enhance a study with a second method"* (Creswell and Plano, 2007). Generally though, the main benefit of a Mixed Methods approach is that it strengthens the weaknesses of both quantitative and qualitative research, enabling questions to be answered, which each method could not accomplish alone (Bryman, 2012). Nevertheless, its implementation requires extensive consideration, to ensure the chosen design is the best approach for the research in hand. Mixed Methods design types vary in accordance with the choice of how to combine quantitative and qualitative elements of the research. Creswell and Plano (2007) formed a simplified classification of the main Mixed Method approaches, outlined in Table 3.1.

Specifically in the field of social media and emergency management, studies tend to focus on quantitative research, for example: semantic analysis to monitor and detect emergency events (Sakaki et al., 2010); machine learning techniques to enhance natural language processing to categorise tweets (Verma et al., 2011); and, automatic data extraction and analysis to compare only communication patterns that occur during an emergency (Bruns and Stieglitz, 2012). The application of Mixed Methods approaches is growing, but still, very few studies in the social media and emergency management domain have utilised both quantitative and qualitative methods. Denef et al. (2013) used a Mixed Methods approach to great effect, which provided the inspiration for, and contributed to, the methods chosen for this research. Focusing on the police, the researchers initially analysed past Twitter data and then conducted workshops and interviews. Their results not only illustrated how Twitter was used, but they made discoveries that explained whether the use of social media was based upon strategy or *"spur-of-the-moment decisions"*(Denef et al., 2013).

Design Approach	**Purpose**	**Description**	**Drawback**
Triangulation	To cross-check results gathered from executing a quantitative and qualitative strategy.	Collect two types of data using separate methods and merge results to draw conclusions.	Possibility that findings may not corroborate.
Embedded	To use a secondary method to provide support to a primary method.	A single set of data is insufficient for answering the research questions, thus another type of data set is also used.	Can be difficult to integrate results if the methods have been used to address different questions.
Explanatory	To use a secondary method to provide support to a primary method.	Selecting either the Follow-Up or Participant Selection model and using qualitative data to explain and expand on initial quantitative results.	It can be a long process to implement.
Exploratory	To build a basis of understanding first, which then develops or informs the quantitative method.	Initially collects qualitative data, and then executes a quantitative approach.	It can be a long process to execute.

TABLE 3.1: Overview of the Main Four Mixed Method Design Approaches, (Creswell and Plano, 2007)

RQ1 of this research was framed specifically to uncover whether emergency responders are using social media and provide deeper understanding as to why. The data needed to answer this question must offer understanding of behaviour, values and beliefs, and therefore, a qualitative approach was required. Although there are certain similarities, **RQ2** and **RQ3** focus on emergency responders' followers and constitute a much larger population, thus a quantitative approach was best suited. Since this research seeks to incorporate the views of both emergency responders and their social media followers, it was decided to employ the Triangulation approach (Table 3.1). A consequence of using this approach could be that results will not corroborate, however, this in itself would be a finding. Any disparities that may evolve will help to uncover if emergency responders' intentions for social media translate into practice, and whether their intentions align with their followers' expectations.

3.2 Methodology Design

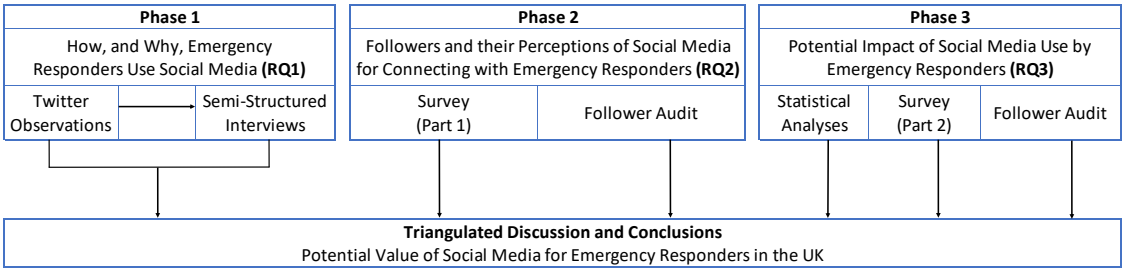


FIGURE 3.1: Research Methodology Design to Determine Value of Emergency Responders' Social Media

Approved by University of Southampton ethical committee (ERGO/24024 and 17440) the research methodology was split into three phases, as illustrated in Figure 3.1, and was comprised of five studies (summarised in Table 3.2. Note: the survey is split into two parts as it had two primary aims).

The purpose of the initial phase was to provide insights into UK emergency responders' uses and perceptions of social media, which relates to **RQ1**. Two methods were utilised: Observations and Interviews. The findings from the quantitative observations were used to help formulate the qualitative semi-structured interviews. Following collection and initial analyses of both datasets, an integration of the results allowed for emergency responders' motivations, attitudes and strategies for social media use to be identified. This helps in understanding their perceptions of its value. Furthermore, without full comprehension of the emergency responders' social media objectives, assessments of their social media use cannot be carried out.

The second phase identified who, and the reasons why, users chose to follow emergency responders on social media **RQ2**. By conducting a Follower Audit (FA) the types of users that follow emergency responders were uncovered. Additionally, by using a targeted survey to reach out to those followers, their motivations, expectations, and intentions were established. This helps determine how social media users value emergency responders' social media use, which, along with the findings from first phase, formed an important part of the triangulation methodology. It will allow for similarities and differences in judgements of social media, by emergency responder and follower, to be identified.

The third and final phase invoked three independent methods (Statistical Analyses, Survey (part 2) and FNA) to gather qualitative and quantitative evidence that identified the potential impacts of emergency responders social media use **RQ3**. Ultimately, this phase measured specific types of impact to determine if UK emergency responders fulfil their social media objectives effectively.

Together, the results from these three phases will help to form final conclusions about the value of social media for emergency responders in the UK, which is the overall goal of this research.

Study	**Purpose**	**Dataset**	**Research Question**
Twitter Observations & Content Analysis	To examine how emergency responders appear to have used a social media site during an emergency, and conduct statistical analyses to identify possible impact in terms of engagement.	Quantitative	RQ1 RQ3
Semi-Structured Interviews & Thematic Analysis	To uncover a richer understanding of UK emergency responders' use and perceptions of social media.	Qualitative	RQ1
Survey and Statistical Analyses	1. To identify reasons as to why users follow emergency responders on social media. 2. To explore impact of emergency responders social media use.	Quantitative and Qualitative	RQ2 RQ3
Follower Audit (FA) of Twitter Data	To acquire evidence of potential impact of emergency responders' social media use.	Quantitative	RQ2
Statistical Analyses of Twitter Data	To provide objective insights to help analyse performance of social media use by emergency responders, in this case, during the Winter Floods 2013/14.	Quantitative	RQ3

TABLE 3.2: Summary of Research Studies

3.3 Methods

The aforementioned five data collection methods were used to secure the information necessary to answer the research questions. This section outlines these methods, explaining the sample and data collection decisions and procedures carried out.

3.3.1 Twitter Observations and Content Analysis

RQ1 requires comparisons between emergency responders' perceived uses of social media and how they are using these tools. Previous studies in the field of social media and emergency management have conducted case study analyses (Kaminska and

Rutten, 2014), participatory action research (Hughes, 2014; Yates and Paquette, 2011) and Netnography: an online field study using participant-observational research (Palen and Liu, 2007). Whilst these provide detailed accounts about uses of social media by specific emergency responders, such methods may be too subjective, relying on researchers' views and choices of what to focus on. Further, they tend to be very specific about one emergency responder, whereas this research seeks to encapsulate the views of multiple agency emergency responders. Therefore, a method was required to objectively examine how emergency responders have used social media; Structured Observations were chosen. Similarly to the method employed by Heverin and Zach (2010), structured observations entails direct observation and recording of behaviour in terms of pre-defined categories of investigation (Bryman, 2012). Recording the actions and features used by emergency responders will provide evidence of their online behaviours, which will help answer RQ1. However, it was imperative to obtain data of emergency responders social media use before, during and after an emergency in the UK, based on the apparent opportunities of social media use across the phases of the emergency management lifecycle, as found in the literature review. In order to best achieve this, it was necessary to refine the scope of the study. As emergency responders based in the UK are central to this research, the case of the Winter Floods of 2013/14 (detailed in Section 3.4) was chosen to be the focal point of this particular study. However, a manageable sample size for the manual analysis process was required. Accordingly, this study was refined to the recording of the online behaviour by the emergency services (Police, Fire and Ambulance) associated with the 10 LRFs in the South East and South West regions of the UK (marked yellow in Figure 3.2; an overview of the quantitative data sample is provided in Section 4.1). These regions were some of the most affected areas of the floods (Thorne, 2014). Thus, the study population was refined to emergency responders based in the Southern Regions of the UK. Further refinement of the study scope involved the decision to focus on the behaviour carried out on one social media platform. Despite Facebook having a high number of monthly active users (as reported in We Are Social (2017)), the ability to easily access and acquire historic Twitter data through its open API (Application Programming Interface), influenced the methodological decision to focus on Twitter for this study. Data collection took place by using Twitter's Advance search. This is a feature that enables users, once logged on, to search through Twitter's archive of all the tweets that have been published. These searches can be tailored by selecting filters including specific date ranges, users and location, as well as specific words in the tweet content, language, and hashtags.

Focusing upon the Winter Floods (2013/14) case study, the data collected were restricted to include only tweets that contained the word 'flood' in the content, and had a timestamp between the dates 1st December 2013 and 28th February 2014 inclusive; the main period over which the emergency took place. This yielded a dataset

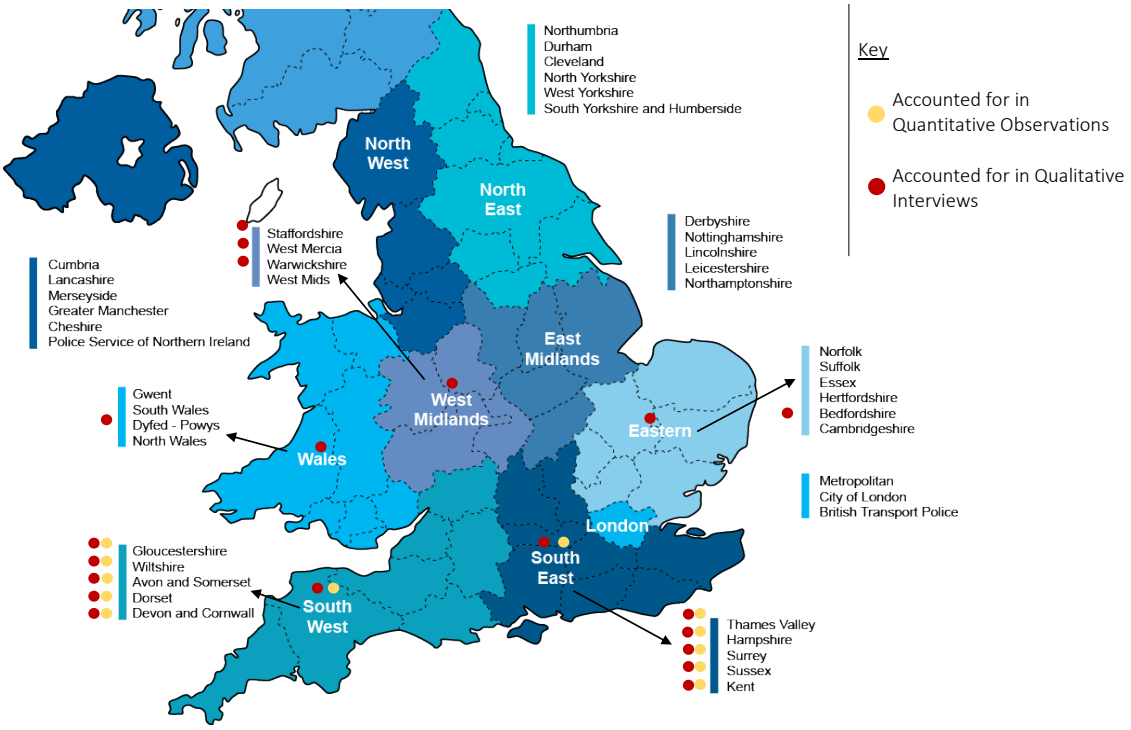


FIGURE 3.2: LRFs in the Regions of England and Wales included in the study population of the Observations and Semi-Structured Interview. *Note: the dotted lines included in this figure represent Counties. These are not the same as the LRF boundaries and are not relevant to this research.* Sourced from: grtpa.com [Last Accessed: Sept. 2018]

of 800 tweets, which was stored in an excel spreadsheet. It is important to address what could be conceived as small and insufficient data sample size.

Firstly, this could be viewed as a finding in itself: that emergency responders rarely used Twitter during the emergency, and so an answer to that question was sought during the subsequent interviews. Secondly, it was not the intention of this research to collect vast amounts of quantitative data across the entire population of emergency responders. Instead, the aim of this study was to offer insights into how UK emergency responders are using social media. Not only did this dataset offer manageable sample sizes, but also the methodological decision to use mixed methods will mitigate these limitations. The qualitative interviews, discussed next, will help to enrich findings from the quantitative data, producing mutually complementary and in-depth findings.

The observations method involved quantifying the actions and features used for each tweet. With the data organised by emergency responder and sorted by date, answers to a set of questions, outlined below, were recorded (Yes answers were marked with a 1 and No with a 0).

1. What type of Tweet is it?
   (a) An original post?
   (b) A Retweet?
   (c) A Quote Retweet?
   (d) A reply?
   Note: this was *not* defined merely by an appearance of a username, as *"@username"* also represents a Mention, which has a different purpose. Effort was taken to distinguish between the two. For example, the position of the username in replies is at the start of the tweet content, and the tone of the tweet content helps identify if it had been tailored as a response.
2. How much engagement did it acquire?
   (a) How many likes did it receive?
   (b) How many retweets did it receive?
   (c) How many replies did it receive?
3. What features did it involve?
   (a) How many Mentions were included?
      i. What user accounts were mentioned?
   (b) How many URLs were included?
      i. What did these URLs link to?
   (c) How many Hashtags were used?
      i. What were they?
   (d) Did it include any media included?
      i. How many Photos?
      ii. How many Videos?

It was considered necessary to offer insights into the occurrence of content themes 'tweeted' by emergency responders. Existing literature, for example Vieweg et al. (2010) and Olteanu et al. (2015), often utilise Content Analysis to determine the types of posts shared by users during emergencies based upon the subject of the message.

Content analysis is an approach that seeks to *"quantify content in terms of predetermined categories and in a systematic and replicable manner"* (Bryman, 2012). Ultimately, it is considered as a means to categorise the phenomenon or phenomena of interest (Bryman, 2012). Generally, rules or instructions - referred to as a coding manual - are decided upon and clearly outlined prior to the analysis. This should include a list of clearly defined categories and guidance on what should be considered in deciding how to allocate

content to each category (Bryman, 2012). Thus, to better understand what messages were distributed by emergency responders during the Winter Floods (2013/14), content analysis based upon the subject of the sampled tweets was carried out, see Figure 3.3.

Olteanu et al. (2015) conducted one of the largest content analyses in the field of social media and emergency management; 285.2K tweets on the topics of 26 natural and human-induced disasters and emergencies between 2012 and 2013 were analysed. (UK Winter Floods of 2013/14 was not included). Their analysis supported the development of a framework that depicts the high-level information types commonly shared on social media during disasters and emergencies. Therefore, for the purpose of this analysis, it was decided that Olteanu et al. (2015)'s framework would serve as the coding manual, see Table 3.3, but the framework would incorporate minor modifications allowing tweets to be organised and feature within *multiple* categories if deemed appropriate. An initial review to familarise with the data highlighted that it was also necessary to add two additional categories (marked with an *). Whilst this might highlight a limitation of using Olteanu et al. (2015)'s framework for categorising tweets specifically generated by emergency responders, the modified structure augmented the investigation into the types of tweets published by emergency responders.

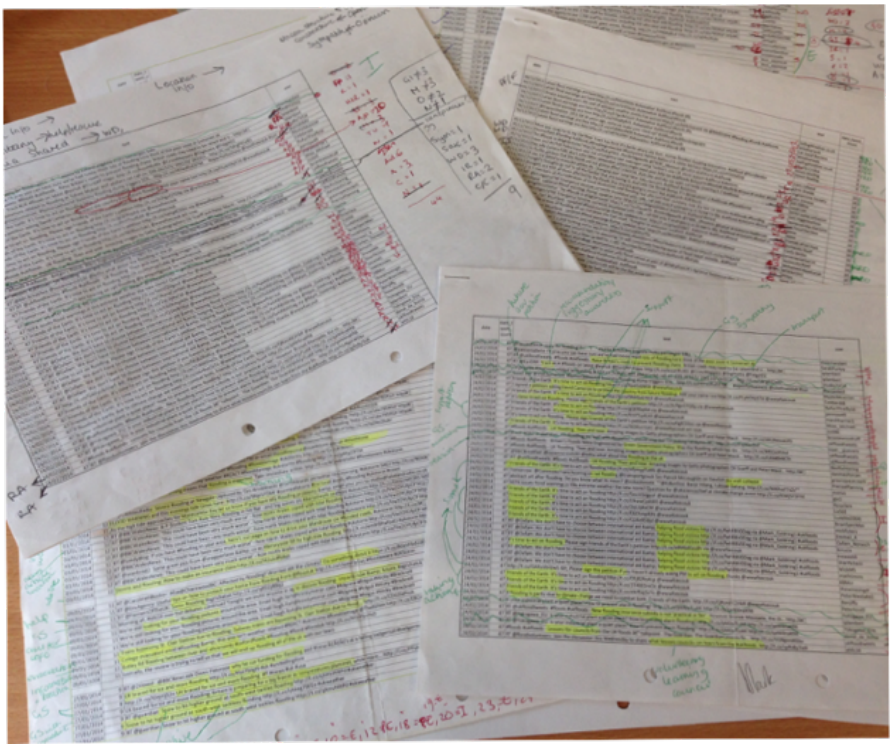


FIGURE 3.3: Evidence of conducting manual content analysis

Information Type	Summary
Affected Individuals	Posts specifically about individuals that were affected by the incident.
Infrastructure and Utilities	Posts about structures such as roads, buildings, and bridges, and utilities such as water and electricity supply, that were affected by the incident.
Donations and Volunteer	Posts related to donations of goods, services and money, and volunteer actions and information.
Rescue*	Posts specifically about rescue actions
Caution and Advice	Posts providing warnings and information in advance of, during, and after an incident.
Sympathy and Support	Posts offering concerns and condolences.
Flood Related Information*	Information that is specifically about Flooding
Other Useful Information	Other information that is related to the incident

TABLE 3.3: Framework adapted from Olteanu et al. (2015) used as the coding manual to categorise the tweet content. **indicates additional categories for analysis*

3.3.2 Semi-Structured Interviews and Thematic Analysis

In seeking to answer RQ1, there was a need to involve emergency responders through methods that allow them to elaborate and offer rich explanations for, how and why they use social media. Existing literature have primarily focused on content analysis and surveys to ascertain the popularity of social media amongst emergency responders and make assertions about how they use these platforms and the data made available on them. However, these research studies, for example Ehnis and Bunker (2012), Bruns et al. (2012) and Heverin and Zach (2010) fail to provide insights as to what emergency responders consider as 'successful' use of social media or what their social media goals are. Interviews allow for deep and meaningful data to be gathered, as demonstrated by Denef et al. (2013) and Kaminska and Rutten (2014); the empirical material that interviews can generate exceeds the brevity of survey data, offering a more in-depth understanding of the motivations and techniques emergency responders possess and deploy to harness social media. The interviews conducted in this thesis offered an opportunity to uncover the reasons behind the responders' actions, as identified in the observations study, to be understood. They also permitted the identification of gaps between how the emergency responders perceive social media and their actual use of it.

Qualitative interviews can be carried out in three forms: Structured, Semi-Structured, and Unstructured, which are outlined in Table 3.4. Semi-structured interviews were chosen for this research. This was to ensure specific areas of investigation were covered, but also to allow participants the freedom to divulge underlying attitudes, motivations and opinions (Bryman, 2012).

Interview Approach	**Description**	**Advantage**	**Disadvantage**
Structured	Administered using an interview schedule that must be adhered to. Each interviewee should experience the same interview.	The attention is focused on the issue(s) at hand.	Concepts not considered in the structure of the interview may not be uncovered.
Semi-Structured	The interviewer makes use of an Interview Guide, which includes a short list of questions of the specific topics to be covered. The schedule may not be followed precisely, but generally all topics will be covered. Furthermore, the interviewees are still provided with freedom in their responses.	Combines structure and flexibility.	The depth of information can be difficult to analyse.
Unstructured	Using at most an aid as a prompt, typically the interviewer will ask a question and leave the interviewee to respond freely. The interviewer tends only to respond to what is said in the interview that seems worthy to expand upon.	Important issues can be exposed and addressed in future enquiries.	Factual information tends to be limited.

TABLE 3.4: Overview of the Three Types of Interviews (Bryman, 2012; Klenke, 2016)

Focusing on emergency responders based in the UK, the primary aims of the interviews were to investigate:

1. How emergency responders use social media.
2. Motivations for using social media.
3. Perceptions of social media for emergency management.

Interview participants were recruited through the distribution of an online questionnaire (Appendix A) over eight months (30/07/2015 – 31/03/2016) relying on the Snowball Sampling Technique. This sampling strategy aims to gather research participants through an initial subject, who is used to establish contact between researcher and possible participants. These participants may themselves open possibilities for expanding contact and inquiry (Lewis-Beck et al., 2004). The online survey was merely a way to invite emergency responders to participate in an interview

and collect the contact details so as to make the necessary arrangements. In view of the nature of the emergency responders' job, this sampling method was believed to be most appropriate for establishing connections. A contact associated with an LRF in Southern England (an Emergency Planning & Resilience Officer) was the initial subject in this sampling method; the sample representation is shown in Figure 3.2 (marked red). The participants were based in widespread locations across the country, thus interviews took place either Online (via Skype), Face-to-Face, or by Telephone, each following the structure of an interview guide. The guide and a list of the questions that were posed during the interviews can be viewed in Figure 3.4. The specific topics that were covered during the interviews, were derived in consideration of the findings from the Observations study.

For analysis purposes, each interview was transcribed manually, using the 'Intelligent Verbatim' technique; omitting mumbles, half sentences and irrelevant words such as "ums" and "like", but without losing the meaning of the content (Bryman, 2012; Salonga, 2018). While for other research, including the 'ums' and 'likes' may be important, the aim of this study was to gather coherent responses, rather than concentrate on any hesitations. Each transcript was returned to the participant for

Semi-structured Interview Guide (approx. 1-2 hours)

Interview aim: To generate a deep understanding of how the emergency responders are using social media and why, explore their online experiences, and uncover their attitudes and opinions towards its application in emergency management.

1) Describe if and how your organisation currently uses social media
   a) Features and Content (e.g. hashtags, media, language etc.)?
   b) Work Allocation?
   c) Strategies?
   d) Standards and Policies?
   e) How does it vary between emergency lifecycle phases?

2) Describe the motivations for using social media
   a) Purpose?
   b) Desired Outcomes?
   c) Audiences' needs?
   d) Benefits and issues?
   e) Communication with other emergency responders?

3) Describe the value for using social media
   a) Effectiveness?
   b) Perceived Impact?
   c) Perceived Audience?
   d) Return of Investment?

FIGURE 3.4: Semi-Structured Interview Guide

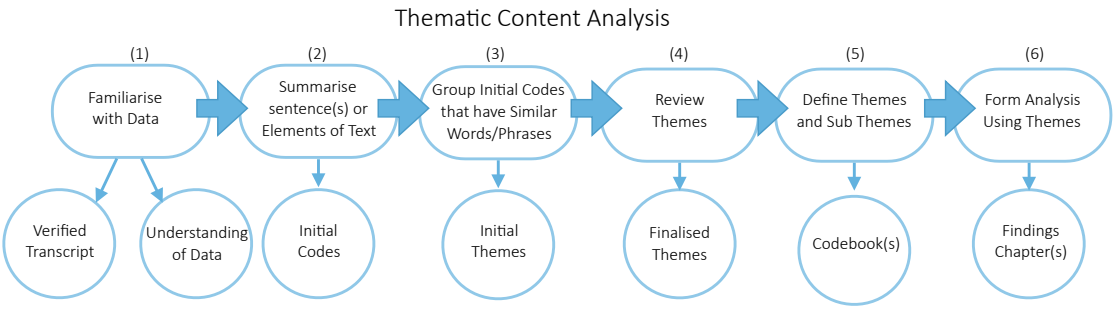


FIGURE 3.5: Thematic Analysis Overview

review, to ensure that it accurately reflected the participants' intended responses, and to reduce any misunderstandings. This was important, as the credibility of qualitative research is heavily debated within academic circles due to its subjectivity. However, it has been argued that arranging for transcripts to be examined by the participants can improve validity; respondents have the opportunity to not only confirm the transcripts, but also develop what they believe and mean in their own terms (Burnard et al., 2008).

Thematic Analysis (TA) was used to analyse the interview transcripts. TA is a method for *"identifying, analysing and reporting patterns (themes) within data"* (Braun and Clarke, 2016). It is seen as a means to organise and describe data in rich detail, which can be achieved through a range of techniques; from word counts to line-by-line analyses (Ryan and Bernard, 2003). Generally, TA involves six steps, which are summarised in Figure 3.5, where the top row represents the steps taken and the bottom row represents the outputs. A detailed overview of the steps taken is given next. However, TA is not necessarily a step-by-step process; often steps are repeated and reviewed until the researcher is content.

1) Familiarise with the data

It is important that researchers first familiarise themselves with and better understand the data, which in this study was achieved through the manual transcription process.

2) Devise initial codes

Initial coding is carried out to form codes, which are essentially labels or tags. This was achieved by summarising sentences or elements of the text in the transcripts known as open coding (Burnard et al., 2008). Each code was given an ID to help with the later steps of the TA process.

3) Create Themes

This step involves the identification and formation of themes that emerge from the data. Care and attention to detail is essential for this procedure to ensure no meaning and context is lost or changed. Initial codes for each transcript were grouped by similar words or phrases to form initial data categories (see Figure 3.6). All codes and groups

were then compared and contrasted to form the overall themes and sub-themes of the entire dataset.

4) Review Themes

Closely connected to the previous step, themes should be carefully reviewed to ensure they closely reflect the data acquired.

5) Define Themes

Codebooks are developed which contain the themes and codes that emerged from the interviews. Each code and theme is given an ID and the main themes are defined. These codebooks can be used as a guide or reference to form the appropriate analyses in step 6. (See Appendix B for a full breakdown of the codebooks developed for this research)

6) Drawing upon themes

The final stage involves the identification and formation of theories by drawing upon the themes outlined in the codebooks (Chapter 4).

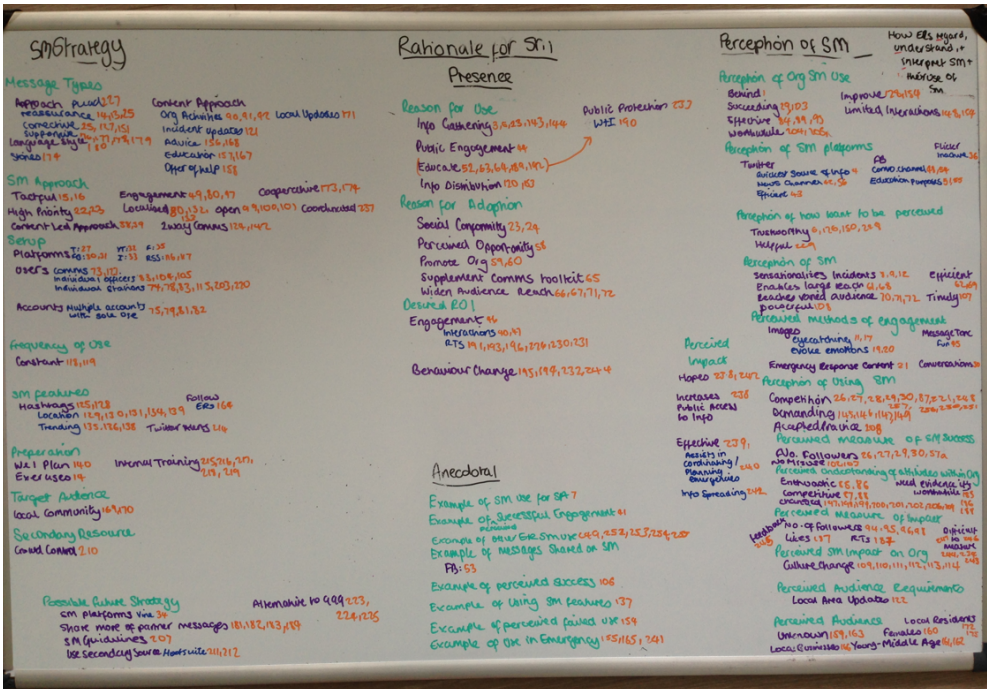


FIGURE 3.6: Example of Process taken to Create Themes

3.3.3 Targeted Survey

Addressing **RQ2** and **RQ3** required the views of the emergency responders' followers. Some researchers have used social media analytics (Bruns et al., 2012) or content analysis (Guidry et al., 2017) to review textual and interactive responses to emergency responders' posts thereby measuring public reaction. However, this research seeks to understand why users' specifically choose to *follow* emergency responders (**RQ2**), and

evaluate the potential influence that emergency responders' social media activity may have on their followers (**RQ3**). Crucially, reaching as many members of this target audience as possible would help validate the findings but, given the large population of followers, this would be difficult to achieve through qualitative methods such as interviews. Hence, a survey was considered best suited to ascertain the views of emergency responders' followers (Bryman, 2012). Whilst this method could be influenced by participant bias and exaggeration, as it heavily relies on participant self-judgments and recording of hypothetical behaviour (Bryman, 2012), a significant advantage of this method over social network analyses was the opportunity to include the perceptions of the users that choose to follow, but do not visibly engage with, emergency responders. A significant portion of social media users are found to engage merely by consuming content (Li et al., 2007). Additionally, obtaining responses in both objective and subjective forms, outlined in Table 3.5, allowed for a richer dataset and findings to emerge that were not necessarily foreseen by the researcher. However, It is important to emphasise that it was not the intention here to establish the amount of value created through social media or to generalise across the entire population. Instead, the aim of this work was to offer insights into what, and how, value may be created between emergency responder and follower on social media.

The survey was divided into five sections, listed below, and comprised of a variety of question types as outlined in Table 3.5. (A full copy of the survey can be found in Appendix C).

1. Introduction - A bit about You
2. Motivations for Following Emergency Responders
3. In Times of an Emergency
4. Interactions with the Emergency Responders Social Media Activity
5. Emergency Responders Social Media Impact

Using the tool iSurvey[1], the survey was distributed on social media sites, relying on users to complete and share. Emergency responders were also contacted with an invitation to publish and share the survey on their social media sites in an attempt to reach their followers. The survey ran for three months (18/10/2016-18/01/2017), during which time there were 106 participants, with 61 completing every question. After completion, the data were downloaded and saved locally as an XLS file for analysis. This approach enabled the collection of both quantitative and qualitative responses, providing the opportunity to conduct systematic testing against the objectives and desired outcomes of the emergency responders.

[1]iSurvey, available at isurvey.soton.ac.uk.uk, is a "survey generation and research tool for distributing online questionnaires." It is free to use for members of the University of Southampton.

Question Type	Description	Data Type	Advantages	Disadvantages
Likert Scale	A scale typically used to measure participants' satisfaction or agreement with a specified set of statements (Bryman, 2012).	Quantitative Value assigned to Qualitative data	Quick for respondents to complete, easy to understand and quantify, and allows respondents to give a neutral opinion (they are not forced to go with an either/or answer).	Respondents can choose the "middle option" as a way to avoid answering the question, which can distort results.
Open Ended	An answer box without limits, allowing respondents to use or provide their own knowledge or feelings in more than a one-worded answer (Bryman, 2012).	Qualitative	Enables respondents to freely express their knowledge or feelings and allows for unexpected findings to emerge.	Respondents give answers to different degrees of detail, and it requires more of their time.
Closed Ended	Respondents must choose a response from a given set of answers (Bryman, 2012).	Quantitative	Quick for respondents to complete. Allows for statistical analyses and ease in comparing answers.	Respondents may be forced into an answer that isn't necessarily true.

TABLE 3.5: Types of Questions used in Survey

3.3.4 Follower Audit of Twitter Data

An element of **RQ2** and **RQ3** required the understanding of user types following emergency responders. Research by Olteanu et al. (2015) found a range of user types that contribute information on social media during disasters and emergencies. Specifically during the US Red River Floods 2009, Starbird et al. (2010) found a significant portion of users publishing tweets on Twitter were newscrawlers or bots. Fake and redundant accounts and bots are prevalent on social media, and could extert a significant influence on social media analytics for measuring impact or 'success' (Ferrara et al., 2016). Therefore, it was considered necessary to conduct an analysis of emergency responders' followers, in a similar way to Starbird et al. (2010). The audit, based on profile attributes and activity, sought to explain whom emergency responders

may be reaching. The evidence uncovered made contributions towards answering **RQ2** and **RQ3**.

Twitter was again chosen for this study due to the public nature of the majority of its data and its open API, which allows for researchers and developers access. However, due to the manual execution of this analysis, it was necessary to examine a refined study population. The random sampling technique is a method of selecting a sample where every member of the research population has a chance to be included (Bryman, 2012). While this is a basic sampling technique, it is the best method for selecting an unbiased representative sample (Bryman, 2012), and was chosen as the most appropriate method for collating a manageable sample size for this study.

Profile attributes, explained in Table 3.6, of users with public accounts[2] and had connected with emergency responders in the interview sample were retrieved by executing a python script. Using an online random number generator, 100 profiles from each of the emergency responders' follower list were chosen, forming the final sample of 1300 follower profile attributes. These were thematically reviewed and emergent categories of user types formed (A significantly high number of followers that a user follows and large count of posts that user has liked can indicate a bot account (Ferrara et al., 2016)).

Attribute	**Description**
User Description	A short biography (max 160 characters)
User's Follower Count	The number of followers that a user has chosen to connect with
Count of Likes	Number of posts a user has liked

TABLE 3.6: Profile Attributes Reviewed for FA

3.3.5 Statistical Analyses of Twitter Data

The availability of social media data has created a 'buzz' in computational and social research (Halford et al., 2017), and claims are often made by correlating online interactions with offline behaviour. Here, the term *online* refers to the visible interactions (for example 'liking' a tweet) and *offline* refers to reality; the 'real-life' actions.

Measuring available interaction data can help to form theories about what people say and do over a given period of time and is particularly useful for providing insights into the levels of engagement between users. Zamparas et al. (2015) describes the number of *likes* as a way of measuring how much a post has been seen and appreciated by

[2]A profile can be either private or public. Private profiles and the tweets sent from these accounts can only be viewed by those who have permission.

social media users and *follower counts* are viewed as an indicator of potential reach (Sterne, 2010). boyd et al. (2010) examined the ways in which *'retweeting'* a social media post can be carried out and the motives for doing so. Whilst a diverse set of reasons for retweeting were discovered, boyd et al. (2010) claimed that regardless of motivation, interaction through retweets indicates that a user is participating in a form of conversation.
Such measures suggest that engagement between emergency responders and their followers does not necessarily have to occur through textual features of social media; likes and retweets indicate the proportion of a population that are interested in emergency responders' posts and are willing to help propagate their messages. Nonetheless, the number of *comments* and *replies* can be insightful, implying an estimate of emergency responders' followership who engage through textual forms of interaction (Zamparas et al., 2015).

Whilst online interactions suggest a level of interest in a user's social media activity and thus make for attractive measures of engagement (Kwak et al., 2010; Sterne, 2010; Zamparas et al., 2015), it would only indicate *potential* engagement and of a specific population; only a portion of the population use social media and only a subset of those choose to visibly engage, whilst a significant portion engage merely to the level of consuming content (Li et al., 2007).
Nevertheless it was important to capture some of this data for statistical analysis to support whether or not the emergency responders' social media usage has an impact on their audience **(RQ3)**.

Using the dataset collected for the Twitter Observations and Follower Audit (discussed previously), levels of engagement between emergency responder and their audience were analysed. Three tests were carried out: Average Rate of Reaction, Correlation and Multiple Regression Analysis, and Follower Count, which are outlined in Table 3.7.
The average rate of reaction refers to the mean number of users that chose to participate in a visible interaction prompted by a post submitted by an emergency responder.
Multiple regression is used to predict the variance in a dependent variable based on the value of two or more independent variables[3]. Here, Level of Engagement is the dependent variable. The test seeks to examine what aspects of Twitter activity, during the Winter Floods (2013/14) by 29 emergency responders, might have played a role in promoting engagement. The IBM Statistics software package SPSS[4] was utilised to perform the Correlation and Multiple Regression tests.
The follower count represents the number of users who have subscribed to a sample of emergency responders' Twitter accounts.

[3] Multiple Regression Analysis using SPSS Statistics [Last Accessed: Sept. 2018]
[4] IBM SPSS Software [Last Accessed: Sept. 2018]

Test	**Purpose**	**Variables and Reasoning**
Average Rate of Reaction	To identify amount of reaction emergency responders' tweets ascertained around the Winter Floods (2013/14).	**Likes Received:** Measure the number of times each tweet was 'liked' to indicate how many followers expressed an interest in the emergency responders Twitter activity (Zamparas et al., 2015). **Retweets Received:** Record the amount of times a tweet was reposted to reflect the number of followers who were willing to help propagate emergency responders' tweets (boyd et al., 2010; Bruns et al., 2012). **Replies Received:** Count the number of replies a tweet received to show how many followers engaged with emergency responders through textual forms of interaction (Zamparas et al., 2015).
Correlation and Multiple Regression Analysis	To explore how Twitter activity by emergency responders around the Winter Floods (2013/14) might have helped to promote engagement	**Correlation and Multiple Regression:** Analyse variables: activity, use of twitter features, and, tweet content, to examine what aspects of emergency responders' Twitter activity might explain levels of engagement (based on likes and retweets) attained on Twitter before, during and after an emergency (Parsons et al., in press).
Follower Count	To explore whether emergency responders' reach large numbers of followers that are their target audience	**Audience Size:** count of the number of followers that have connected with emergency responders' Twitter accounts to evidence the "potential" reach of their posts (Sterne, 2010; Kwak et al., 2010)

TABLE 3.7: Statistical Analyses Tests

3.4 Case Study: UK Winter Floods (2013/14)

To provide depth and emphasise context for certain methods adopted during this research, a case study was chosen; the UK Winter Floods of 2013/14. The event occurred shortly before this work started, and was a motivation for this research project. A brief synopsis of the event follows.

October 2013 heralded the beginning of an unforgettable event in the UK. St Jude's Storm was the first of at least 12 storms to hit the UK during the winter months of December 2013, and January/February 2014. It is considered to be the stormiest period of weather that the UK has experienced since 1969 (Rodgers and Bryson, 2014). Persistently heavy rainfall and strong winds caused widespread disruption and devastation across many southern regions (Figure 3.7). UK records for winter reached 165% of average rainfall (see Figure 3.8), hurricane force winds, and record-breaking high tides in the Humber and Thames Estuaries (Office, 2015b; Thorne, 2014).

During the main period of the Winter Floods (Dec. 2013 to Feb. 2014) rivers, including the Thames, burst their banks, trees were brought down by high winds, and sea defences were weakened, if not destroyed (Office, 2015b). High water tables and the extent of soil saturation caused an increase in sinkholes and triggered landslides (Thorne, 2014). At least 10 fatalities were attributed to the event. Hundreds of people were left without power, many were forced to leave their homes, and farmers had to evacuate livestock from flooded land (Office, 2015a,b). According to the Met Office, around 50,000 homes experienced blackouts over the Christmas period, and between January and February 2014 the Environment Agency reported at least 6,000 properties to be flooded and that up to 100,000 homes and businesses were without power (Office, 2015b).

FIGURE 3.7: "UK Storm - Arundel Flooding" (left) by Rob and, "Flooded Thames" (right) by David Short, both licensed under CC by 2.0 [Last Accessed: Sept. 2018]

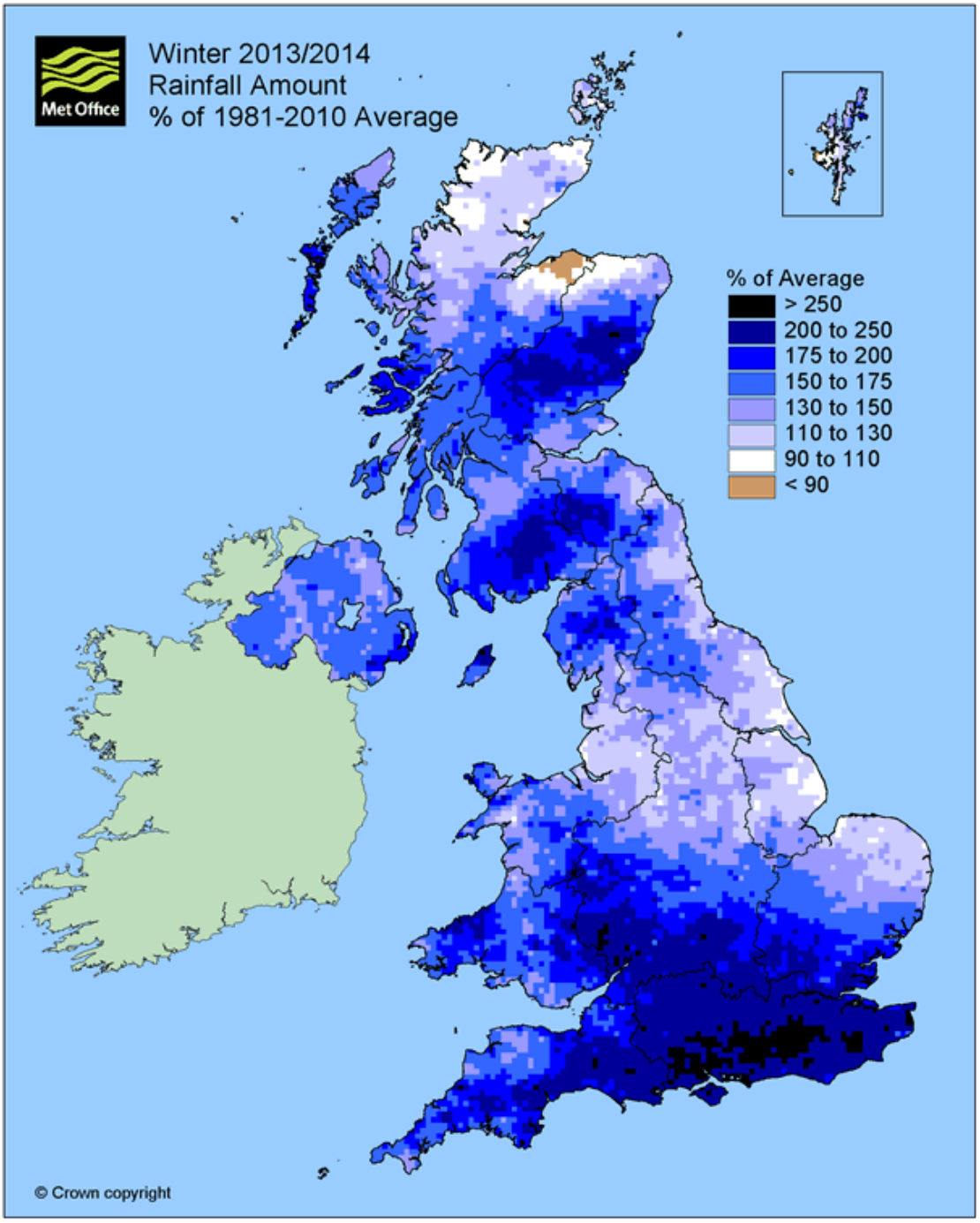


FIGURE 3.8: Rainfall Records of Winter Floods December 2013-February 2014, Source: Met Office - Winter 2013/14 Summary

FIGURE 3.9: "Flooding" (left) by Richard and, "Flood Road Chiddingstone Kent" (right) by John K Thorne, both licensed under CC by 2.0 [Last Accessed: Sept. 2018]

Transport infrastructures were affected, causing chaos for commuters. Railways were destroyed, roads were flooded, and airports, including London Gatwick were forced to terminate flights (Figure 3.9). Vulnerable areas such as the Somerset Levels were inundated with floodwaters to the extent that villages were only accessible by boat (Thorne, 2014).

Southern UK regions from Dorset through Hampshire, Surrey into Sussex and Kent were some of the most affected areas (Thorne, 2014). By the end of February 2014, the crisis began to subside. Major recovery and resolution actions were required to restore and reform the UK and help victims return to normality. Various grants were awarded to farmers, householders and business owners. Local Authorities and communities were supported by funding schemes (Department for Communities and Local Government, 2014).

3.5 Chapter Summary

This chapter has explained the mixed methods and triangulation approach used for this research. Given the detail required to answer the research questions set out, it was essential to use a set of methods to produce a grounded understanding in the domain of social media use by emergency responders. Further details of the data samples acquired are provided at the start of each of the proceeding chapters, along with discussions that bring the results of the studies together to answer the research questions of this thesis.

The next chapter will outline the results of the Twitter observations and interviews to examine emergency responders uses and motivations for integrating social media into emergency management.

Chapter 4

Social Media Use by Emergency Responders in the UK

This chapter details the first set of key findings of this thesis. It concentrates on eliciting the underlying motivations and strategies for social media use by UK emergency responders. This is question one of the research: How, and why, are emergency responders in the UK utilising social media? **(RQ1)**.

It seeks to uncover why emergency responders use social media, and what they aim to achieve by doing so. Only by identifying the emergency responders' aims for social media use can the effectiveness of their online activity be examined, which contributes to an overall understanding of the value of social media for emergency responders. The findings discussed in this chapter are based upon the combination of observations of Twitter use together with the interview responses given by emergency responders based in the UK. The sampling space is represented in Figure 4.1.

This chapter first provides an overview of the samples of both the quantitative and qualitative data. This is followed by the results of the Twitter observations, and the qualitative interview data. The integration of the interview data with the findings of the Twitter observations is discussed, which leads to four key findings about emergency responders' social media use:

1. Social media use for communications during an emergency is a low priority for emergency responders.
2. Emergency responders favour social media for preparedness and resilience building.
3. An overarching aim of social media is to encourage public engagement in emergency management, but participating in dialogue is not a priority.
4. Social media are considered effective tools for promoting the organisation, and helps to rebuild and develop relationships with the public.

The chapter concludes with a proposed conceptual framework of the emergency responders' key objectives and desired outcomes, named: the SMOKE framework.

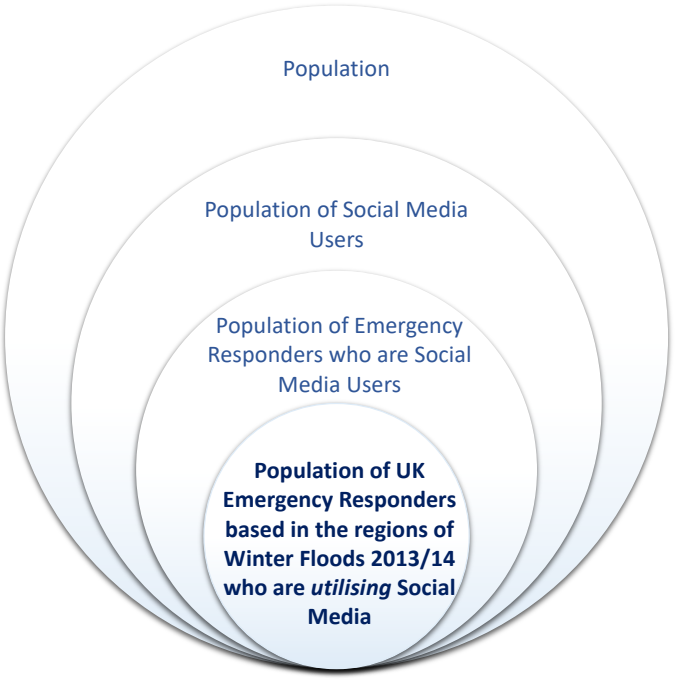


FIGURE 4.1: Representation of the sampling space in this research chapter
Note: diagram is not to scale

4.1 Data Samples

The data collection methods: quantitative observations and qualitative interviews, were carried out separately to acquire the necessary data for this investigation. The actions taken by emergency responders, and the Twitter features they used were observed and recorded. Further, the content of tweets were thematically coded into pre-defined categories defined by the framework in Olteanu et al. (2015). This framework was chosen, as the authors had successfully developed it while following a large analysis of tweets, posted during 26 different emergencies.

The recorded observations provided insights into the types of activity and interactions emergency responders participate in while using a social media platform. It is important to note that this particular analysis was based upon the Twitter platform and the UK Winter Floods of 2013/14 case study (Section 3.4). A case study helps to provide depth and emphasise context. The UK Winter Floods of 2013/14 occurred shortly before this research begun, and was a motivation for this research project.

The data collection method aimed to capture data about emergency responders' posts submitted in the lead-up to the Winter Floods (December 2013), during the emergency period, and in the recovery phase as the flooding subsided (February 2014). Thus, by

adding specific keyword and date filters, only tweets relevant to the case study were included in the analysis; All tweets contained the word 'flood', and had a date/time stamp between 1st December 2013 and 28th February 2014 inclusive, which was the predominant period of the Winter flooding. As previously explained in Chapter 3 (Section 3.3.1), a decision was made to restrict the observations sample to data only of the 'Blue light' services (Police, Fire and Ambulance) affected by the Winter Floods of 2013/14.
As a result, the final data sample consisted of 800 tweets associated with 29 emergency organisations in the Southern Regions of the UK, which were the areas most affected by the winter floods (as illustrated in Figure 3.8) (Thorne, 2014).

14 emergency responders agreed to participate in an interview. The interview study aimed to gather information on emergency responders' motivations, opinions, and experiences of social media. Following transcription, thematic analysis was carried out to reveal the emerging themes of the interview responses. The new codes identified were organised into five codebooks, which are summarised later in Section 4.3.

To summarise, 37 emergency organisations in the UK are represented in this research, of which five are included in both the quantitative and qualitative data. Of note, two interview participants were associated with the same organisation The representation of each dataset by sector can be found in Table 4.1 below.

Sector	**# of Emergency Responders' Corporate Twitter Accounts Reviewed in Observations**	**# of Emergency Responders Interviewed**
Fire Service	14	4
Police Force	12	1
Ambulance Service	3	2*
Local Authority (City/County Councils)	n/a**	7

TABLE 4.1: Sample Representation by Sector of Emergency Responder
**Both ambulance interview participants were associated with the same organisation. **A decision was made to restrict the observations sample to data only of the 'Blue light' Services affected by the Winter Floods of 2013/14. Refer back to (Section 3.3.1) for further explanation.*

4.2 Observations of Twitter Use during the Winter Floods 2013/14

An overview of recorded observations concerning emergency responders' Twitter use, during the Winter Floods 2013/14, was collated. A summary of these observations is presented in Table 4.2 (a full breakdown is provided in Appendix (D)).

Of note, Olteanu et al. (2015)'s framework for categorising the tweet content specifically generated by emergency responders required a modified structure. It was necessary to add two additional categories: Rescue and Flood Related Information. This highlights that content shared by emergency responders on social media is likely to differ to those of general users. Future work should seek to establish techniques that distinguish and categorise social media posts based on content *and* author.

Summary of Data Sample	**Amount Collated**
Type of Tweet	
Original Tweets	682
Retweets	92
Replies	26
Use of Twitter Functions	
Tweets with at least one Hashtag	382
Tweets with at least one Mention	218
URL Included	378
Media (Photo or Video)	71
Follower Interaction Metrics	
Likes Received	1092
Retweets Received	6212
Replies Received	369
Information Types*	
Caution and Advice	527
Infrastructure and Utilities	155
Donations and Volunteer	4
Sympathy and Support	5
Affected Individuals	31
Flood Related Information	135
Rescue	94
Other**	159

TABLE 4.2: Summary of Observations of Twitter use during Winter Floods of 2013/14
**Note: A tweet could be categorised into one or more information types*
***Category comprises of tweets that did not fit into the other pre-defined categories*

4.2.1 Frequency of Use during the Winter Floods (2013/14)

All 29 emergency organisations were observed to have used Twitter at some point during the Winter Floods (2013/14). However, the histogram in Figure 4.2 illustrates a positive skew, alluding to the fact that many of the organisations were not actively tweeting during the crisis. Further to this, the results in Figure 4.3 show that over half of the sampled tweets (51%) were posted in the third month of the crisis (February 2014), and that some organisations did not post in every month of the floods. For example, Fire Service 'N' only submitted Tweets in December 2013. A number of reasons could explain these data variations. For example, the flooding may have varied spatially or that an impact of the data collection process used could mean that the sample does not necessarily represent the entire portion of tweets posted by emergency responders in this period. Without the qualitative data, however, these conclusions would remain conjecture.

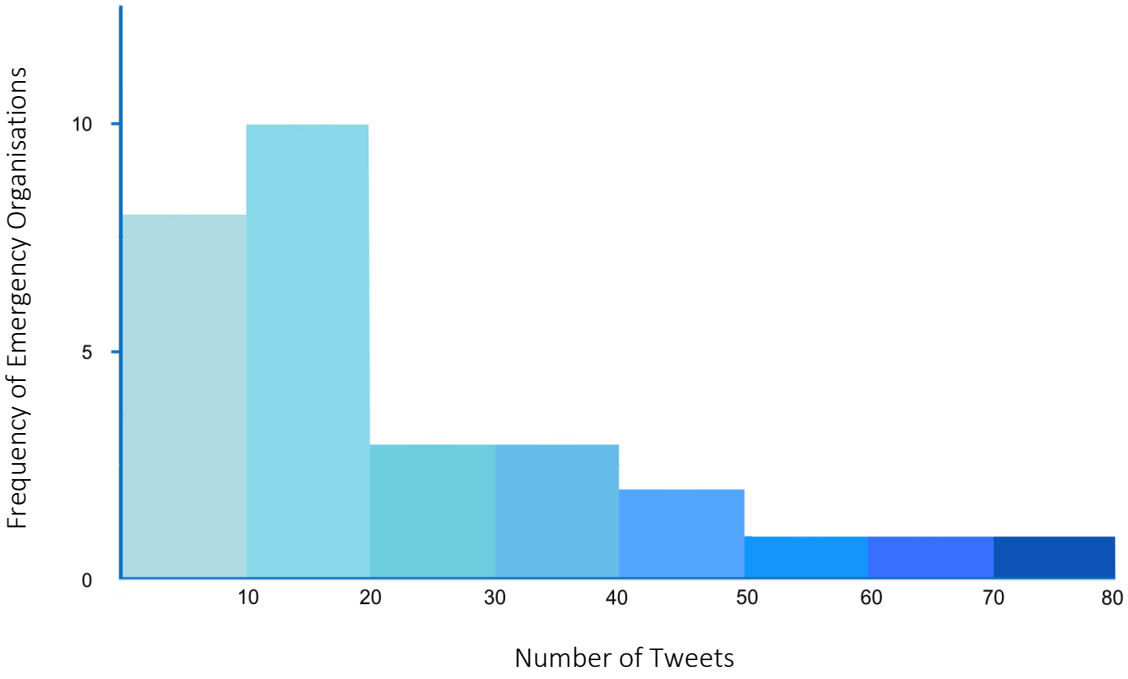


FIGURE 4.2: Distribution of Original Tweets by Emergency Organisations

4.2.2 Use of Twitter Features during Winter Floods (2013/14)

Explorations into uses of Twitter features revealed some interesting findings about how emergency responders use social media in emergencies. Figure 4.4 illustrates the percentage of Twitter features used in the sample by emergency responders. Only 9% of the sampled tweets contained a photo or video (categorised as media). This may be considered as a surprising result. As noted in existing literature, the use of photos and videos are perceived as a method for capturing engagement and influencing interaction (Yetim et al., 2011). Given this low use of media, it could be inferred that emergency responders do not prioritise the use of imagery, or that their social media literacy is low. But this would merely be speculation: firm evidence is required to identify how emergency responders think about the use of photos and videos on social media for emergency management.

Zamparas et al. (2015) and boyd et al. (2010) describe both replies and retweets as indicators of a user immersing themselves in some form of conversation. Based on these metrics, the results in Figure 4.4 indicate that emergency responders rarely engage in conversation: the majority of observed activity (85% of tweets) were original tweets, and only 3% of the sampled tweets were replies and 12% retweets. This suggests that Twitter was primarily used as a source of information and monitoring and consolidates the findings of Ehnis and Bunker (2012), Heverin and Zach (2010) and Hughes et al. (2014a). Participating in conversations is not central to emergency responders' social media strategy; or at least that appears to have been the case during the Winter Floods (2013/14) crisis.

The use of hashtags and URLs is, however, noteworthy. Hashtags, the marking of keywords or topics in a tweet by using the '#' symbol, help to group and find information of a similar subject and can increase the likliness of a high reach (Bruns and Liang, 2012). Of the sampled tweets, 48% contained a hashtag. A review of the hashtags uncovered that the most popular hashtag was #floodaware, see example tweets below. This was a pre-defined hashtag for promoting messages related to the 'floods destroy' campaign[1], which aims to encourage people to be prepared for flooding and protect themselves, their families and their homes.

> **Police Force Tweet:** Roads may be hit by flash flooding in the next 24 hours – take extra care on the roads. Be aware of fallen trees and debris #floodaware
>
> **Fire Service Tweet:** If you're driving in areas affected by flooding, steer clear of flood water. 30cm of water will float your car. #floodaware
>
> **Ambulance Service Tweet:** If you've been flooded do not use petrol or diesel generators indoors due to risk of carbon monoxide poisoning #floods

[1] More information on the 'floods destroy' campaign can be found at: floodsdestroy.campaign.gov.uk [Last Accessed: Aug.2018]

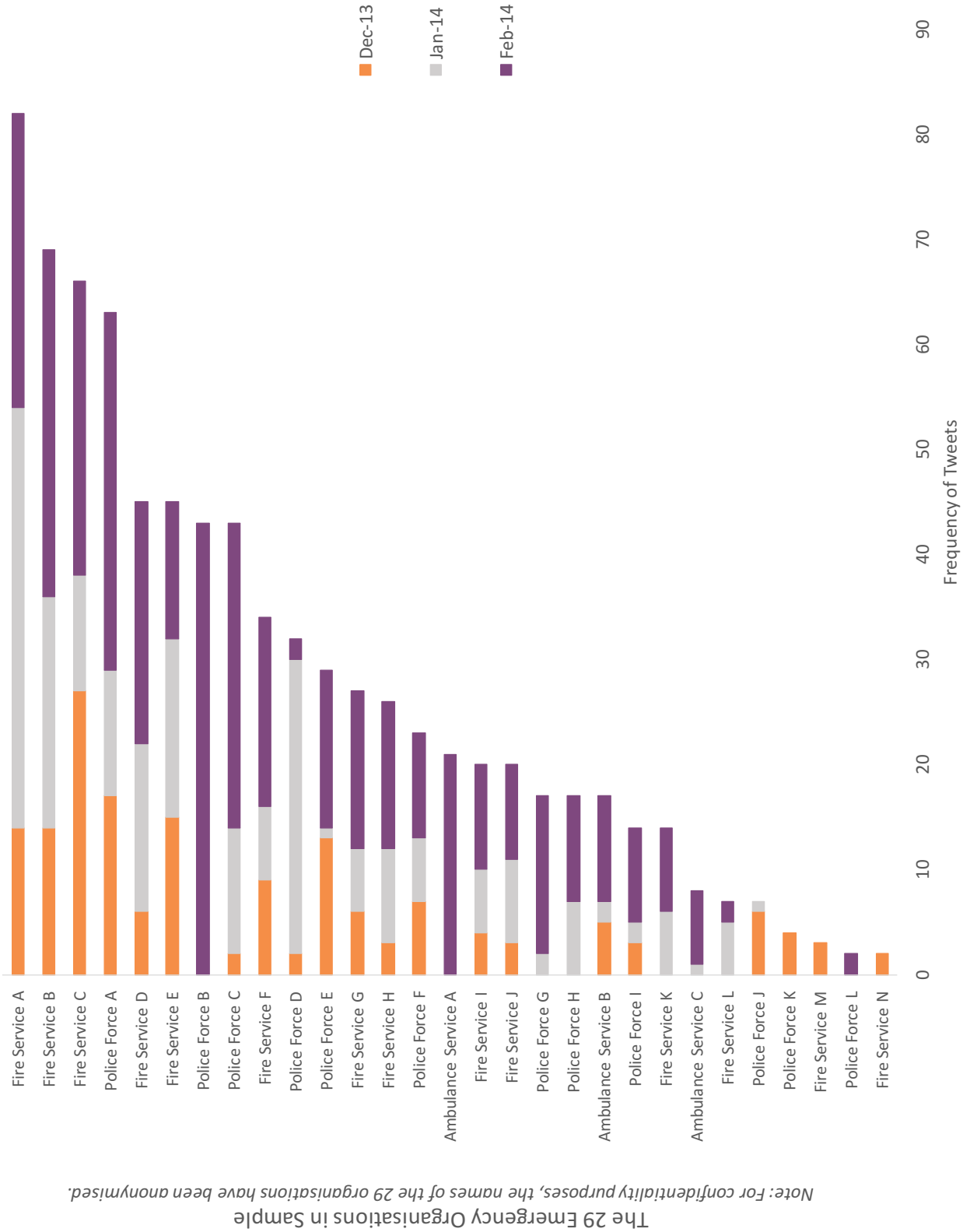


FIGURE 4.3: Frequencies of Twitter posts across the three months of the winter floods: December 2013, January 2014 and February 2014

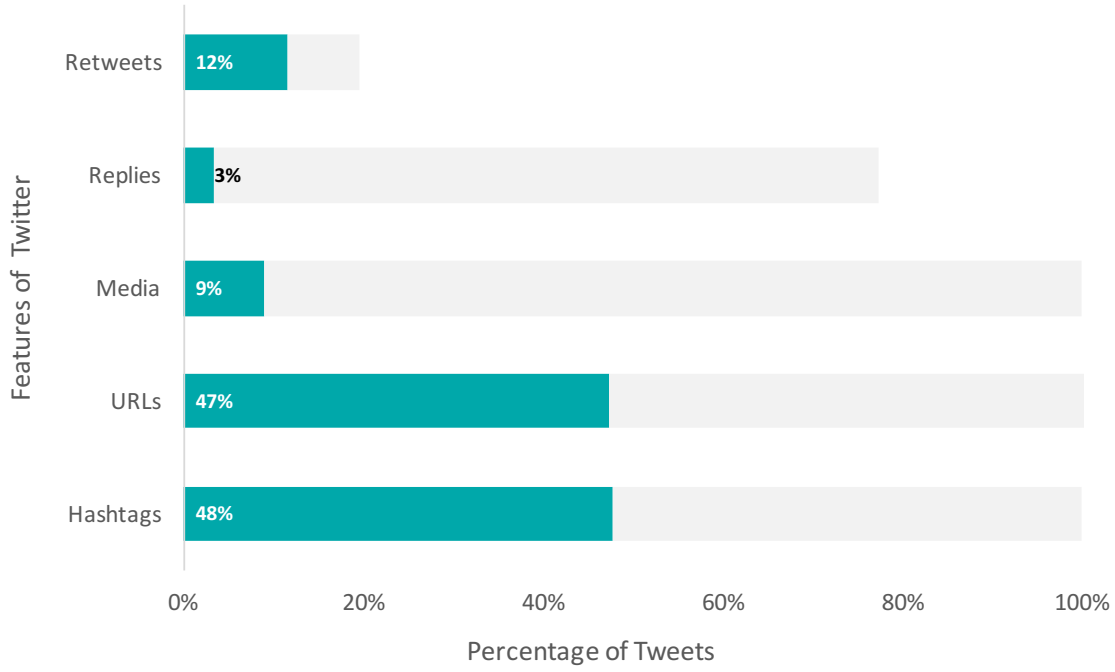


FIGURE 4.4: Use of Twitter Features by Emergency Responders during Winter Floods (2013/14)

Police Force Tweet: We are not expecting any properties that haven't already flooded to be impacted, but those that have flooded may flood again #floodaware

Fire Service Tweet: Be safe in possible flooding later today & the weekend is predicted by the Met Office, see our top tips *[url]* #floodaware

Users of Twitter can add URLs, whether they be in full or shortened. In the data sample, 47% of tweets contained a URL, for example:

Fire Service Tweet: Firefighters help two people after their car gets stuck in flood water *[url to organisation report]*

Ambulance Service Tweet: If you have any health questions related to #flooding, why not check out advice provided by the Health Protection Ag? *[url to advice on another organisation's website]*

Police Force Tweet: Public advice - Floods on roads and landslide risk #floodaware *[url to advice leaflet on website]*

An examination of those links revealed three main uses of URLs, which are listed in Table 4.3. Of note, 38% connected users to web pages that aim to support individuals in preparing and protecting themselves with regard to flood related emergencies.
The uses of hashtags and URLs would appear to correspond with the aims of the National Resilience Capabilities Programme (NRCP) and resonates with the findings of Dufty (2012) and Dufty (2015) who advocated social media use to help improve community preparedness and resilience.

Use of URL in Tweets	**% of Tweets with URLs**
Flood Warnings/Forecasts and Situation Updates	35%
Press Releases/Links to Reports on Organisations' Website	27%
Advice on how to Prevent, Prepare for, and Handle a Flooding Crisis	38%

TABLE 4.3: Uses of URLs on Twitter by emergency responders during the Winter Floods of 2013/14

4.2.3 Content Shared during Winter Floods 2013/14

For a comprehensive analysis, it was also of interest to investigate what emergency responders communicate on social media. To do so, the contents of the sampled tweets were thematically coded, using categories adapted from Olteanu et al. (2015)'s framework. The results, presented in Figure 4.5, illustrate that 19% of tweets were reports of infrastructures and utilities affected by the flooding, 12% of tweets gave information about rescues carried out, specific flood reports made up 17% of tweets, and 4% were updates about individuals affected by the incident. This portrays the efforts made to keep social media users informed about the incident. A significant portion of tweets (20%) were also categorised into the 'Other' category. This was made up of tweets that did not fit into the other pre-defined categories, for example content about the use of resources, reports of response actions and links to news articles:

> **Police Force Tweet:** Our search team gave fire prevention & health and safety advice to flood-hit residents on #SomersetLevels today
>
> **Fire Service Tweet:** A news feature on fire crews transporting much-needed oil by boat to the water-locked village of #Muchelney *[url]*
>
> **Fire Service Tweet:** Thanks to *[Name]*, President of the Chief Fire Officers Association for his visit to flood-hit Somerset *[url]* #CFOA

The majority of tweets (66%) were categorised as caution and advice. Distributing weather warnings was common but the content and references of these tweet types were often aimed at increasing risk awareness and encouraging users to better protect themselves, which again resonates with the requirements of the NRCP:

> **Ambulance Service Tweet:** It's wet and windy out there. Please stay safe and only dial 999 in an emergency. If you are on the roads slow down and avoid flood water
>
> **Fire Service Tweet:** Heavy #rain is forecast in *#[location]*. Know how to prepare your home in case of a #flood *[url]*
>
> **Police Force Tweet:** Several flood alerts for *[Location]* tonight, please be careful, keep speed to a minimum!
>
> **Fire Service Tweet:** Do you know what to do before, during and after a flooding event? Please view these essential tips: *[url]* #weather #rain
>
> **Police Force Tweet:** Be aware of the waves you create when driving through water; you could divert the water elsewhere and cause further flood damage #floodaware

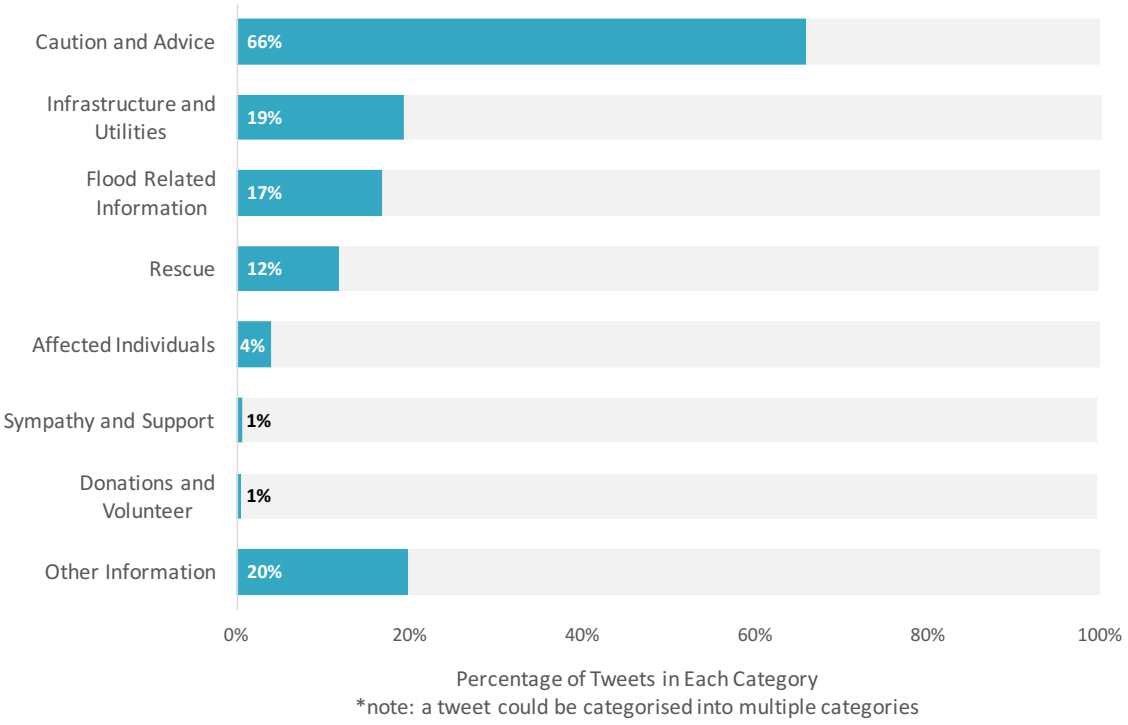


FIGURE 4.5: Categories of content shared by emergency responders on Twitter during the winter floods (2013/14)

4.2.4 Twitter Observations Summary

This section provided insights into the ways in which emergency responders represented in this sample used the Twitter social media platform before, during and after the main period of the Winter Floods (2013/14). The results are summarised in Table 4.4. However, this only begins to answer **RQ1** of this research. We can only deduce from this analysis how emergency responders have *appeared* to use social media; we cannot draw firm conclusions as to why such behaviours were observed, or what such actions intended to achieve. Hence, there is a need for a mixing of both quantitative and qualitative data.

The following section will outline the themes that emerged from the interviews, before moving on to the integration of the quantitative and qualitative data, which allude to key findings about social media use by emergency responders in the UK.

#	**Twitter Observations (TO) Summarised**
1.	Marked variation in frequency of use by organisations.
2.	Low use of photo/videos sharing.
3.	Rare participation in dialogue.
4.	Twitter served primarily as a source of information.
5.	Hashtags used to denote preparedness campaigns.
6.	URLs used to point users to further advice and additional information.
7.	Most common type of content in tweets aimed at risk awareness and encouraging specific behaviours.

TABLE 4.4: Summary of Twitter Observations

4.3 The Qualitative Interviews

Interviews with 14 emergency responders were carried out. Each was manually transcribed and thematic analysis was used to code and categorise emerging themes, resulting in five codebooks, which are summarised in Table 4.5. (Full versions of the codebooks can be found in Appendix B). This process revealed insights into emergency responders' social media strategies and perceptions, which are outlined in the next subsections.

Code ID	Name of Codes
1.	**Reasons for Social Media Presence**
1.1.	Reasons for Using Social Media
1.2.	Reasons for Adopting Social Media
2.	**Social Media Management**
2.1.	Set Up
2.2.	Administration
2.3.	Preparation
3.	**Social Media Strategy**
3.1.	Posting Strategies
3.2.	Methods
3.3.	Approaches
3.4.	Possible Future Strategy/Needs
3.5.	Anecdotal Evidence of Social Media Use
4.	**Perceptions of Social Media Impact**
4.1	Perceived Impact
4.2	Perceived Measures of Impact
4.3	Perceived Requirements for Using Social Media to Increase Social Media Impact
4.4.	Perceived Use of Social Media Features for Increasing Social Media Impact
4.5.	Perceived Strategies for Increasing Social Media Impact
5.	**Perceptions of Social Media Experience**
5.1.	Perception of Organisations Social Media Presence
5.2	Perception of Social Media
5.3.	Perception of Using Social Media

Table 4.5: Summary of Interview Codebooks

4.3.1 Adoption and Utilisation of Social Media

For many emergency organisations represented in this research, the decision to adopt social media was not necessarily a strategic move, primarily undertaken by individuals in various roles:

> *"We wanted to have a proper strategy in place, but it was set up for us by someone who is very enthusiastic in that area, so then we [Comms. Team] had to take it over"* – ***Fire Service Interviewee***
>
> *"Because I have an interest in the warning and informing group I tend to organise it. I keep an eye on social media stories"* – ***Local Authority Interviewee***
>
> *"We had an account, or an account set up relatively quickly, but I think it was underutilised, so I [Communications Manager] kind of took it upon myself to do it"* – ***Fire Service Interviewee***
>
> *"It's been quite a long time that we've been on social media, I think we're looking at - at least 4 years, ish. But we've not been very active on it"* – ***Police Force Interviewee***
>
> *"I looked at other [emergency organisation social media] sites and thought 'you know what? Why aren't we doing that?'"* – ***Fire Service Interviewee***
>
> *"We only just started last year, we did a little bit of social media but we didn't have a full time Comms. Manager."* – ***Ambulance Service Interviewee***

While initially that was the case, two key themes, namely public engagement and a desire to improve public communications, emerged as strong motivations for social media adoption:

> *"So, the motivation was that we knew there was a gap, we knew we needed to communicate better. We thought it [social media] was a good idea, to put public information messages and advice and guides on there for the public."* – ***Local Authority Interviewee***
>
> *"To give you a little bit of background. We have recently gone through what is a peer challenge, and that is, essentially, it is like an audit from a mixture of stakeholders, they come in and they assess your service on various aspects. One of those elements is communication, and that was seen as less, as an area for development - let's put it like that. So, one of the ways that I identified to improve it, is we use social media"* – ***Fire Service Interviewee***

> *"I mean the important thing from social media, and the most effective thing from social media is engagement. So, to be effective and for people to take notice of you, you are not looking to dictate to them, you want them to engage with you."* – ***Ambulance Service Interviewee***

> *"It's interesting actually, whenever we have a debrief after an incident, the thing that's always gone wrong is communication. Every time it's mentioned, 'communications were crap', 'we could have done better here'. During the bomb incident, again, communications broke down, but the Twitter side of it went well."* – ***Local Authority Interviewee***

> *"Newspaper readership has gone down, so we're starting to move towards - we still do traditional media - but we are starting to move our focus towards social media."* – ***Fire Service Interviewee***

> *"So that was our idea of pushing Twitter, Instagram, Snapchat accounts, get people engaged, get people sharing pictures, push the website as well, and push out our two messages."* – ***Local Authority Interviewee***

> *"Really, our focus is on trying to engage people in a positive way"* – ***Local Authority Interviewee***

Specifically, some responses show social media are considered as platforms that support the delivery of incident updates and emergency-specific information during emergencies. Perceptions are held of an ability to reach and inform users at speeds that cannot be offered through other traditional methods of communications:

> *"During emergencies I'm hoping it cuts out the middle man. When it comes to warning and informing the public, it used to be slow response, you wait for the news. We had to have a media statement prepared for the 3 o'clock news, that sort of thing. Which of course is no longer the case, it can get out instantly if there's something happening."* – ***Police Force Interviewee***

> *"If you have a very important message you want to get out there and get out there very quickly, you have to do it in a number of ways, and social media is a very important tool within that toolkit"* – ***Ambulance Service Interviewee***

> *"It's faster than whatever we can put out on the radio."* – ***Local Authority Interviewee***

However, a further trend emerged indicating that social media were favoured for preparedness and resilience building activities; from promoting campaigns to raising risk awareness, educating and encouraging behaviour change:

> *"It is a really effective way of educating people, which is why one of our methods is to go on social media."* – ***Fire Service Interviewee***
>
> *"We're on social media, we're on Twitter for a reason, and that is to try and keep people safe."* – ***Fire Service Interviewee***
>
> *"I mean obviously our whole mode of operandi is safety. We're trying to educate people about safety, so we try and make Facebook a bit more about that element."* – ***Fire Service Interviewee***
>
> *"On the other side, we've got a community resilience team, which is the likes of me that go out and say, 'the community is really on the down for example, not quite resilient, what do we need to do? How can we help them?' Then we go to the Comms. Group and go 'right, we think, x amount of communities are in danger of snow, we need a campaign'. And they could be anything from printing out leaflets, to going down there and having meetings, and then also having campaigns on social media."* – ***Police Force Interviewee***
>
> *"If we put out a message that says 'most likely the fire was caused by a phone charger'. We'd far rather our messages were retweeted, and therefore spreading the word and spreading about the dangers that dodgy phone chargers can cause fire. Because, for us, that can cause behavioural change, which is ultimately what we are trying to do."* – ***Fire Service Interviewee***

Additionally, the responses revealed that social media are perceived to develop relationships with the public. This relates to another theme that found emergency responders feeling obligated to prove self-worth and accountability to the public:

> *"We've never really proactively had to sell ourselves and make ourselves relevant, and prove our worth. Whereas in this day and age we do."* – ***Fire Service Interviewee***
>
> *"There is an element of fun in it, trying to bond with your communities."* – ***Police Force Interviewee***
>
> *"One of the things you can do is keep the public on your side."* – ***Fire Service Interviewee***
>
> *"It is a great way to form a relationship with people."* – ***Local Authority Interviewee***

> *"Being the bad guys, being the 'Our areas flooded, the [organisation] aren't doing anything to help us,' by going onto Facebook and talking to people directly in that affected area in that Facebook group, it changed people's views of them."* – ***Fire Service Interviewee***

> *"We need the public to trust us, so we need to tell them the truth and that what we're doing is for their benefit rather than for our own."* – ***Police Force Interviewee***

> *"It's mainly to give awareness of what we're doing [...] to raise the awareness that we're training and exercising on specific risks."* – ***Local Authority Interviewee***

> *"We had a couple of police officers that made a video, they slipped down slope on a shield, and it showed police officers having fun. And unfortunately, some managers didn't think it was fun and they told them off for it. But the public, low and behold, came back and said 'you know what, that's police officers having fun, that's police officers being human' and I think that was a turning point for us, to actually show police officers as people, having fun along with the public."* – ***Police Force Interviewee***

In contradiction to what the literature might suggest about the opportunities of social media to help emergency responders establish situational awareness (Lindsay, 2011), discussions on the use of social media for monitoring and information gathering were minimal. Such use was considered as challenging and time consuming, with mentions of resource being a barrier:

> *"That was the biggest challenge we had. We just couldn't listen to every single tweet or every single Facebook post at the time when something was happening."* – ***Local Authority Interviewee***

> *"We don't try and get information on that because we don't have the capacity at the moment."* – ***Fire Service Interviewee***

> *"The whole warning and informing piece needs to sit closer with the gaining situational awareness and intelligence about what's happening – but it's so live so fast, at the minute we just miss so much of it."* – ***Local Authority Interviewee***

> *"Twitter is not something that I've got time for."* – ***Police Force Interviewee***

> *"It's an argument that goes a bit round in circles which is that we are not all particularly massively well resourced as comms teams in different fire services. It does vary to be fair from fire service to fire service, but generally speaking fire service comms teams aren't particularly well resourced."* – ***Fire Service Interviewee***

4.3.2 Perceived Value of Using Social Media

A clear trend established from the interviews was that social media were valued for communications, but placed emphasis on the perception that social media should not replace current communication methods. This was specifically summarised by one participant:

> *"Social media can supplement, it can help, but it must not replace. The traditional ones have to keep on going. They are still very important."* – ***Police Force Interviewee***

Despite the trend identified above, there were mixed responses as to what value emergency responders perceive to be created by using social media. Several participants emphasised a firm opinion that social media are of value to emergency management and shared stories of perceived successes:

> *"During the last snow incident we had a couple of police officers that made a video, they slipped down slope on a shield, and it showed police officers having fun. I think that was a turning point for us, to actually show police officers as people, having fun, along with the public, that's a good thing, rather than you know, the patrolling."* – ***Police Force Interviewee***

> *"We had a period of bad weather a couple of years ago. we were putting out messages about where roads were closed, gritters, school closures, these types of things, and we seemed to get a really big increase in followers."* – ***Local Authority Interviewee***

> *"Quality of content links to the number of followers you have, and then the number of followers you have, the more powerful that tool can be."* – ***Fire Service Interviewee***

> *"People seem to be responding a lot more to it, interacting with it, which is a sign I think of better quality comms, more interesting, more useful."* – ***Fire Service Interviewee***

> *"It's a good resilient means of communication and as the technology changes, there's the ability to target messages to people in local areas."* – ***Ambulance Service Interviewee***

> *"We'll tend to have more engagement if a post has more than just text... the content is vital and the more visual it is, the more likely you are to get that engagement – ambulance."* – ***Ambulance Service Interviewee***

> *"I think social media brings real time insight into the local community. People active on social media are more likely to be in conversation with the council on social media than they would be in another form I think. We get more reaction during times, for example, when there's lots of road closures, or lots of flooding, snow, we get a lot more traffic on our website, we get a lot more reach on our social media posts. So we know it's a good way for us to build our social media influence."* – ***Local Authority Interviewee***

On the other hand, several responses conveyed pessimism and doubt and when asked to reflect on their organisations' use of social media, many interviewees generally considered such activity to be limited and basic. It emerged that specific social media training was not mandatory, rarely undertaken and merely covered the general basics on how to use social media. Few participants considered guidance and policy documents to be up-to-date.

> *"I mean personally, I'm not particularly technology literate. I'm not on social media personally, so I only use it for work and so yeh I had to kind of learn it myself really"* – ***Fire Service Interviewee***

> *"We do [have training], yes. Basically that's me, standing up in front of the team and saying 'This is how you use twitter, this is how you upload a photo, this is how you use YouTube and upload videos and then all our duty officers have access to action cards which we'll go through step-by-step as to how you put a post on twitter, or how you upload something on youtube etc.' So we do it internally."* – ***Local Authority Interviewee***

> *"I'm sure the novelty will wear off [. . .] Sorry you can see how rubbish I am with this."* – ***Fire Service Interviewee***

> *"Whether or not I'm supposed to do that, I don't know, but it gives it another angle. "* – ***Local Authority Interviewee***

> *"There is a, for everyone that does do tweets, there is a standard and a policy in what you can and can't do. So, they'll be on a computer somewhere, but I haven't read it."* – ***Police Force Interviewee***

> *"There's not a lot of national guidance [on social media use]"* – ***Local Authority Interviewee***

> *"It's quite scary really, it's a big risk"* – ***Fire Service Interviewee***

Further, the responses below indicate a focus towards a one-way communications approach. This contrasts with the literature that boasts two-way engagement is a key differentiating feature of social media compared with other emergency communication

tools such as TV or Radio (Haataja et al., 2016). Instead, the interview responses suggest that interacting with users is not central to emergency responders' social media strategy:

> *"I don't know how it all works in practice, and whether people use it in a way that's actually useful in emergency response."* – ***Local Authority Interviewee***
>
> *"What you've got to understand is that, and I'm sure you'll appreciate actually, is that you can do 99 things right in social media and one thing wrong and that one thing wrong could completely and utterly screw your reputation."* – ***Fire Service Interviewee***
>
> *"You know, once it's out there it's out there. Lots of people can see it. So it's a great tool but potentially quite dangerous."* – ***Ambulance Service Interviewee***
>
> *"The interaction is probably quite limited. We just want them to follow our advice really."* – ***Local Authority Interviewee***
>
> *"I do believe there is use in social media, or there will be use in social media, it's just in an early stage and I'm not convinced that it's of much use, at the moment."* – ***Local Authority Interviewee***
>
> *"I have to say we don't do a huge amount [of interacting with users], just because of the speed of how everything moves, it is very hard to kind of respond and engage with people directly, when things are happening. We try and make sure that we are putting out information that people can rely on, and they know it's true."* – ***Fire Service Interviewee***
>
> *"I don't think enough people, or people don't immediately go to it as a source of information."* – ***Local Authority Interviewee***
>
> *"I think in particular Twitter, I think it's some way off in actual, for working well in an emergency situation, at this stage."* – ***Local Authority Interviewee***
>
> *"I think we're probably still pretty basic with it really. we do tend to just tweet and then reference people back to our website."* – ***Fire Service Interviewee***
>
> *"So as it stands we are really poor at interacting and reacting to requests."* – ***Fire Service Interviewee***

It also emerged that many interviewees have found the demand difficult to handle, and several responses demonstrated that social media are considered low priority compared with their other daily, and legally required, duties, particularly at the time of an emergency:

> *"I think it requires a bit of specialist resource and time. Rather than just people doing it on the side. It does need someone with a professional background to make the best use of it."* – ***Ambulance Service Interviewee***

> *"Whether in my response role I would have the time to look at it, I doubt it to be quite honest. As with everything, we've cut down the numbers, it's not always that easy to get dedicated people to do it."* – ***Police Force Interviewee***

> *"When something happens, if I'm on duty, then I'm doing other things so, if I've got time to tweet something, that is a bonus."* – ***Local Authority Interviewee***

> *"Predominantly it is me that responds to things that come in, or proactively tweet things out, not around incidents because I don't have access to that information or anything they do. I can respond pretty quickly, but only when I'm looking at it. Generally, that is when I'm waking up in the morning and when I'm going to bed at night. Which is not great."* – ***Fire Service Interviewee***

> *"If you're talking specifically about the emergency services I think social media has a massive role to play in appropriate situations."* – ***Ambulance Service Interviewee***

Moreover, when participants were specifically asked about how they identify the success of their social media usage, few responses included mention of follower reach or number of interactions received (e.g. likes on Facebook or retweets on Twitter). Knowledge of these metrics was quite apparently linked to the job role of the interviewee, for example: an emergency responder specifically trained in communications. Despite that, one of the key themes to have emerged from the interview process was the lack of awareness as to whether their social media efforts have any impact:

> *"It's difficult with the emergency services because, if you're trying to sell something, then clearly you can get a tangible benefit and you'll see real gain, because if you've got, in Twitters example, a larger followership, I don't know what the stats are but, if you're following a company, I think it's something like you are 80% more likely to buy a product from them, or something like that, so what's our equivalent of selling a product to someone."* – ***Fire Service Interviewee***

> *"You just have to assume you're doing the right thing."* – ***Fire Service Interviewee***

> *"Probably useful to a certain extent, but there is still a lack of understanding about what it is capable of really."* – ***Local Authority Interviewee***

> *"You can analyse things whichever way you want, but actually is it changing people's behaviour? Is it having an impact? ...that has to be more kind of anecdotal in the kind of feedback we get. So through comments, replies ...That's where I guess you can show you have had an affect."* – ***Fire Service Interviewee***

> *"Yes, and again, I think that is the kind of 'Holy Grail', you know, it's one of those things with social media, there's more stats than you could ever need really. You can analyse things whichever way you want, but actually is it changing people's behaviour. That's where I guess you can show you have had an effect, it's very hard to show that in numbers."* – ***Fire Service Interviewee***

> *"Having someone merely respond to you, doesn't necessarily give a definition of success. That's the problem I have with people in this job is, you're saying 'look, we're dealing with social issues', and in a social issue you can't necessarily apply a quantitative measure."* – ***Fire Service Interviewee***

> *"I sometimes feel we are concentrating too much on the social media. I don't really care whether you've got 10,000 followers on Facebook, if you've got a million people that need to be evacuated, it all depends on which areas you're looking at, as to whether it's going to be a good thing or a bad thing."* – ***Police Force Interviewee***

> *"We're going through a whole process at the moment 'how do we define success?' We're scratching our heads about it."* – ***Fire Service Interviewee***

4.3.3 Interviews Summary

The interviews enabled the collection of rich, in-depth qualitative data regarding emergency responders' uses, and perceptions, of social media. By conducting thematic analysis, numerous themes were uncovered from the interview transcripts, summarised in Table 4.6.

The adoption of social media was not strategically planned for most emergency responders; however, aims for using social media have since evolved. These focus on enhancing communications with the public, particularly promoting resilience building and preparedness, and to develop and build relationships with the public.

The perceived value created by using social media received mixed responses in the interviews, although it emerged that assessing the impact of their social media usage is a difficult task, particularly given that many outcomes they desire (e.g. raised risk awareness and behaviour change) are not necessarily detectable on social media itself.

These responses emphasise the importance of this research. Whilst emergency responders in the UK have adopted social media, they themselves are unclear as to what impact their online activity might have with regard to emergency management. Next, the interview themes above will be used in conjunction with the Twitter observations to identify key findings about emergency responders' social media objectives and usage.

#	**Interview (I) Themes Summarised**
1.	Social media adoption was generally not a strategic decision.
2.	Overarching aims of social media are to increase public engagement in emergency management and improve communications with the public.
3.	Social media are considered an opportunity to complement emergency communications with the public.
4.	Social media are favoured for actioning preparedness and resilience building.
5.	Social media are perceived to develop relationships with the public.
6.	Feeling of obligation to prove self-worth and accountability to the public on social media.
7.	Generally, monitoring and information gathering not part of social media strategy.
8.	Social media only to complement traditional communication strategies.
9.	Social media are considered to bring value to emergency management, but emergency responders' activity perceived as basic and participating in specific social media training is rare.
10.	Two-way communications are not central to strategy.
11.	In practice, social media are treated as low priority with few resources being allocated, particularly at the time of any emergency.
12.	Difficult to identify the impacts of their social media use.

Table 4.6: Summary of Interview Themes

4.4 Key Findings of Observations and Interview Data Combined

The results from the Twitter observations were compared and contrasted with the interview themes, forming four key findings (KF) about emergency responders' (represented in this sample) social media usage.

KF1: The use of social media for communications during an emergency is a low priority for emergency responders.

The combination of results revealed findings about social media use for emergency communications. While social media are understood to offer opportunities to improve emergency communications **(I3)**, a second interview theme – **I11** – showed that in practice, particularly during emergencies, social media are treated as low priority with resources allocated to the other duties and responsibilities emergency responders are legally obliged to carry out:

> *"I think there's likely to be, for me, there's likely to be more activity before and after [an emergency], less activity during."* – ***Local Authority Interviewee***
>
> *"Whether in my response role I would have the time to look at it, I doubt it to be quite honest"* – ***Police Force Interviewee***
>
> *"As of yet, I don't think it's been overly useful, but it has been used, press releases, you know, but the old fashioned press releases are probably still the main way of getting information to the public in general."* – ***Local Authority Interviewee***

These responses might explain the observed marked variation in frequency of use by the organisations during the Winter Floods **(TO1)**. Indeed, one interviewee explained that inhibited access to social media influenced their decision to treat social media a low priority during the Winter Floods:

> *"For example, the Winter Floods incident [...] our more effective way of communication was to go out because WIFI in Somerset is not good and a lot of them [victims], they didn't have electricity because their homes were flooded. So, social media wasn't working, some of them [victims] were just literally in their house and they didn't have anything. So we were going out and knocking on every door that was affected."* – ***Fire Service Interviewee***

One interviewee specifically emphasised that:

> *"We need to think a bit more about a strategic way of planning how we deliver and what we deliver"* – ***Fire Service Interviewee***

Thus, these results form the first key finding: social media use for communications during an emergency is a low priority for emergency responders.

KF2: Emergency responders favour social media for preparedness and resilience building.

Combining the evidence of **I4, I5, TO5, TO6,** and **TO7** alludes to the second key finding that emergency responders *favour* social media for emergency management tasks: increasing public preparedness and resilience building.

The interview themes - **I4** and **I5** - found that emergency responders value social media as a way to shape the attitudes of the public and encourage behaviour change in order to operationalise resilience[2] and encourage preparedness, resembling with their obligated duties under the Civil Contingencies Act (2004) and objectives of the NRCP.

> *"We tend to use social media to mirror the campaigns we're doing. We have a calendar of community safety activity throughout the year. So, for example, the summer might be sort of fires outside, BBQ's, camping fires, fires on the wall land, and that kind of thing So we might do a press release, which we would then tweet about."* – ***Fire Service Interviewee***

> *"I think social media is going to be better for building resilience, because you don't have to get a hit straight away with an individual, whereas, in an emergency situation, okay if you've got time to do it fine, but there's probably better ways of trying to get information across to the people, is what I'd say."* – ***Local Authority Interviewee***

> *"If you want to be successful, and for me I define success as getting my message out, getting people to engage in resilience related issues."* – ***Fire Service Interviewee***

> *"You know the old ounce of prevention is better than cure and all that. So if we can push those messages out, then ultimately those communities are more resilient because they don't require an emergency service, hopefully."* – ***Fire Service Interviewee***

> *"I think it [social media] does [help with building resilience], it's one more area where we can go into and build it up and you know, add it to our, what do you call it, our tool box."* – ***Police Force Interviewee***

[2]Note, the use of the term resilience here is based on the definition under the Civil Contingencies Act (2004), which has some emphasis on communities and individuals playing a role to help themselves in an emergency (Cabinet Office, 2012b). However, emergency responders are legally obligated to promote and help build individual and community resilience, which includes elements of changing people's attitudes and behaviours towards resilience (Civil Contingencies Act, 2004)

This is corroborated by three of the Twitter observations: Hashtags were popular to denote preparedness campaigns **(TO5)**, URLs were used to direct users to advice and additional information **(TO6)**, and, the most popular type of content shared was aimed at raising risk awareness and encouraging specific behaviours **(TO7)**. See additional examples of these observed tweets below:

> **Ambulance Service Tweet:** If you've been flooded do not use petrol or diesel generators indoors due to risk of carbon monoxide poisoning #floods
>
> **Fire Service Tweet:** Do you know what to do in an emergency? Check out our website for some useful guides about flooding and fire safety *[url]*
>
> **Police Force Tweet:** We've issued advice for parents ahead of Half-Term to raise awareness of danger of fast flowing water *[url]*
>
> **Fire Service Tweet:** Don't attempt to drive through #flood water – 30cm of flowing water is enough to move the average family car #floodaware
>
> **Police Force Tweet:** Keep off the tracks! *[url]* Stark warning as photos emerge of trespassers on flood-hit *#[location]* line.

KF3: Emergency Responders aim to encourage public engagement, but participating in dialogue is not a priority.

During the interview process, public engagement was described as an overarching aim of social media **(I2)**. However, this contrasts with **TO2** and **TO3**, which found few tweets included a photo or video and very little use of the interaction metrics (retweets and replies) during the Winter Floods. Referring back to the interview themes, it would appear that while social media are considered an opportunity for public engagement, interacting with users and participating in two-way communications are not central to emergency responders' social media strategy (**I10**). Instead, the focus appears to be on delivering quality content.

> *"Providing good quality content I believe is, pretty obvious, but that is key, essentially."* – ***Fire Service Interviewee***

This corroborates the observation in **TO4** that found Twitter to serve merely as a primary source of information:

> **Fire Service Tweet:** NEWS: Flood warnings issued in Kent *[url]* #floodaware
>
> **Police Force Tweet:** Severe flood warning in Datchet village, especially for properties in Slough Road. Please take care and do not drive through flood water.

> **Ambulance Service Tweet:** Heavy rain issued for much of the South West today and 2moro. More here: *[url]* stay safe and away from flood water if poss.

Therefore, the combination of the above observations and interviews themes **(I2, TO2, TO3, I10** and **TO4)**, indicate the third key finding: An overarching aim of social media is to encourage public engagement in emergency management, but participating in dialogue is not a priority, particularly in the emergency response phase.

KF4: Social media are perceived as being effective for promoting the organisation, and help to build and develop relationships with the public.

The fourth and final key finding found social media to be considered as effective tools for promoting the organisation, as well as helping to develop relationships with the public. The interview theme - **(I5)** – uncovered that to build and develop relationships with the public is an underlying motive for using social media:

> *"It's also a good PR thing for us to say: 'here tax payer, this is what we're spending your money on, this is what it can do, and this is why you're safer."* – ***Fire Service Interviewee***
>
> *"It is a great way to form a relationship with people without it being hugely costly either."* – ***Local Authority Interviewee***
>
> *"So social media is a really great way of linking to the people we really need to"* – ***Local Authority Interviewee***
>
> *"I think it's a vital tool for anybody to be involved in engaging with the public"* – ***Ambulance Service Interviewee***

While it was not necessarily observable using Olteanu et al. (2015)'s framework, referring back to the tweets submitted during the Winter Floods categorised as 'Other' showed that emergency responders were devoted to sharing content about the use of resources and progress of response actions:

> **Police Force Tweet:** Supt [name] said 'We have deployed a number of officers across the areas that have serious flood warnings in [location]'
>
> **Fire Service Tweet:** Fire crews are using this #unimog and other transport to check the changing depths of water on the #somersetlevels *[photo of unimog].*
>
> **Ambulance Service Tweet:** Our staff are continuing to work closely with Fire & Police colleagues to check on & evacuate vulnerable people affected by the #flooding.

> **Police Force Tweet:** Our underwater search team has been in [*Location*] on #[*Location*] today using their boat to reach flood-hit homes.

Further, it was observed that emergency responders specifically mentioned interactions with victims, see Figure 4.6, whilst others posted content that aimed to demonstrate proactiveness (anticipatory measures carried out to prepare for, and reduce the effects of, an emergency) as well as reactiveness (mobilisation and coordination of resources in times of emergency), see examples below:

> **Police Force Tweet:** We're now patrolling flooded areas by boat 24/7 offering help, reassurance and a visible deterrent to would-be criminals #somersetfloods
>
> **Fire Service Tweet:** We are committed to ensuring 24-hour access to flood-affected people in need with boat teams and specialist 4x4 and wading vehicles.
>
> **Ambulance Service Tweet:** Preparations include mobilising #[org name] teams, moving 4x4s & assessing likely impact on our premises #flood

FIGURE 4.6: Examples of Tweets that mention interactions with victims

These additional observations correspond to the interview theme (**I6**), which found emergency responders feeling obliged to demonstrate proof of self-worth and accountability to the public. This was summarised particularly well by one interviewee:

> *"We've never really proactively had to sell ourselves and make ourselves relevant, and prove our worth. Whereas in this day and age we do."* – ***Fire Service Interviewee***

Arguably, relationship building could be linked to resilience building. However, during the interviews emergency responders often referred specifically to the term resilience, whilst comments about building relationships with the public emerged from the analyses. Therefore, a decision was made to treat them as two distinct objectives in this research.

4.5 The SMOKE Framework

The integration of the observations and interview themes alludes to the fact that emergency responders have multiple social media objectives, but emergency communications are not a priority. This is important to consider for explorations into the value of social media. By understanding what emergency responders set out to achieve, performance and impact assessments can be designed and planned accordingly. Therefore, a set of key objectives and desired outcomes, identified from the findings above, have been assembled to form a conceptual, multifaceted framework entitled: Social Media Outcomes and Key objectives for Emergency management, see Table 4.7.

The framework represents emergency responders' (1) key objectives for using social media, and, (2) desired outcomes they strive to achieve. Given the finding that an overarching aim of social media was to engage the public in emergency management, the concept 'audience engagement' is prominent for all three objectives. These objectives resemble and corroborate the results of a study in Kaminska and Rutten (2014), whereby social media activity by Canada's emergency management community was categorised into three main uses: (1) public information, (2) situational awareness, and (3) community empowerment & engagement. This suggests that, in addition to emergency communications, other common aims for emergency management organisations could include organisational PR, social engineering and building relationships with the public. Further, the evidence suggests that such findings are not necessarily restricted to any particular region of the world.

The SMOKE framework may serve two purposes: Firstly, as a guideline for future assessments of emergency responders' social media usage by using the desired outcomes as tangible measures. Secondly, as a training and strategy tool for emergency responders, acting as checklist to help guide their social media activity and self-assessments. It should be noted, however, that this framework is not necessarily exhaustive or representative of all emergency responders, particularly those outside the UK. Future research may look to build upon and reconfirm these objectives and outcomes. Nevertheless, in order to answer **RQ3** of this research, the SMOKE framework will form the basis for examining the benefits and impacts achieved through social media by emergency responders represented in this research.

TABLE 4.7: The SMOKE Framework - Social Media Outcomes and Key objectives for Emergency management (SMOKE)

	Key Objectives (KO)		
	A: Preparedness & Resilience Building	*B: Relationship Development*	*C: Emergency Communications*
Desired Outcomes (DO)	1: Audience Engagement 2: Social Influence 3: Behaviour Change 4: Raised Risk Awareness	1: Audience Engagement 5: Public Trust 6: Increased Organisational Awareness	1: Audience Engagement 7: Large Public Reach 8: Informed Audience

4.6 Chapter Summary

This chapter has concentrated on eliciting emergency responders motivations and strategies for using social media, answering **RQ1** of this research. By employing a mixed methods approach, the integration of quantitative and qualitative data led to the discovery of four key findings about emergency responders social media usage, summarised in Table 4.8.

Emergency communications are not necessarily the main priority for emergency responders. Instead, these results suggest that they favour social media to encourage preparedness and resilience building and develop relationships with the public. Therefore, in order to understand the value of emergency responders social media activity, it is important that future assessments go further than merely judging their ability to effectively communicate in an emergency. The responders' ability, with the use of social media, to influence behaviour and perceptions towards risk, build public trust, and raise organisation awareness, also needs to be examined. These elements were captured as a conceptual framework, referred to as the SMOKE framework Table 4.7, which will form the foundations for examining the effectiveness of the emergency responders' social media activity in Chapter 6.

Finding #	Finding Summary
KF1	Social media use for communications during an emergency is a low priority for emergency responders.
KF2	Emergency responders favour social media for preparedness and resilience building.
KF3	An overarching aim of social media is to encourage public engagement in emergency management, but participating in dialogue is not a priority.
KF4	Social media are considered effective tools for promoting the organisation, and help to build and develop relationships with the public.

Table 4.8: Key Findings Summary

Having identified the emergency responders' social media objectives, the following chapter will shift focus to investigate the views of users who follow emergency responders on social media. This will give another perspective on the role of social media with regard to emergency management, and also help to identify the impacts that may be achieved by emergency responders through social media.

Chapter 5

Followers' Perspective on the Value of Social Media for Connecting with Emergency Responders

This chapter seeks to address research question two of this thesis: Why do users follow and engage with emergency responders on social media? **RQ2**. The focus shifts onto the perceptions of those users that choose to follow UK emergency responders on social media; perception is defined as an understanding of reality and experiences which is influenced by individuals' views, judgements, and opinions (Munhall, 2008). The value of emergency responders' social media use cannot be determined unless we understand the impacts upon those who have been reached. Thus, it is first necessary to establish *who* emergency responders are reaching through the use of social media. Secondly, the reasons as to why these users choose to follow emergency responders need to be explored. Here, a 'follower' is a social media user who has subscribed to receive posts by emergency responders on a social media channel (i.e. a user who views Tweets posted by an emergency responder on Twitter, or updates on Facebook, or Snaps on Snapchat). Figure 5.1 represents the sampling space considered in this research chapter.

RQ2 was inspired by existing literature and the interview responses, as recorded in the previous chapter. Whilst opportunities of social media have been recognised to involve public participation in formal emergency management (Palen and Liu, 2007; Hughes et al., 2014b; Simon et al., 2015), the question remains as to which users are actually engaging with emergency responders on social media and their motives for doing so.

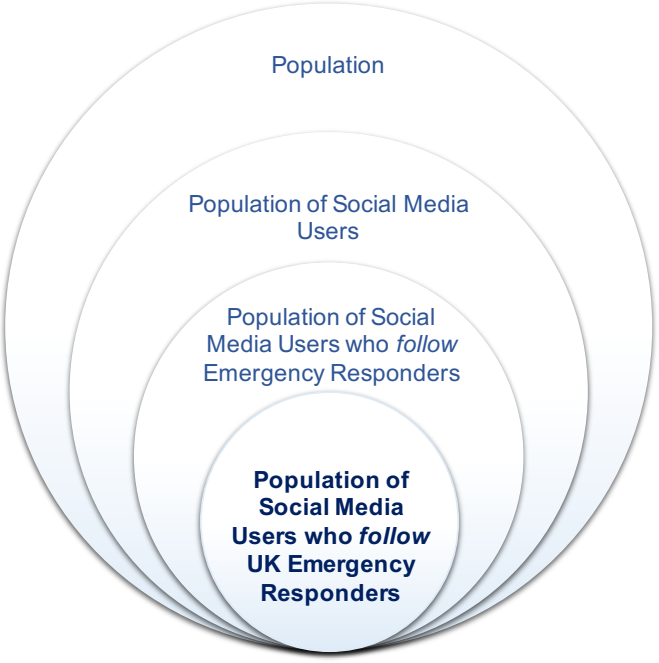


FIGURE 5.1: Representation of the sampling space in this research chapter
Note: diagram is not to scale

From the interviews, a theme emerged that suggests the majority of emergency responders interviewed do not know who their social media audience actually are. When prompted to describe their followers some participants guessed, whilst others openly admitted they did not know:

> *"Well, generally it's, who are our followers, it's anyone who takes an interest...I think the local communities and local responders we're pally with"* – ***Local Authority Interviewee***

> *"Although quite difficult - maybe I need to give this some more thought - but we need to know who our audience are, or probably more important, who they are not."* – ***Fire Service Interviewee***

> *"We do have a number of individuals who we are not aware of or where they are from etc. Without going into too much detail in finding that out, so I think it's members of the public"* – ***Local Authority Interviewee***

Results of two investigations: a Follower Audit and a Targeted Survey are presented and will form the basis for answering RQ2. An overview of the data samples is provided, followed by a discussion of the results. In combination they allude to four high-level findings about the followers and their perceptions of social media as tools for connecting with emergency responders:

1. Social media facilitate two key, distinct, emergency responder-follower relationships: emergency responder/public and emergency responder/emergency responder.
2. Social media are most valued as information hubs between emergency responder and follower
3. Followers frequently engage but do not tend to interact, and
4. Level of engagement is strongly influenced by relevant and reliable content

Further, three groups of followers emerged based on their motives and willingness to engage (Information Listeners, Community Seekers, and Collaborators), which will be discussed at the end of this chapter.

5.1 Data Samples

The results in this chapter are based on data from two independent studies aimed to profile those users who have chosen to follow UK emergency responders via a social media platform (Follower Audit), while capturing their views on the usefulness of such applications in establishing connections with the emergency responders (Targeted Survey).

5.1.1 Follower Audit (FA)

Profile attributes of a sample of followers were reviewed to gain an insight into the categories of users that chose to follow UK emergency responders on social media (see Chapter 3). Twitter was favoured for this study due to the ease of access to its open Application Programming Interface (API). Additionally, the study was confined to the followers of the 13 emergency responders represented in the interview study. 100 followers for each of the 13 emergency responders were randomly selected, giving a total sample of 1300 profiles for thematic review. The sample could only ever be a snapshot of emergency responders' followers as they change over time. Nevertheless, it was sufficient to provide the necessary insights required to contextualise emergency responders' followers and complement the survey results.

5.1.2 Targeted Survey Sample

The survey followed the design discussed in Chapter 3 and had two main aims. This chapter concerns itself with the first of these objectives and explores the results to the question of why users choose to follow emergency responders. The results associated with the second objective, investigating the degree of impact, are discussed in the next chapter. A variety of open-ended, multiple choice, and Likert scale type questions were used to produce both quantitative and qualitative data. This allowed for systematic testing and underlying perceptions to be uncovered. The survey was distributed on social media sites (including Facebook, Twitter and Google+), relying on users to complete and share. Emergency responders were also contacted with an invitation to publish and share the survey on their social media sites in an attempt to reach their followers. The survey ran for three months, during which there were 106 participants (SP), with 61 completing every question.

97% of participants considered their social media activity to be regular (the remaining 3% categorised their use as occasional). The majority also stated that they follow more than one emergency responder on social media; see Figure 5.2. The emergency services (Police, Ambulance and Fire services) were the most popular type of emergency responder to be followed (Table 5.1).

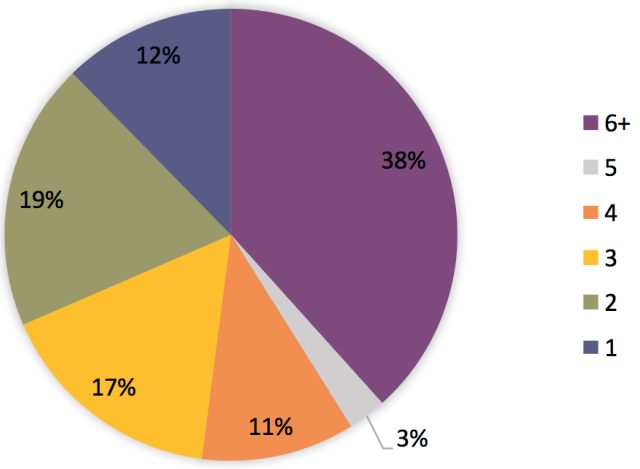


FIGURE 5.2: Average Number of Emergency Responders that Survey Participants Follow on Social Media

Emergency Responder Sector	**% of Participants**
Police Force	58%
Ambulance Service	35%
Fire Service	29%
NHS Bodies	25%
Local Authorities	22%
Environment Agency	21%
HM Coastguard	19%
Public Health Organisation	17%

TABLE 5.1: Sectors of Emergency Responder that Participants Choose to Follow *Note: Participants could select more than one sector*

Participants were also asked to indicate which platforms they utilise to follow emergency responders. Most participants reported that they had connected on Facebook and Twitter, see Figure 5.3. It is noteworthy, however, that the emergent photo-based platforms Instagram and Snapchat were also popular with 48% and 38% votes respectively. This might suggest that while Facebook and Twitter are currently the most favoured platforms, users are increasingly turning to image-based platforms for connecting with emergency responders, which would corroborate the findings of Guidry et al. (2017), who proposed that image-based platforms might be better suited to emergency responders reaching and communicating with their target audience.

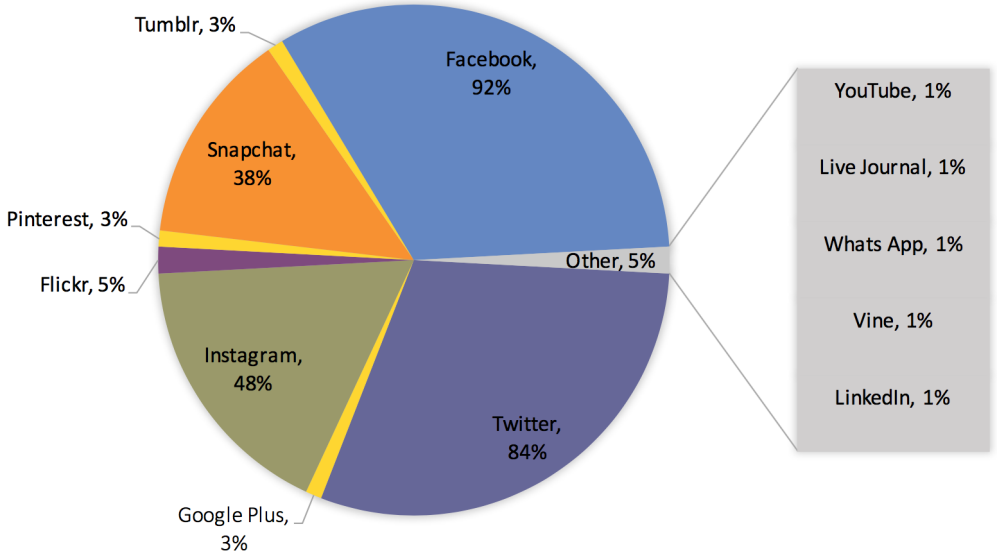


FIGURE 5.3: Social Media Platforms that Survey Participants Use to Connect with Emergency Responders *Note: Participants could select more than one social media platform*

Age Group	% of Participants
18-20	5%
21-39	60%
40-59	28%
60+	5%
Did Not Disclose	2%

TABLE 5.2: Sample of Survey Participants by Age Group

Some demographic data was collected. However, the survey aimed only to provide an insight into the types of users that follow emergency responders, supporting the follower analysis discussed previously. It was not the aim to make generalisations by population, and such conclusions would not have been possible given the number of participants. The age group 21-39 was the most represented in the sample (60%), with younger and older adults the least represented (see Table 5.2). Also, the majority of participants reside in southern regions of the UK including Hampshire (24%), West Sussex (12%), Devon (9%) and London (7%) (7 participants did not disclose this information).

5.2 FA and Survey Findings

This section details the results of the FA and Survey that led to the four high-level findings about the followers and their perceptions of social media as tools for connecting with emergency responders. By employing SMOKE, proposed at the end of the previous chapter based upon emergency responders' objectives and desired outcomes (Table 4.7), it allowed for comparisons to be made between emergency responders intentions with their followers expectations.

5.2.1 Faciliation of Two Emergency Responder-Follower Relationships

A thematic review of the profile data collected for the FA exposed key distinctions that allowed for the follower categorisations in Table 5.3 to emerge. Though the identified categories may not be exhaustive, these findings indicate that a variety of users form the emergency responders' audience. Some accounts could not be determined or were possibly bots, and featured prominently. Of note, 8% of followers were found to be emergency responders or users affiliated to the emergency management community. The largest group of followers, however, were found to be members of the general public (40%).

User Type	**% of sample**
General Member of the Public	40%
Unidentifiable Accounts/Possible Bot	23%
Business	17%
Emergency Responder / individuals affiliated to emergency management community	8%
Charity/Volunteer Groups	2%
Other	2%
Reporter/Journalist and Media	2%
Entertainment	1%
Groups, Societies and Communities	1%
Campaign/Fundraisers	1%
Council or Government Agency	1%
Schools/Universities	0.38%
Suspended Account	0.23%

TABLE 5.3: Follower Classifications

Crucially, while the survey did not aim to generalise by population, 'Members of the Public' and 'Individuals affiliated to emergency management community (e.g. a fire officer, paramedic, police officer or communications operator/dispatcher) were the most represented in the survey sample, see Figure 5.4.

Together, the results above imply that emergency responders' intended audience (the public) are likely to comprise a significant portion of their followers, indicating that responders are achieving a 'public reach'. However, there is scope to extend the size of their reach in order to satisfy DO7 of SMOKE: 'Large Public Reach'. Many other user categories including Businesses, Government Agencies, and Charities constitute a notable part of their followership. Leveraging these connections could help emergency responders to increase the reach of their posts, although the perceptions and views of these user types were not captured in the survey.

Building upon these results, the qualitative responses from the survey indicated reasons that prompted followers to initially connect with emergency responders. Survey participants were asked to explain what had influenced their choice to subscribe to an emergency responders' social media feed. Their responses were organised into thematic categories; see Table 5.4.

Generally, followers' motivations are found to be dependent upon their follower classification. Many were influenced by their job role: for example, one participant stated: *'I am a student paramedic with [organisation] and like to know what's going on with both my own and partner organisations'* [SP24], and another: *'I work in a [emergency organisation] Control Centre looking after 8000 miles of road; when something is affecting them no doubt it will be affecting me'* [SP9].

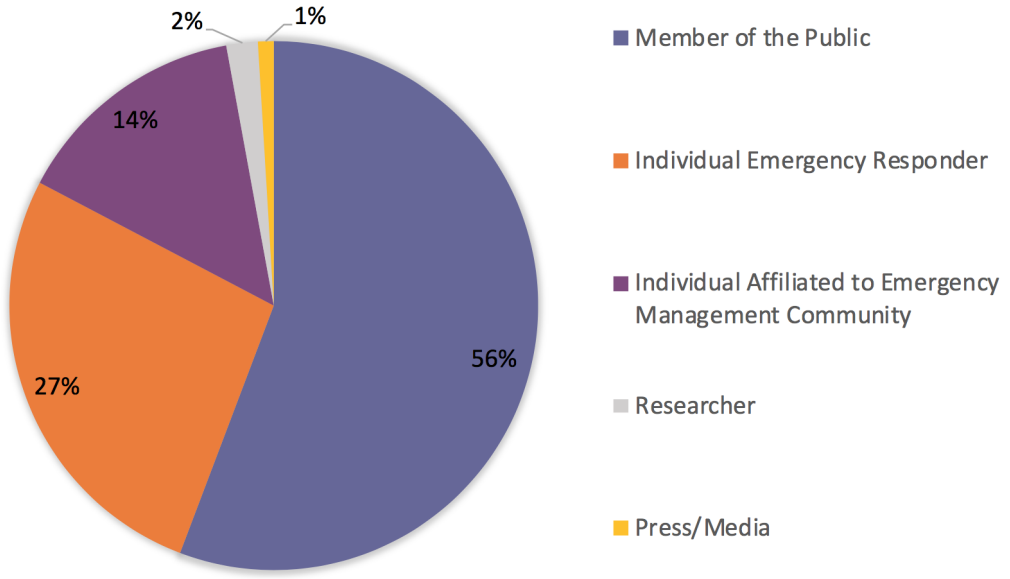


FIGURE 5.4: Survey Participant Categorisation of Themselves as a Follower

Several participants also expressed that a 'follow' was based on some form of personal relation: *'Ex-special constable, blood biker and police volunteer. Father of a paramedic and husband of an NHS employee. Pretty obvious really'* [SP29]; *'My partner is a [organisation] paramedic. I used to work for [organisation]'* [SP62]; *'I have family in the police'* [SP80].

Importantly, 40% of participants were *'interested to see the jobs that other emergency responders go to'* [SP57] and wished to learn more *'about cuts [being made across the emergency services] and the potential impact'* [SP82]. This finding corresponds with a motivating factor for emergency responders to adopt social media (KF4 in Table 4.8 in Chapter 4) and suggests potential value is created through increased organisational awareness, which is DO6 of SMOKE.

Influences for Following Emergency Responders	**% of Participants**
General Interest in emergency responders' work	40%
Job Role	32%
Perceived Value of Information Shared by Emergency Responders	29%
Connection through Family or Friend	10%
Don't Know	3%
A Post seen on Social Media authored by an Emergency Responder	1%

TABLE 5.4: Participants' Motivations for Following Emergency Responders

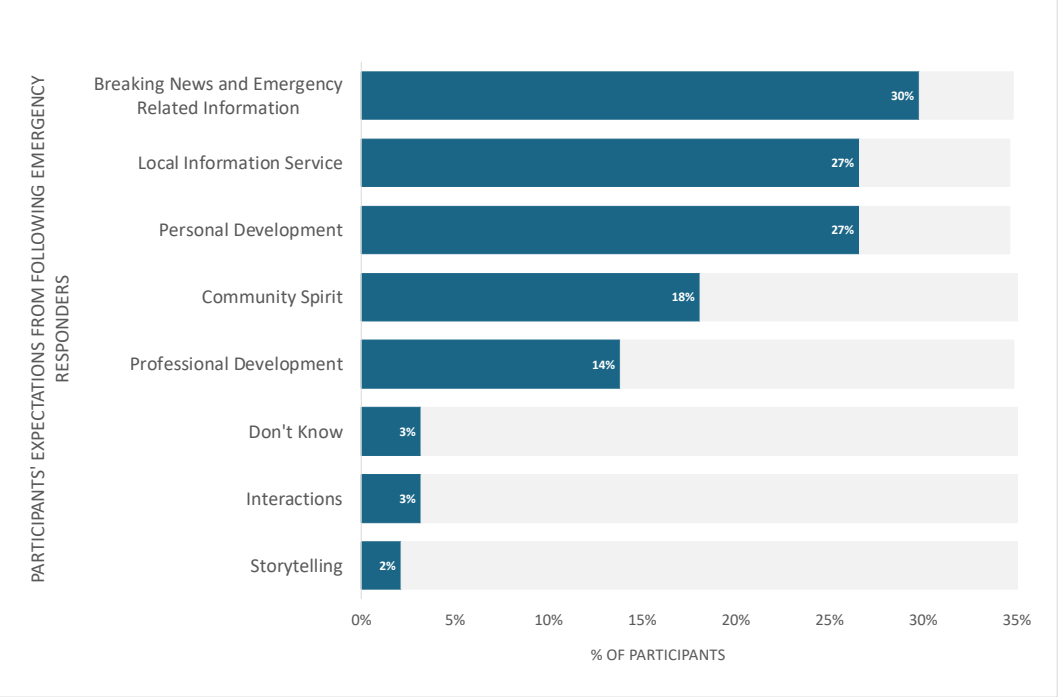


FIGURE 5.5: Varying expectations of Survey Participants *Note: to clarify, some participants gave multiple expectations which were categorised independently*

The survey moved on to explore the participants' expectations in deciding to follow emergency responders. This provided important understanding as to why emergency responders are attracting two particular followings (general public and other emergency responders). Evidenced in Figure 5.5, various expectations emerged. Responses that comprised multiple expectations were categorised independently.
To be made aware of *'breaking news'* [SP13], acquire *'Information about current incidents - mostly road traffic accidents/traffic jams'* [SP1] and *'to receive relevant local updates'* [SP6] were popular responses from members of the general public. Additionally, there was a suggestion by a significant portion of public participants that they expect information to help improve their *'Knowledge; being able to act if anything might affect me (eg. traffic, storms)'* [SP77].

Responder participants often sought *'Education, ideas sharing and networking'* [SP63] and have the expectation of *'Feeling part of a community'* [SP21]. The qualitative responses revealed that social media are undeniably effective in fostering feelings of *'Support and companionship'* [SP28]. Responder participants also expressed the sentiment that by following emergency responders on social media they hope for *'morale boosting'* [SP66] and *'camaraderie and support if you have bad event'* [SP72]. Other responder participants viewed social media as a place that facilitates *'mental health support for emergency responders'* [SP29] and the *'feeling of family'* [SP38].

Referring back to the observations of Twitter use during the Winter Floods 2013/14, a portion of tweets categorised as 'Sympathy and Support' were found to offer praise and recognition, for example:

> **Police Force Tweet:** Chief Constable [name] and officers working hard with military to help communities affected by flooding #flood
>
> **Ambulance Service Tweet:** Our staff & volunteers are under real pressure but are all doing a great job! Situation likely to remain difficult for a while :(#flooding
>
> **Fire Service Tweet:** Here are just some of the fantastic crews from across England and Wales who are assisting us with the flooding

In summary, social media have been observed to facilitate two key, distinct, emergency responder-follower relationships: emergency responder/public and emergency responder/emergency responder. This relates to an objective of SMOKE: Relationship Development (KOB), though clearly the value is not confined to bridging connections between emergency responders and the public; it links emergency responders themselves. Thus, the scope of KOB may warrant extension to capture this classification of follower, which will be addressed in the final discussion (Chapter 7).

5.2.2 Social Media Valued as Information Hubs

The survey participants' expectations (Figure 5.5), coupled with their reasons for initially connecting with emergency responders (Table 5.4), revealed a motivation to be a thirst for information: *'I want to know what's happening in the area, and they provide useful information'* [SP40]. In particular, responses referred to the need for information specifically about emergencies: *'Commuting long distance on the motorway. I wanted to identify incidents prior to leaving so I knew if there was a route to avoid'* [SP37]; *'Location and situation of immediate emergencies'* [SP98]; *'I might see some information that saves me from walking into some trouble'* [SP23]. This observation was reinforced by the result that the majority of participants - 75% - stated that they would refer to social media content posted by emergency responders to obtain updates during an emergency:

> *'Social media are the best way to get immediate updates without television or radio access'* [SP98]

Method	**# of Participants**
999 or 101 or 111	4
Emergency Operations Centre	3
News Sites	3
Google	2
Emergency Responders' Website	2
TV	1
Radio	1
Peers/Colleagues	2

TABLE 5.5: Alternative methods used to find information during an emergency

25% of participants responded to the contrary, and would use other methods to retrieve emergency information listed in Table 5.5[1]. Nevertheless, this does indicate that social media are considered to hold considerable value for receiving breaking news and emergency updates posted by emergency responders.

This would appear to conflict with emergency responders' current priorities for using social media. Despite emergency communications being an objective of social media use for emergency responders (KOC in SMOKE), during the emergency response phase of the emergency management lifecycle social media use is often considered a low priority by emergency responders (KF1 in Table 4.8 in Chapter 4).

> *"When something happens, if I'm on duty then I'm doing other things. If I've got time to tweet something that is a bonus."* – ***Local Authority Interviewee***

Participants were asked to report as to whether they use social media: 1) To contact or communicate with emergency responders; 2) To respond to the posts of emergency responders; and 3) To collaborate with emergency responders. The results in Figure 5.6 suggest that survey participants place limited value on the conversational nature of social media to reach emergency responders. A quote by one participant was enlightening:

> *'Tracked the state and direction of [London] rioters. While ineffective for contacting Responders, it [social media] was very useful in promoting personal safety'* [SP98]

Rather, social media are viewed much more as *'a source of information'* [SP2] and *'an easy way to get updates without looking for them'* [SP94].

[1] 999 is the emergency telephone number in the UK; 101 is the phone number for local police stations in the UK; and 111 is the non-emergency telephone number for medical advice in the UK

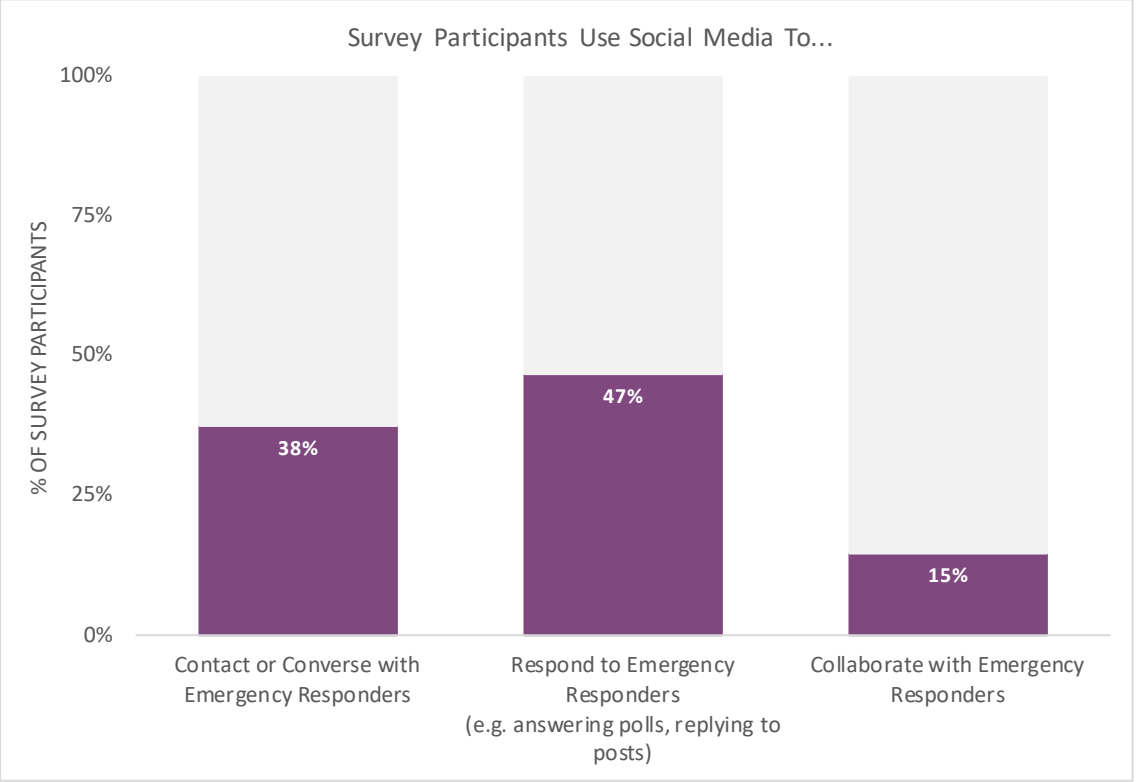


FIGURE 5.6: Survey Participants that use Social Media to Contact or Converse, Respond and Collaborate with Emergency Responders via Social Media

In summary, from the followers' perspective social media are most valued as information hubs between emergency responder and follower:

> *'Information straight from source, where possible, without it being contextualised or distorted by other people (eg the news)'* [SP20]

This would seem to align with emergency responders' primary focus of delivering information to the public (KF3 in Table 4.8 in Chapter 4). However, with 25% of participants claiming they would utilise other methods in preference to social media for the retrieval of emergency information, there is scope to increase audience engagement (DO1 in SMOKE) during emergency response.

5.2.3 Frequent Engagement but Minimal Interaction

An aim of the survey was to determine the participants' levels of engagement with emergency responders on social media. Participants were asked to indicate whether or not they interact with emergency responders' social media activity and how they stay informed. The results in Table 5.6 show that most participants (62%) will not actively

Method	**% of Participants**
As they appear in my newsfeed	62%
By visiting the Emergency Responders' profile page	20%
Through hashtags	15%
Via other followers' interactions	2%
Using a search function	1%

TABLE 5.6: How Participants Stay Informed of Emergency Responders Posts

search for updates, and instead rely on posts appearing in their newsfeed[2], implying passive engagement (participating with minimal effort/action). Summarised by one participant:

> *'I tend to skim past anything by them [emergency responders] unless I'm looking specifically for some information'* [SP2]

This raises concerns as to how well emergency responders might be achieving Audience Engagement (DO1 in SMOKE). Utilising a Likert-scale, participants were asked to indicate approximately how often they might use features of social media to interact with emergency responders' activity. The results in Figure 5.7, whereby a score of 1 denoted *'Never'* and a score of 5 indicated *'All the Time'*, show a skew towards the lower end of the scale for interaction, with the exception of applying likes and shares (or equivalent), which had mean scores of 3.11 and 2.79 and standard deviations of 1.27 and 1.29 respectively. Some 68% of participants indicated that they would never privately message an emergency responder and 63% would rarely or never reply/comment back to a post published by an emergency responder. This implies that followers rarely interact with emergency responders through the textual features of social media. This finding corresponds with the perspective of emergency responders, that participating in dialogue is not a priority for using social media (KF3 in Table 4.8 in Chapter 4). This could have implications for determining social media value and suggests that measuring the effectiveness of a post might be difficult for emergency responders. The number of *likes*, *shares* and *comments* are common measures used to gauge impact or 'success'; for example, as in Bruns et al. (2012) and Guidry et al. (2017). However, based on the results in Figure 5.7, such measures are likely to be skewed towards those who choose to engage and visibly interact, which might only be a small portion of their followers.

[2]A newsfeed is a list of updates on a user's homepage that is regularly updated with their followers' posts. It may also include advertisement.

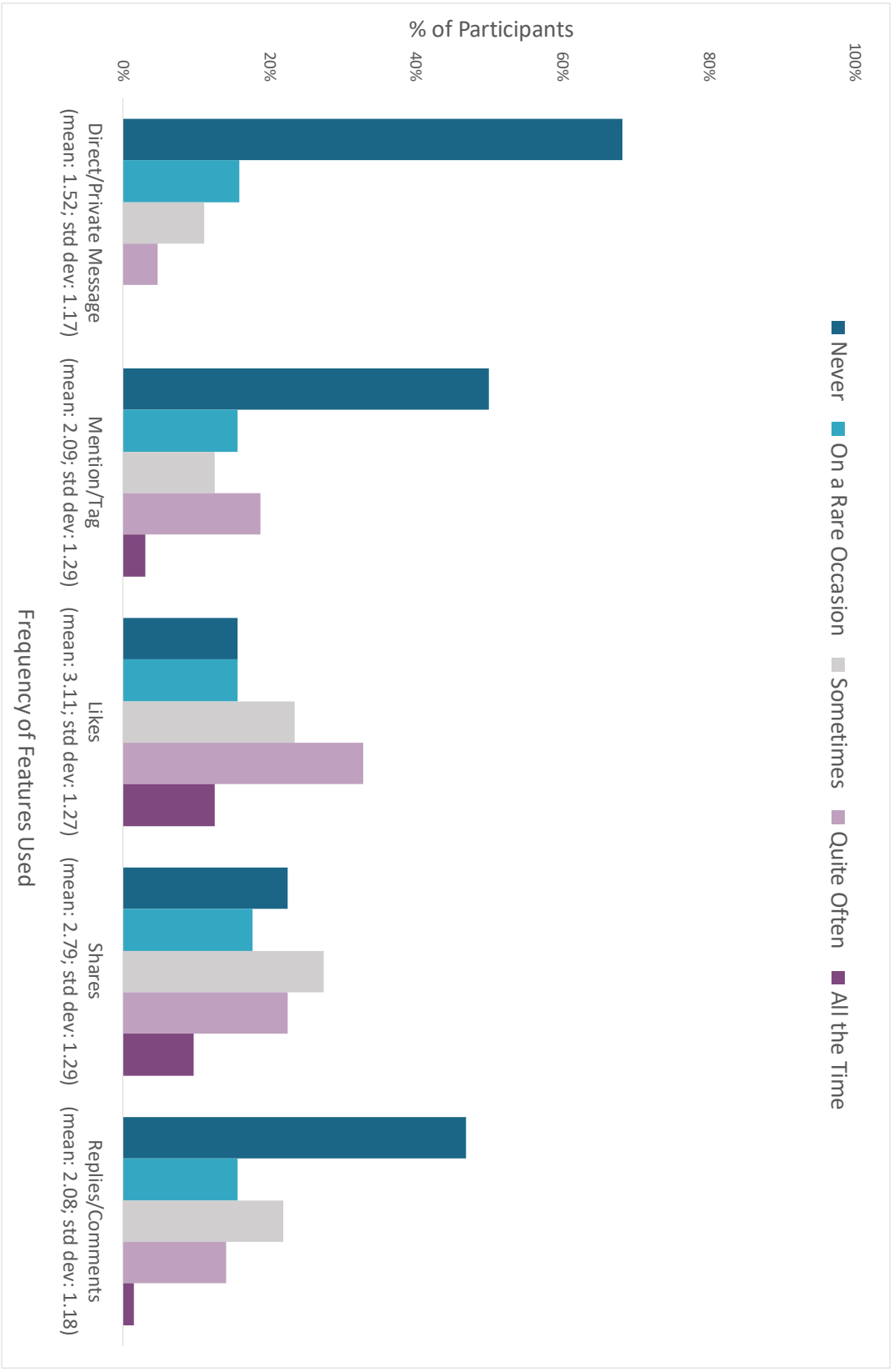


FIGURE 5.7: Frequency survey participants use social media features to interact with emergency responders' social media activity

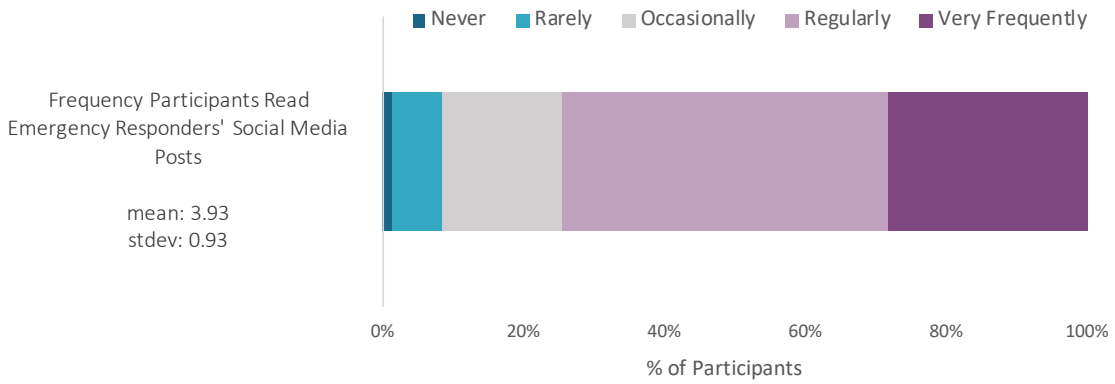


FIGURE 5.8: The regularity with which participants believe they read emergency responders' social media posts

Survey participants were also asked how often they read emergency responders' social media posts. Crucially, the results in Figure 5.8 (where a score of 1 denoted *'Never'* and 5 signified *'Very Frequently'*) show a mean score of 3.93 and standard deviation of 0.93, indicating that a significantly large portion of participants regularly read, and thus engage, with emergency responders' posts. One participant specifically mentioned that:

> *'I tend not to repost or interact with the tweet. I just read and digest the information and move on'* [SP39]

This observation was corroborated by qualitative responses to a later survey question. Participants were asked to recall the content of a recently viewed social media post, submitted by an emergency responder whom they follow. They were required to: 1) briefly describe the post, including details such as who the author was and what it was about, and 2) state whether they had interacted, responded, or shared the post. To increase the authenticity of this test, participants were urged at the start of the survey not to view any social media platforms while completing the survey. Further, participants were encouraged to state explicitly that they could not remember a post, if that were the case. Some 78% of participants reproduced details of a post they had seen, most referring to crime and traffic incidents:

> *'Message about a closure on the M3, I think from the [emergency responder]. I didn't interact with it and I don't recall any media attached'* [SP16].
>
> *'Police looking for a missing teenager thought to be in a local area. Did not share or like'* [SP14].
>
> *'[Emergency Responder] posted an image with a caption about a car that had overturned and how they worked with police and fire to extract stuck persons. I liked the post'* [SP32].

'Warnings of thefts near [Location] posted by [Emergency Responder]. I shared the post as I have family and friends in the area' [SP77].

'A video of [emergency responder] dancing which I liked as it was shared by a friend' [SP95].

'Last one I remember was the [emergency responder] tweeting about the local elections' [SP40].

'Recent Facebook post about humour around uses of equipment. I liked this post and tagged colleague' [SP31].

Of the 78% that could recall a post, only 20% stated that they went on to interact. One participant explained that: *'I generally don't share info unless it is of particular relevance to a large number of my followers'* [SP67].

To summarise, the results suggest that followers frequently engage with emergency responders but are less likely to interact. However, there is considerable value to be gained by those who merely *'listen'* to what emergency responders have to say on social media. It is recognised that these results are based upon a relatively small sample size and thus no firm conclusions can be drawn. Nevertheless, they do provide important insights that warrant future investigation.

5.2.4 Content is Key

The survey sought to identify what aspects of emergency responders' social media activity encouraged followers to remain engaged. Responses from an open-ended question were thematically reviewed and organised into emergent categories, see Figure 5.9.

The results indicate that engagement is primarily content driven. Useful, accurate and timely information was evidently important to participants: *'Up to date information on reality (not 'spun' by media etc)'* [SP5]; *'Live information! Such as road closures, weather warnings, live incidents'* [SP48]; *'Updates on emergency situations, advice in case of emergency'* [SP94].
Emergency responders' social media use was considered of value if it helped to enrich knowledge, for example: *'Numbers to call or better ways to report non-emergencies'* [SP92]; *'Any info that may impact on me such as traffic, road closures due to fires, accidents etc'* [SP14]; *'see the difference in practice in regions and hear of interesting cases that could expand my knowledge'* [SP36].

Other survey responses included comments such as *'successes and outcomes, thanks and congratulations'* [SP81], whilst others sought recognition *'that they [emergency responders] are doing their job, helping people and responding to queries'* [SP95].

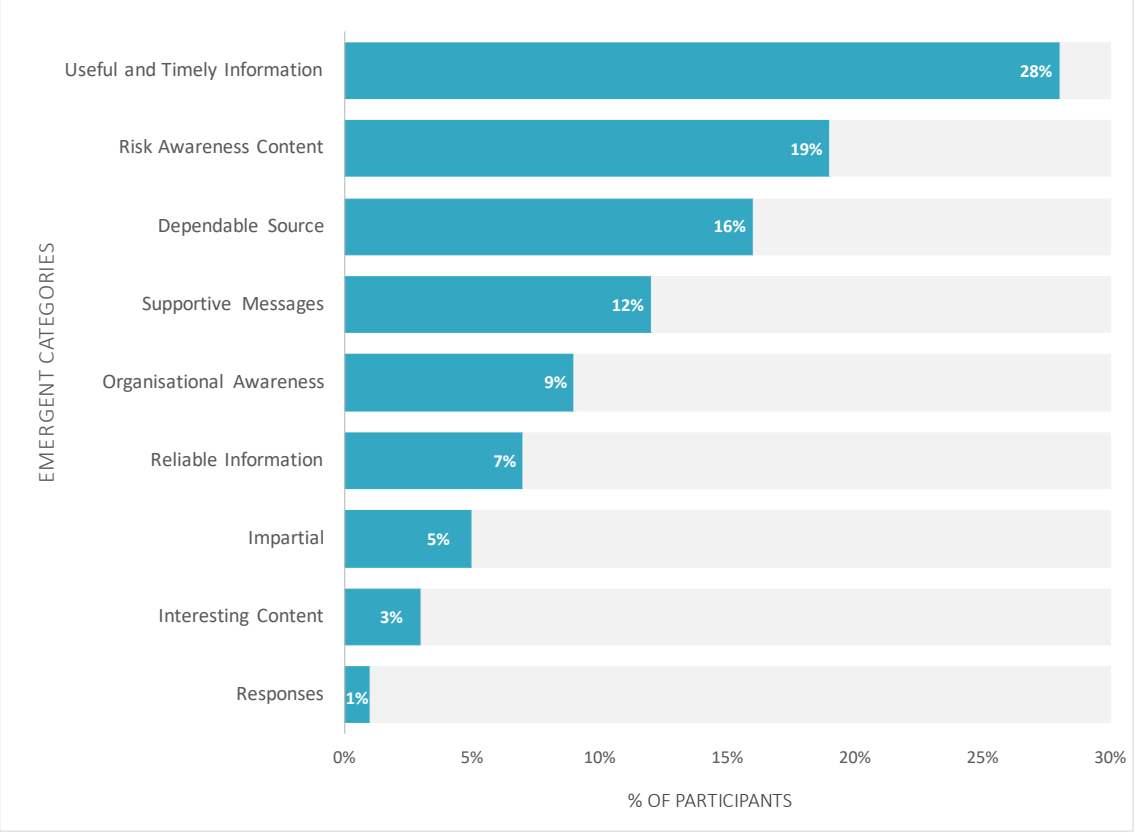


FIGURE 5.9: Aspects of Emergency Responders' Social Media Activity that Encourage Engagement

'Pictures of scenes/training' [SP57] and *'seeing photographs to get a sense of scale of emergency'* [SP63] were also considered important elements of emergency responders' activity by some participants.

These responses above place a great importance on designing and implementing social media strategies for emergency responders whereby content will resonate with their audience and keep them engaged. This assertion was reinforced by the responses to the survey question that asked participants if and why they had *unfollowed*[3] an emergency responder. The strategy employed by the emergency responder was the main reason cited for unfollowing. Responses indicated that followers found activity had been: *'too chatty'* [SP55] *'boring'* [SP62], or *'unprofessional'* [SP30] and *'included too many false alarms'* [SP51] or *'far too many posts'* [SP21]. These perceptions emphasise a need for emergency responders to focus their social media strategies on content that is succinct, timely and relevant to ensure that they attract and maintain their followership.

To summarise, level of engagement of followers would appear to be strongly influenced by emergency responders posting relevant and reliable content, particularly if such

[3]Here, to 'unfollow' defines the action of a user choosing to 'disconnect' from receiving updates by an emergency responder

information educates and enriches knowledge. This resonates with emergency responders' primary motivation for using social media: to increase preparedness and encourage resilience building (KF2 in Table 4.8 in Chapter 4), and suggests great promise for achieving the desired outcomes: Social Influence (DO2), Behaviour Change (DO3) and Raised Risk Awareness (DO4) of SMOKE.

5.3 Discussion

There is a strong suggestion from the literature (as discussed in Chapter 2) that social media represent an opportunity for emergency responders to distribute information rapidly, and to potentially large audiences (Hughes et al., 2014b; Simon et al., 2015). However, there exists a need to clarify as to who engages with their activity. The integration of the findings from the Follower Audit, together with the survey responses, allude to the fact that users' reasons for following and engaging with emergency responders vary. Broadly, the followers' motives and willingness to engage allow them to be categorised into three groups, which resonate with the findings of Li et al. (2007) who categorised the levels of participation by users of Web Technologies. The three groups are described below. It is important to emphasise that these groups have no fixed boundaries; a follower could shift between groups dependent upon the emergency responders they are following and the subject matter of that emergency responder's posts.

Information Listeners

The results from this chapter's investigations suggest a significant portion of emergency responders' followers to be *'information listeners'* – they utilise social media as a way to seek information provided by emergency responders, but tend not to visibly interact, particularly through textual features. Despite the survey participants' suggestions of 'general interest' and 'job role' as being initial motivations for following, participants very much valued emergency responders' social media activity as a source of information; whether it be breaking news, local area updates or details about the work emergency responders carry out. Regardless of whether followers visibly interact, there is clearly important value created for those who merely *'listen'* to what emergency responders have to say; accurate and timely information is well received.

Community Seekers

Another group that emerged are those followers who seek *'Community'*; here community is considered as relationships built upon shared values, responsibilities, attitudes and interests. A significant portion of participants value social media use by emergency responders to aid their development through the building of both professional and personal relationships. This would appear to corroborate findings of Dufty (2012), who discuss the value of social media for providing community development, offering users support during and after an emergency or disaster. It was identified that potential value exists for relationship development between emergency responders. Through messages of support and commendations, survey participants who classified themselves as emergency responders indicated that by following their peers, they felt comforted by a morale boost during times of perceived isolation.

Collaborators

A small subset of followers emerged and comprised a third group: the *'Collaborators.'* These are followers who are receptive to posts aimed at educating and enriching knowledge. Given that under Civil Contingencies Act (2004), emergency responders are obligated to inform, advise and educate communities about potential risks and the steps they can take to mitigate them, social media may have the potential to play an active role. Content that is interesting, timely and personally relevant is more likely to stimulate engagement and promote interaction by the followers. When participating they are more inclined to invoke the use of likes and shares rather than the textual features such as comments and replies.

In terms of determining the value of social media for emergency responders, which is the overall goal of this thesis, the findings in this chapter illustrate the importance of considering the views of their followers. Evaluating the effectiveness of social media for emergency management in a quantitative manner alone (as by Ehnis and Bunker (2012) and Bruns et al. (2012)) could present misleading results. Instead, this chapter both qualitatively and quantitatively explored a sample of followers' motives for connecting with emergency responders through social media in an attempt to produce insights that could extend more generally across a wider audience. Understanding what emergency responders' followers set out to gain, and how they intend to engage, provides valuable insights that could help contextualise performance and impact assessments of emergency responders' social media activity, thus emphasising a need for further mixed methods research in this field. Further, it might prove sagacious for emergency responders to focus on improving strategies by which they can increase the reach of their posts in addition to encouraging direct interaction, which will be addressed in the final discussion (Chapter 7).

Previous works have predominantly focussed on assessing the impacts of emergency responders' social media usage for the public (Bruns et al., 2012; Guidry et al., 2017; Ehnis and Bunker, 2012), but undoubtedly emergency responders can benefit from the social media activity by their peers. The methods used in this thesis allowed for the identification of these motives. Future efforts are necessary to ascertain the most effective strategies to employ and which platforms are best suited to meet the needs of individual emergency responders.

The FA discovered that the followers of emergency responders included Government agencies, businesses and charities. However, their perceptions and views were not captured in the survey. This is, perhaps, a limitation of using a survey, or possibly a consequence of the distribution method. Alternatively, these followers may have chosen not to engage with emergency responders' social media activity and thus did not participate in the survey; to question here would be mere speculation. Studies that follow on might want to consider exploring these users' perceptions, whether they choose to engage and if so, why.

5.4 Chapter Summary

This chapter has explored who emergency responders are reaching through social media, and the reasons why users follow emergency responders on social media, answering RQ2 of this thesis. This aspect of the research was also a prerequisite for investigating RQ3. Using a combination of methods, the Follower Audit (FA) and targeted survey responses led to four high-level findings, summarised in Table 5.7 and three groups of followers: Information Listener, Community Seeker and Collaborator.

Finding #	High-Level Finding Summary
1.	Social media facilitate two key, distinct, emergency responder-follower relationships: emergency responder/public and emergency responder/emergency responder.
2.	Social media are most valued as information hubs between emergency responder and follower.
3.	Followers frequently engage but do not tend to interact.
4.	Level of engagement is dictated by relevant and reliable content.

Table 5.7: High-Level Findings Summary

This chapter's exploration provided a contrasting view on the value of social media for emergency responders, and has allowed for the followers who connect with emergency responders, but do not necessarily visibly interact, to have their views included. Additionally, it provided an opportunity to compare the emergency responders' intentions for using social media, identified previously in Chapter 4, with their followers' expectations. These findings contribute to an overall understanding of social media's potential value upon emergency management, particularly for developing relationships, promoting preparedness and encouraging resilience-building activities and will form part of the final discussion in Chapter 7.

Having identified the followers' perspective on the value of social media for connecting with emergency responders, the following chapter moves on to investigate the possible impacts that emergency responders may have through their use of social media, as influenced by SMOKE.

Chapter 6

The Potential Impacts of Social Media Use by Emergency Responders

"You can analyse things whichever way you want, but actually is it [social media] changing people's behaviour?" – ***Fire Service Interviewee***

The above quote typifies a common uncertainty that exists among emergency responders in the UK with regard to social media; there is considerable ambiguity as to what impacts upon emergency management are achieved as a consequence of their social media use.

As discussed in the literature review (Chapter 2), success criteria for evaluating emergency responders' social media use have not been defined. Hughes et al. (2014b) noted a similar gap, stating that: *"Social media success stories continue to appear; however, no standardized performance measures exist that assess social media's effectiveness for the practitioner"*. Additionally, the implications of measuring social media data in insolation, particularly interactions, can be misleading. They are not necessarily meaningful indicators of reaching the target audience and influencing a user to act or behave in a particularly way. This argument was supported by the results of the previous chapter. There is a need to investigate the effectiveness of emergency responders' social media use looking *beyond* basic reach and explore the extent of the reactions that such activity might generate; this chapter seeks to address research question three: What are the potential impacts upon emergency management in the UK resulting from the use of social media by emergency responders? **(RQ3)**.

> *"I think that's the kind of holy grail you know, it's one of those things with social media, there's more stats than you could ever need really [. . .] but it's a very hard thing to directly correlate something we've done on social media with a drop in house fire or road traffic collisions"* – ***Fire Service Interviewee***

> *"We don't get the feedback so I don't know if it helps. I like to think it does"* – ***Local Authority Interviewee***

> *"There is still a lack of understanding about what it [social media] is capable of really"* – ***Fire Service Interviewee***

Chapter 4 established criteria for gauging social media impact based upon emergency responders' objectives and desired outcomes and led to the development of a proposed framework entitled Social Media Outcomes and Key objectives for Emergency management (SMOKE), see Table 4.7.
Statistical Analyses, the Targeted Survey (Part 2[1]) and the Follower Audit (FA) were used to formulate answers to **RQ3**. SMOKE influenced the methods employed and directed the investigations towards specific areas of potential impact (see Table 6.1 and Table 6.2), thus demonstrating how the framework can provide a structure for exploring potential value created through social media in relation to emergency responders' aims.
The Statistical Analyses provided objective insights into the effectiveness of social media use by emergency responders, specifically during the Winter Floods 2013/14. The targeted survey produced findings that not only indicated the reasons why users choose to follow emergency responders on social media (as in Chapter 5), but also yielded awareness of the impacts. Results of the FA (as in Chapter 5) were used to indicate whether emergency responders reach large numbers of followers and if those users are indeed their target audience. The data from the Twitter observations and Interview quotes (Chapter 4) were drawn upon, where appropriate, to provide additional context.

This chapter will present four key impacts:

1. Varying Engagement
2. Relationship development
3. Increased awareness and knowledge amongst followers
4. Shaping attitudes and initiating behaviour change

[1]The targeted survey had two aims. The first objective was to explore why users choose to follow emergency responders (discussed in the previous chapter). The second objective was to investigate the degree of impact, discussed in this chapter.

A discussion then assesses, in accordance with SMOKE, whether emergency responders are indeed achieving their key objectives: Preparedness and Resilience Building (KOA), Relationship Development (KOB) and Emergency Communications (KOC). The chapter concludes with an annotated version of the SMOKE framework, illustrating the desired outcomes that emergency responders appear to be 'fulfilling', 'partially fulfilling', or 'not achieving'.

Test	**Data Sample**	**SMOKE Influence**	**Variables and Reasoning**
Average Rate of Reaction	Twitter Observations data in Table 4.2	Audience engagement (DO1) is prominent for each of the Key Objectives in SMOKE.	**Likes Received:** Measure the number of times each tweet was 'liked' to indicate how many followers expressed an interest in the emergency responders Twitter activity (Zamparas et al., 2015). **Retweets Received:** Record the amount of times a tweet was reposted to reflect the number of followers who were willing to help propagate emergency responders' tweets (boyd et al., 2010; Bruns et al., 2012). **Replies Received:** Count the number of replies a tweet received to show how many followers engaged with emergency responders through textual forms of interaction (Zamparas et al., 2015)
Correlation and Multiple Regression Analysis	Twitter Observations data in Table 4.2	Audience engagement (DO1) is prominent for each of the Key Objectives in SMOKE.	**Correlation and Multiple Regression:** Analyse variables: activity, use of twitter features and, tweet content, to examine what aspects of emergency responders' Twitter activity might explain levels of engagement (based on likes and retweets) attained on Twitter before, during and after an emergency (Parsons et al., in press).
Follower Audit	FA data in Table 5.3	Members of the General Public were the common focus of the desired outcomes in SMOKE.	**Audience Size:** count of the number of followers that have connected with emergency responders' Twitter accounts to evidence the "potential" reach of their posts (Sterne, 2010; Kwak et al., 2010) **Follower Classifications:** user types that have connected with emergency responders on Twitter to help identify the likeliness of emergency responders reaching their target audience (the public) on social media (Starbird et al., 2010)

TABLE 6.1: Statistical Analyses Tests Influenced by the SMOKE framework

Data Sample	SMOKE Influence	Question Types and Reasoning
Survey Sample data in Chapter 5	Many desired outcomes are concerned with educating the target audience and influencing specific behaviours.	**Likert scales:** to imply followers' satisfaction or agreement with statements regarding emergency responders' social media usage (Bryman, 2012; Bird et al., 2012) **Open-ended questions:** to understand the benefits felt by followers, and their opinions towards emergency responders' social media usage (Bryman, 2012; Bird et al., 2012) **Multiple choice questions:** allows for systematic testing to indicate the 'offline' behaviours that are influenced by emergency responders' social media activity, and which could not be observable through social media analyses alone (Bryman, 2012; Davis III et al., 2014).

TABLE 6.2: Survey Investigation into Impact Influenced by SMOKE framework

6.1 Impact 1: Varying Engagement

An overarching aim of social media use for emergency responders is to attain audience engagement in emergency management, forming DO1 of SMOKE. It is the single DO that features within all Key Objectives (KO) of SMOKE. Thus, an exploration into the effectiveness of emergency responders' social media use for fostering engagement and reaching their target audience was important.

> *"I think it's more about the engagement, you want people to be engaging with you"* – ***Ambulance Service Interviewee***

First, the number of followers and likeliness of those users being the target audience was reviewed.

Revisiting the FA, the *Follower Count* (number of users who have subscribed to one account) for each emergency responder was recorded, see Table 6.3. These counts were combined in Figure 6.1 with the percentage of the randomly sampled followers categorised as being 'Members of the General Public' (from Table 5.3). This faction was afforded particular emphasis due to the finding that emergency responders consider members of the public to be their primary target audience on social media, and subsequently most desired outcomes of SMOKE focus on the public, for example: Raised Risk Awareness Awareness (DO4), Public Trust (DO5), and Large Public Reach (DO7).

The results in Figure 6.1 indicate that emergency responders have built a followership that includes their target audience but to varying, and sometimes limited, extents.

Emergency Responder Account (anonymised)	**Follower Count**
Police Force 1	139347
Local Authority 2	28742
Local Authority 4	27145
Fire Service 3	24839
Fire Service 2	17864
Fire Service 1	9218
Local Authority 7	9174
Local Authority 6	8704
Local Authority 3	5708
Fire Service 4	5512
Local Authority 1	3092
Ambulance Service 1	2512
Local Authority 5	307

TABLE 6.3: Follower Count

Police Force 1 presents an apparent, noteworthy anomaly, being the only emergency responder to have a significantly high follower count but also the lowest percentage of followers categorised as members of the general public. However, such analysis in isolation is limited. At first sight it may suggest that the desired outcome, of *large public reach* (DO7 of SMOKE), is not necessarily being accomplished. However, there are many reasons that could explain the identified variation, for instance some organisations signed up to Twitter a number of years prior to others. Further, the follower count alone does not necessarily equate to what extent those users are actively engaged, but merely implies a potential maximum audience size.
The survey was therefore used to question how strongly participants agreed with the statement: *'I feel engaged with emergency responders on social media'*. The responses in Figure 6.2 show that the distribution of perceived engagement follows a normal distribution, with a mean of 3.15 and standard deviation of 1.10, indicating that levels of engagement do vary.

Next, the amount of *reaction* that the emergency responders accumulated on Twitter during the Winter Floods 2013/14 was explored, see Table 6.4. Here, reaction refers to the number of users that chose to participate in a visible interaction prompted by a post submitted by an emergency responder. The Average Rate of Reaction is the total number of likes, retweets and replies each emergency responder received, divided by the total number of tweets each emergency responder posted (rounded to the nearest whole number and grouped according to the emergency responders' associated LRF). Of note, the number of *likes* and *retweets* received compared with *replies* received are considerably higher, corroborating the finding in the previous chapter that followers are less likely to interact with emergency responders through the textual features of social media (Section 5.2.3).

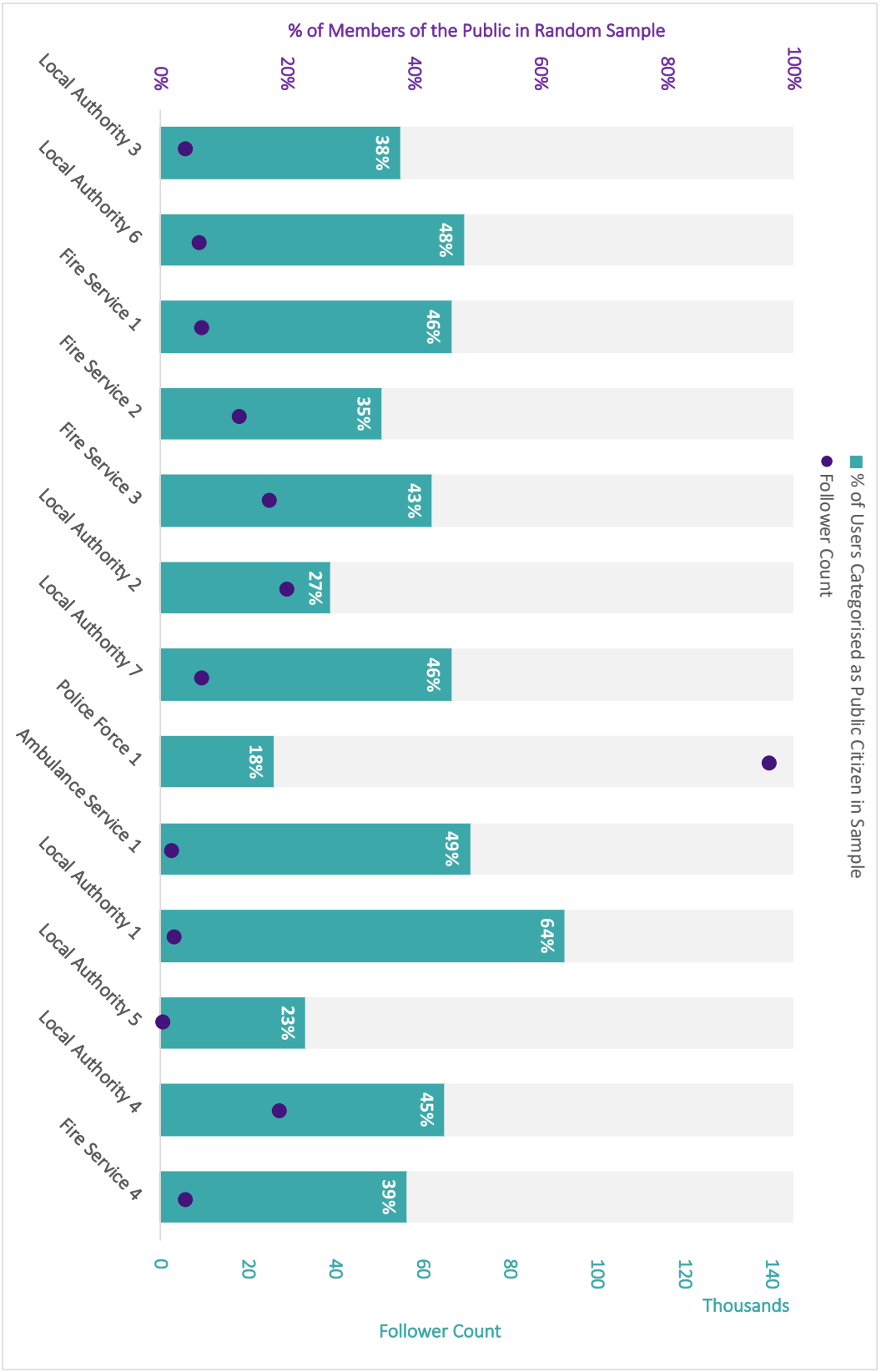


FIGURE 6.1: Follower Count and % of FA Sample Categorised as Members of the Public

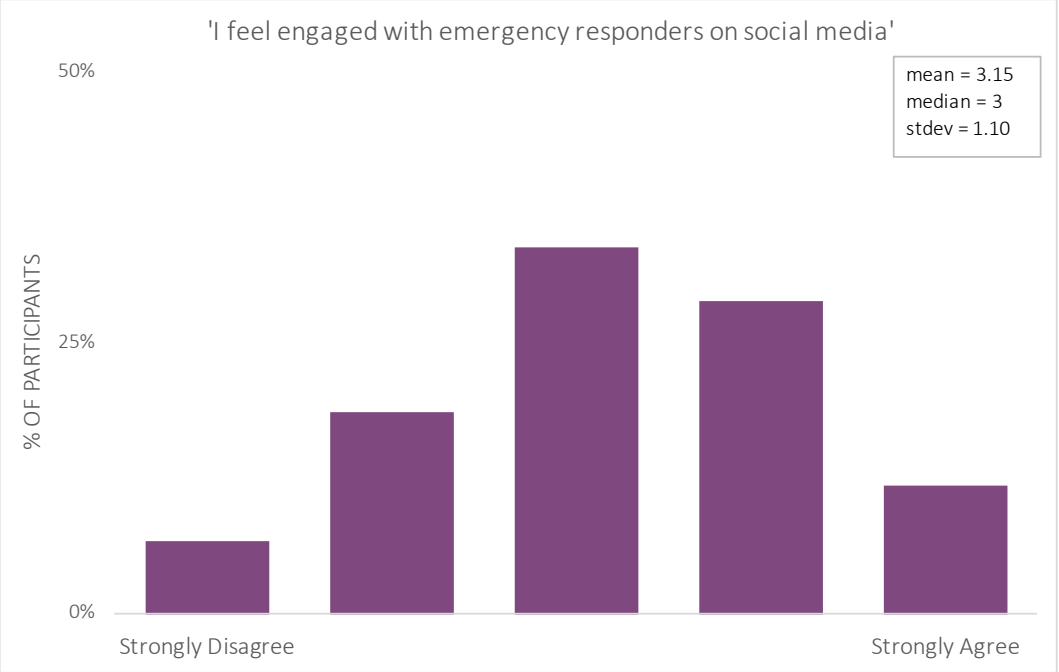


FIGURE 6.2: Distribution of Perceived Engagement with Emergency Responders Through Social Media

The results support the previous argument that some emergency responders are considerably more successful than others in attaining an engaged audience. It could also be inferred from these results that engagement between emergency responders and their audience is generally low and thus may not produce much value for emergency management. On the other hand, one of the interviewed emergency responders explained that the victims of the Winter Floods, who constitute the primary target audience, experienced long-lasting power outages. Without power to charge their devices, access to social media would inevitably be hampered, thus engagement and interaction with emergency responders would be impeded and affect such quantitative investigations:

> *"For example, the Winter Floods incident [...] our more effective way of communication was to go out because WIFI in Somerset is not good and a lot of them [victims], they didn't have electricity because their homes were flooded. So, social media wasn't working, some of them [victims] were just literally in their house and they didn't have anything. So we were going out and knocking on every door that was affected"* – ***Fire Service Interviewee***

Nevertheless, as identified in the previous chapter, regardless of whether followers visibly interact, there is clearly important value created for the *Information Listeners* - those that merely *'listen'* to what emergency responders have to say.

LRF	# of Tweets	Retweets Received	Likes Received	Replies Received	Average Rate of Reaction per Tweet
Wiltshire & Swindon	35	174	26	10	6
Devon, Cornwall & Isle of Scilly (IoS)	140	698	116	45	6
Kent	118	718	136	21	7
Avon & Somerset	137	845	196	27	8
Bournemouth, Dorset & Poole	66	481	58	16	8
Thames Valley	192	1316	272	87	9
Sussex	69	533	59	25	9
Gloucestershire	29	260	29	17	11
Surrey	127	1350	261	117	14
Hampshire & Isle of Wight (IoW)	65	802	127	29	15

TABLE 6.4: Reaction Accumulated on Twitter during Winter Floods 2013/14 - Grouped According to Emergency Responders' Associated Local Resilience Forums (LRF)

One survey participant specifically expressed use of emergency responders' social media activity during the Winter Floods 2013/14:

> *'During the St Jude storm (Oct 2013) I was able to keep track of road closures caused by fallen trees, high winds etc. and avoid them'* [SP100]

The integrated findings thus far advocate a need to explore methods that can support emergency responders to foster increased audience engagement. As such, initial insights into effective social media strategies follow, which constitute one of the key contributions in Parsons et al. (in press).

Correlation and Multiple Regression Analysis tests were carried out to examine what aspects of Twitter activity, during the Winter Floods (2013/14) by 29 emergency responders (studied in Chapter 4), might have played a role in promoting engagement. An overview of the data analysed is given in Table 6.5. Previously identified in Chapter 5, survey participants were found to be more inclined to invoke the use of likes and shares rather than the textual features such as comments and replies.

Twitter Activity during Winter Floods (2013/14)

Activity	# in sample
No. of Tweets	800
Use of Twitter Features	% of sample
Interactive Features (retweet, quote retweet, replies and mentions)	42%
Media (tweets containing photos and videos)	9%
URLs	47%
Hashtags	48%
Tweet Content	% of sample
Caution and Advice	47%
Infrastructure and Utilities	14%
Donations and Volunteer	1%
Sympathy and Support	1%
Affected Individuals	3%
Flood Related Information	12%
Rescue	8%
Other	14%

TABLE 6.5: Summary of Twitter Activity during Winter Floods (2013/14) *Note: the percentages can be greater than 100% as one tweet can yield more than one interaction (like/retweet)*

Thus, Level of Engagement used in these tests, expressed as a percentage, is the ratio of likes and retweets each organisation received, to the total number of tweets each organisation posted, see Figure 6.3; of note the percentages can be greater than 100% as one tweet can yield more than one interaction (like/retweet).
The first multiple regression model focused on the content categories and the second was fitted to investigate the use of Twitter features, including activity, interactions, media, URLs, Hashtags.

The first multiple regression test revealed that only the Infrastructure and Utilities content category (posts about structures and utilities that had been affected by the incident (Olteanu et al., 2015) explained a proportion of the variance statistically (63%; $p < 0.05$). The other categories did not have any association statistically. The Pearson's product-moment correlation coefficient (0.795, $p < 0.05$) indicates a large positive association between the level of engagement and the Infrastructures and Utilities category. The plot in Figure 6.4 shows that the LRFs that posted a large number of tweets categorised as Infrastructures and Utilities achieved a higher level of engagement. Examination reveals that the correlation has been impacted by an outlying data point (X = 129%). Whilst omitting this outlier from the analyses marginally reduces the Pearson's product-moment correlation coefficient between the two variables, it nonetheless remains statistically significant (0.702, $p < 0.05$).

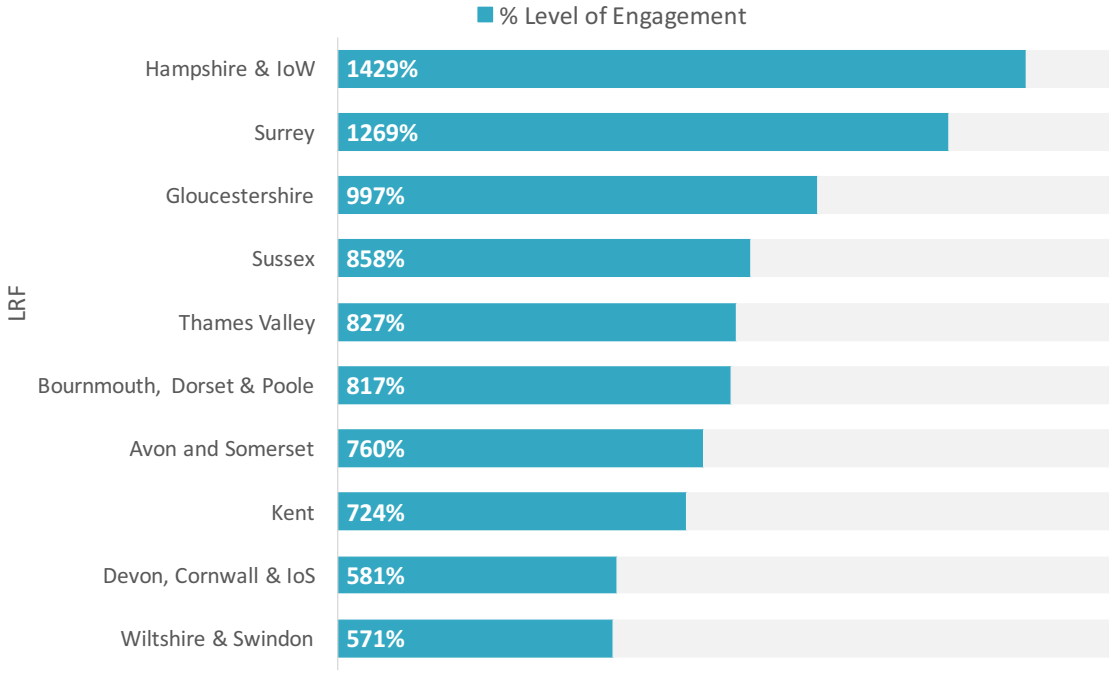


FIGURE 6.3: Level of Engagement (%) Each LRF Attained During the main Period of the Winter Floods (2013/14), (Parsons et al., in press)

The results of the regression analysis are similarly affected, although importantly, still continue to explain a proportion of the variance statistically (49%; $p < 0.05$). In contrast to findings in Chapter 4, whereby emergency responders favour social media for preparedness and resilience building, these results indicate that updates about infrastructures and utilities (see examples below) are more likely to engage the audience (Parsons et al., in press).

> **Police Force Tweet:** A29 [Location] - A29 [Location] Road in [Location] closed in both directions between [Location] and [Location], because of flooding.
>
> **Fire Service Tweet:** Flooding is now affecting the [Location] Road [Location] in the vicinity of the old reservoir please avoid the area as traffic is building up.
>
> **Ambulance Service Tweet:** Many roads are being affected by floodwater today. Please think before calling 999 #floods

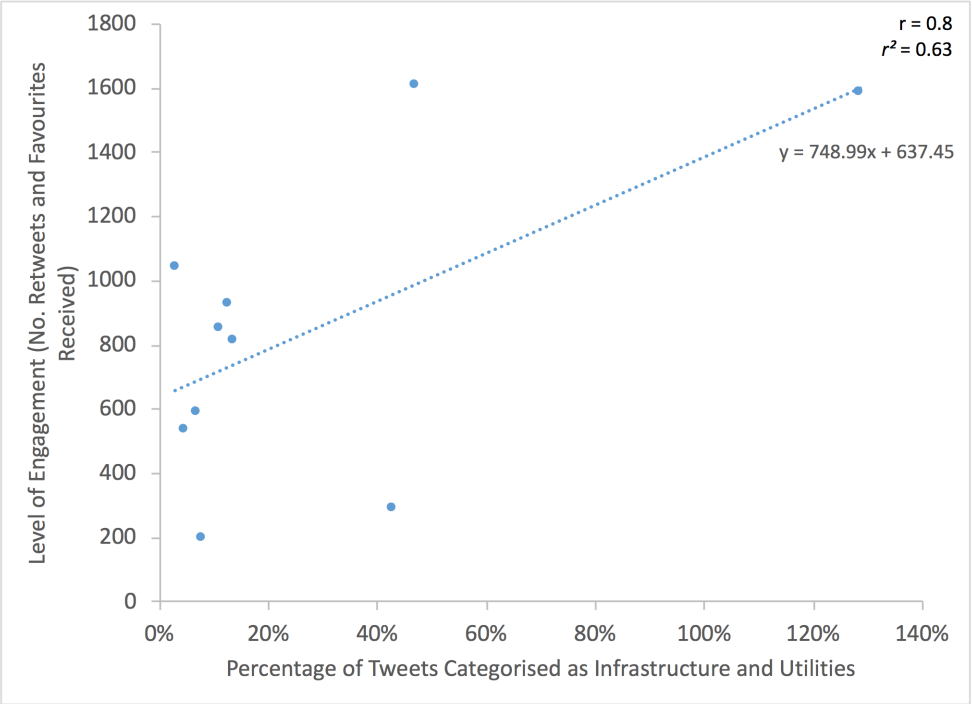


FIGURE 6.4: Correlation between Percentage of Tweets categorised as Infrastructure and Utilities and the Level of Engagement

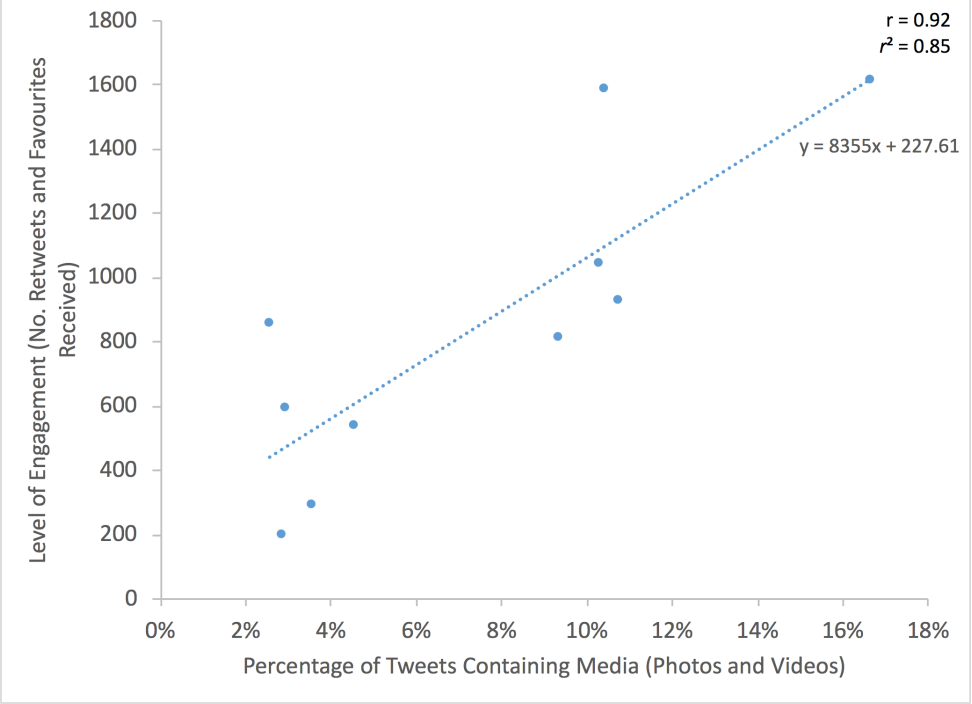


FIGURE 6.5: Correlation between Percentage of Tweets containing Media and the Level of Engagement

The second multiple regression model showed that the use of photos and videos explained 85% of the variation in the level of engagement ($p < 0.01$). The other variables do not explain the variance statistically. Furthermore, a large positive correlation was found between the variables (0.920; $p < 0.01$), illustrating that the LRFs that posted the highest proportion of photos and videos also obtained a higher level of engagement Figure 6.5, a result that was not unexpected. Surprisingly, however, activity around the Winter Floods that included a photo and video made up only 9% of the total data sample (Parsons et al., in press).

Together, the results of the multiple regression and correlation indicate that should future strategies increasingly focus on posting content related to the Infrastructure and Utilities category – particularly during emergencies – and include more photos and videos, emergency responders are likely to achieve a much higher level of engagement (Parsons et al., in press). This finding was reinforced by the qualitative survey data; participants were asked if they had used emergency responders' social media activity during the course of an emergency (Figure 6.6). Responses showed that of those who had utilised responders' activity – 54% – the majority found it useful:

> *'A large fire causing road closures in the area I was planning to go, so I changed my travel plans accordingly. Without social media would not of known about it in advance of travel'* [SP14]
>
> *'Bomb discovered in the area. And yes got info needed'* [SP41]
>
> *'During the riots in London I used the posts to work out which was the safest route home'* [SP2]
>
> *'Croydon Tram Crash, I looked at the Croydon police Twitter feed for information which they updated frequently'* [SP91]
>
> *'During flooding in the past few years, [Emergency Responder] has been very good. Posting live updates. Roads were closed so could avoid. It all started during snow events (2010). Police accounts were also good'* [SP48]
>
> *'Winter Flooding 2015. Used as situational awareness too'* [SP54]
>
> *'During the Bataclan disaster in Paris. My other half was there at the time so I used it to look up instructions to civilians RE keeping safe/ where to avoid on the commute home'* [SP106]

Further, in response to the survey question that asked how strongly participants agreed with the statement: *'I am kept well informed by emergency responders social media activity'*, results in Figure 6.7 showed a skew towards the upper end of the scale, with a mean of 4 and standard deviation of 0.85, indicating the fulfilment of SMOKE DO8 (Informed Audience).

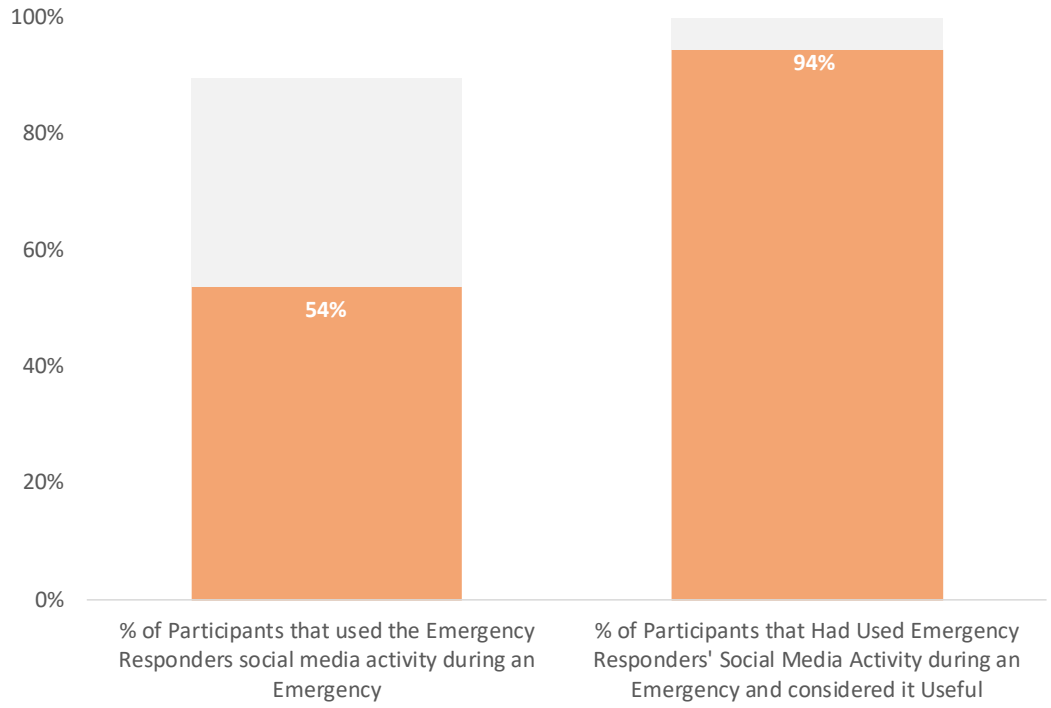


FIGURE 6.6: % of Survey Participants that had used Emergency Responders' Social Media during an Emergency and found it Useful

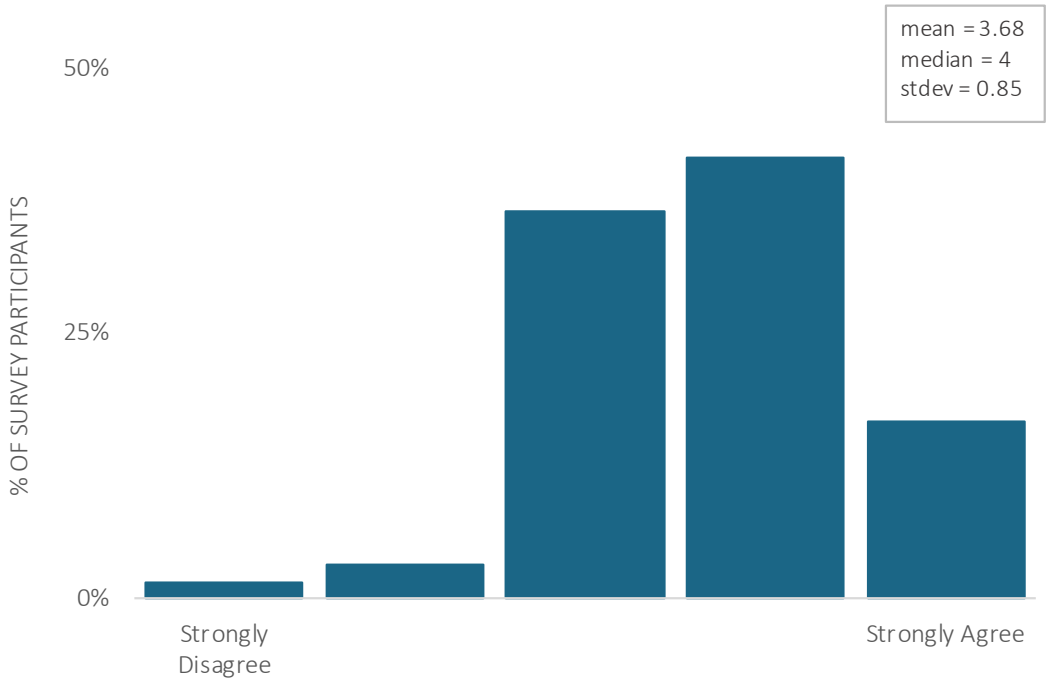


FIGURE 6.7: Survey Participants Responses to the statement: *'I am kept well informed by emergency responders social media activity'*

To summarise, the combined findings of this section illustrate that levels of engagement vary significantly. It would appear that emergency responders have, to some extent, engaged an audience on social media (DO1 of SMOKE). Followers consider themselves to be kept well informed, particularly during emergencies (DO8). It might be argued, however, that a large public reach (DO7) is less likely to have been fulfilled. Nevertheless, as cited in Parsons et al. (in press), should future strategies focus more on posting content related to the Infrastructure and Utilities category – particularly during emergencies – and include more photos and videos, emergency responders may be able to achieve a much higher level of engagement.

6.2 Impact 2: Relationships Development

Using social media for relationship development was found to be important to emergency responders and formed Key Objective B of SMOKE. They deem social media an opportunity to promote organisational awareness and develop trust. As such, the survey sought to explore whether participants' perceptions were influenced by following emergency responders on social media.

> *"It is a great way to form a relationship with people"* – ***Local Authority Interviewee***

Survey participants were asked to rate a variety of characteristics of emergency responders' social media activity from 1 to 5, where a score of 1 indicated 'Not At All' and 5 denoted 'Extremely'. These characteristics, outlined below (Table 6.6), were inspired by the interviewed emergency responders.

The weighted averages of the scores awarded were calculated and the results are shown in Figure 6.8. Evidently, the perceptions of survey participants towards emergency responders on social media are favourable, given that all but one of the characteristics that emergency responders desire to portray on social media received a weighted average score of 0.7 or above. This was particularly well summarised by one survey participant: *'Such good information, usually pretty up to date and very informative!'* [SP48].

Of note, the weighted average score of 0.81 for 'Trustworthy' suggests that emergency responders are fulfilling the desired outcome: Public Trust (DO5 in SMOKE). This was further emphasised by a survey participant who stated: *'During emergencies that affect my organisation the situation is very fluid and time is limited, a drip feed of trusted information via social media is vital'* [SP9].

Characteristic	**Interview Quote**	**Source**
Trustworthy	*"We want to be that kind of single source of trusted, you know, of truth, that trusted voice, that you know"*	Fire Service Interviewee
Informative	*"It's mostly education and informing to be honest. And the warning and informing in response."*	Police Force Interviewee
Useful	*"It's about putting something on there that's useful and relative."*	Local Authority Interviewee
Understandable	*"I've tried to soften it up a little bit, to make it a bit more user friendly and remove jargon and stuff."*	Fire Service Interviewee
Interesting	*"Content is key when it comes to social media. we have to have a variety of content to keep people interested in what we do."*	Ambulance Service Interviewee
Supportive	*"There's been lots of things we've done to try and improve in terms of support"*	Fire Service Interviewee
Approachable	*"It needs to be a respected but an approachable respected service."*	Police Force Interviewee
Funny	*"Some of my tweets, over the last year or so, since we've had access, I've tried to put a few funny ones... it gives it another angle."*	Local Authority Interviewee

TABLE 6.6: Characteristics which Interviewed Emergency Responders Endeavour to Emulate

Additionally, participants were asked to rate how strongly they agreed, or disagreed, with a set of statements regarding the effectiveness of emergency responders' social media activity for building meaningful connections between emergency responders and themselves. The results in Figure 6.9 show a skew towards the upper end of the scale, indicating that the majority of participants considered it very effective for increasing organisational awareness. However, the results in Figure 6.10 resemble a normal distribution with a slight positive skew, suggesting that emergency responders are utilising social media effectively for strengthening relationships, although there remains scope for further progression. This finding was complemented by the qualitative responses gathered from the survey.

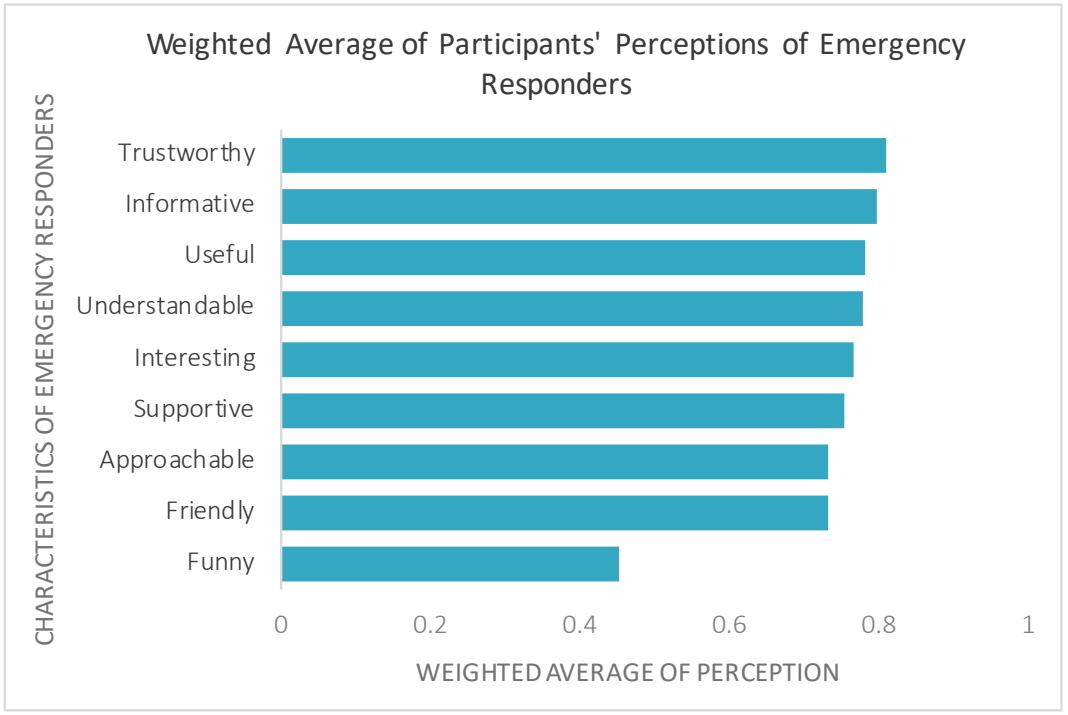


FIGURE 6.8: Weighted Average Scores of Participants' Perceptions of Emergency Responders' Social Media Activity

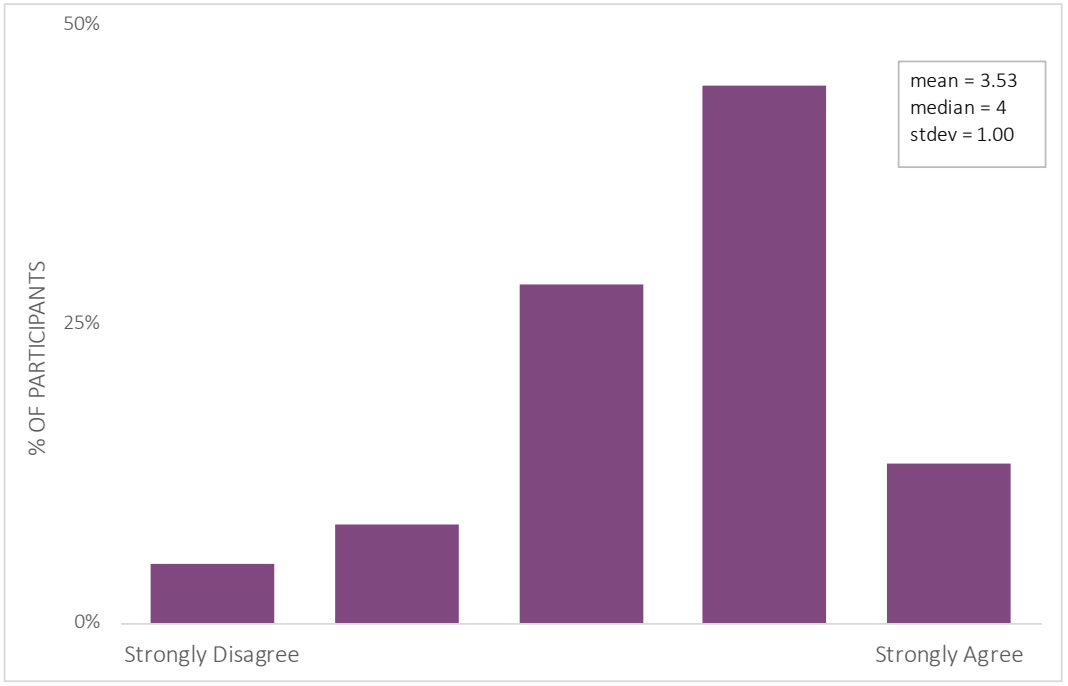


FIGURE 6.9: Survey Participants' Responses to the Statement: *'I have a better understanding of Emergency Responders' Job Role'*

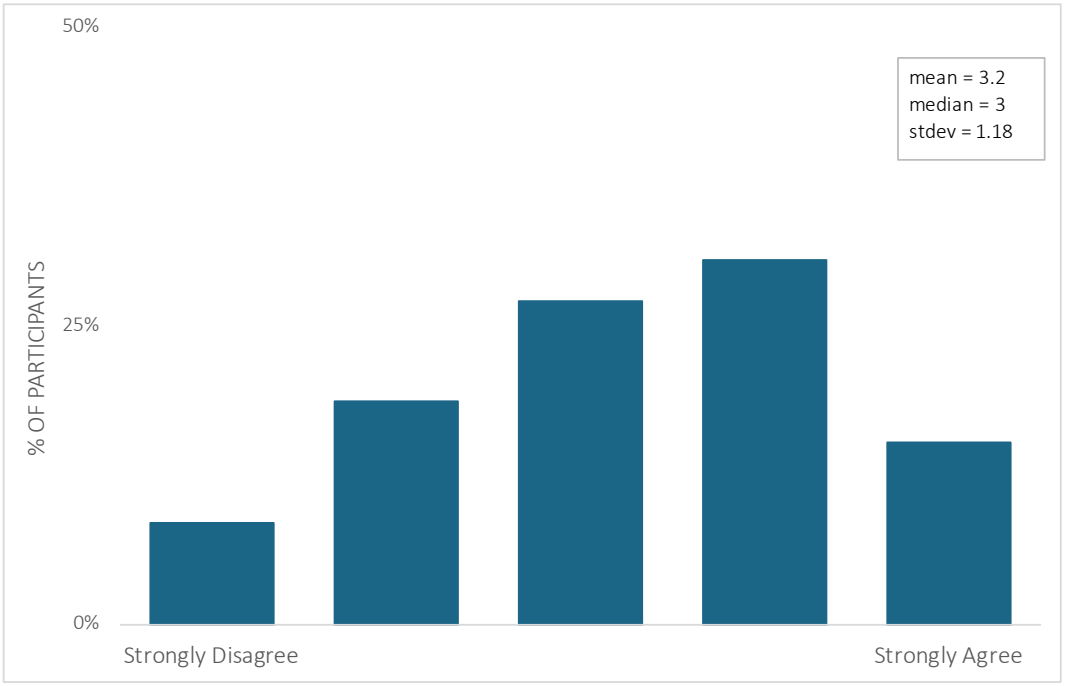


FIGURE 6.10: Survey Participants' Responses to the Statement: *'I have a good relationship with Emergency Responders'*

Some participants specifically stated that *'it [social media] has led me to appreciate further the cuts being made across all emergency services'* [SP57] and that they *'appreciate and understand workload pressures and priorities'* [SP80]. Others mentioned that they generally *'have a better understanding of what happens within the services'* [SP24] and are *'more aware of the work [emergency] professionals do'* [SP67]. One participant specifically expressed that: *'I have a better understanding of this often-overlooked group of public servants'* [SP67], whilst another claimed it allows for *'Sharing ideas, learning new techniques, recognition within my field, chances to get involved in activities promoted through social media, awareness of the wider world's thoughts on pertinent issues'* [SP63].

The above responses from followers demonstrate understanding and awareness. Moreover, the followers are developing an empathy towards emergency responders, indicating relationship building. Referring back to the Twitter observations, it would seem that certain types of emergency responders' tweets are more likely to generate such feelings of empathy:

> **Police Force Tweet:** It's 4am [Emergency Responder] HQ & all agencies working through the night to co-ordinate flood response
>
> **Fire Service Tweet:** Here's the [Charity] at [Location] feeding some hungry crews during the flooding

> **Ambulance Service Tweet:** Our staff are continuing to work closely with Fire & Police colleagues to check on & evacuate vulnerable people affected by the #flooding

The FA highlighted that a portion of the sampled followers (8%) were *'Emergency Responders'* or *'Users affiliated to emergency management community'*. This finding, in conjunction with the responses that emerged from the survey, revealed a significant potential of social media for relationship development between emergency responders themselves. The qualitative responses provided by some survey participants revealed that by following emergency responders it provides a *'feeling like I belong'* [SP38] and *'the feeling of not being alone'* [SP66]; isolation was recognised as being a *'stressor of the job'* [SP66]. Others reported that social media fosters *'morale boosting'* [SP66] and serves as a *'confidence builder in my own practice'* [SP36]. One participant added a comment that they *'would like them [emergency responders] to follow us as well for completeness and team working'* [SP47]. Referring back to the observations of Twitter use during the Winter Floods 2013/14, a portion of tweets categorised as 'Sympathy and Support' were found to offer praise and recognition, for example:

> **Fire Service Tweet:** Lovely to welcome [name] to [location] fire station tonight, he wanted to thank fire crews and police for work during floods.
>
> **Police Force Tweet:** Thanks to the [emergency responder], other charities & the MoD for their help supporting isolated people & those in flooded homes #SomersetFloods
>
> **Ambulance Service Tweet:** Helpful to hear about changes made. Impressed by the work [Emergency Responder] have been doing responding to flooding – [Name] [URL]

This unanticipated finding is enlightening and needs to be captured by emergency responders and within their social media strategies. Perhaps desired outcomes under KOB of SMOKE (relationship development) should be expanded upon and will be addressed in the final thesis discussion (Chapter 7).

In summary, the results in this section demonstrate that emergency responders' social media use is having an impact upon their relationships with the public and with their peers. There is a strong indication that emergency responders' social media efforts are worthwhile for establishing and building a good rapport with their audience (DO5: Public Trust). Further, there is evidence to support that their social media usage plays a role in improving and increasing reputation (DO6: Organisational Awareness). This was summed up particularly well by one survey participant:

> *'A better understanding of this often-overlooked group of public servants'* [SP67]

6.3 Impact 3: Increased Awareness and Knowledge amongst Followers

As part of emergency responders' responsibilities under the Civil Contingencies Act (2004), they are obligated to inform and advise communities about potential risks and the steps they can take to mitigate them (Cabinet Office, 2013a). There was therefore a need to understand the potential for social media to play an active role.

> *"You know the old ounce of prevention is better than cure and all that."* – ***Fire Service Interviewee***

Survey participants were asked to explain what benefits they have gained by following emergency responders on social media. Responses were thematically reviewed and organised into emergent categories, see Figure 6.11. The results show that such benefits extended beyond the mere satisfaction of people's curiosities and interests.

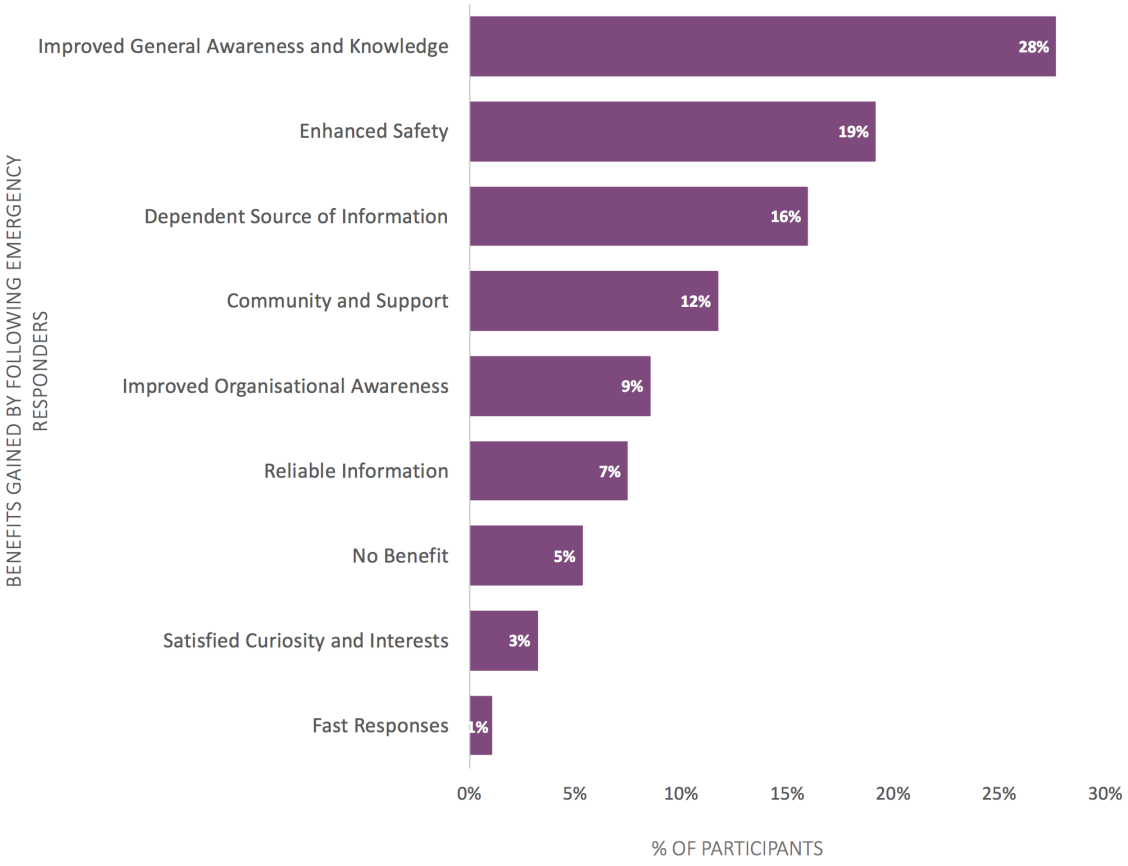


FIGURE 6.11: Survey Participants' Responses on the Benefits of Information shared by Emergency Responders through Social Media

As supported by the following quotations, participants appear to be processing and, more importantly, *utilising* such information, empowering them to make decisions and take action. Here, empowerment is a reflection of individuals and communities being confident and in control of their actions related to emergency management (Keim and Noji, 2011; Kaminska and Rutten, 2014). For example, survey participants who classified themselves as other emergency responders explained that: *'When reading updates [on social media] about new influx of flu etc. I have more knowledge surrounding this to treat patients I encounter'* [SP31], *'[social media are] a way of finding out about research or clinical trials they speak about I may not have heard of'* [SP24], and *'I introduced a treatment plan based on trusted knowledge shared by colleagues on social media'* [SP63]. Whereas, public participants stated that they *'can plan journeys, can stay informed and inform others'* [SP48] and *'can save time by avoiding roads which are closed due to traffic incidents or weather'* [SP100]. Additionally, public participants revealed that it helped with *'finding numbers to call or better ways to report non emergencies'* [SP92], *'so can report more effectively'* [SP92] and they feel *'more aware of any criminal occurrences in my local area which may cause me to take more care'* [SP100].

These quotations were further corroborated by the results to another survey question: participants were asked to rate how strongly they agreed with a set of statements concerning emergency responders' ability to support them in preventing and preparing for emergencies through social media. A score of 1 denoted 'strongly disagree' while a score of 5 indicated 'strongly agree'. The results in Figure 6.12 show skews towards the upper end of the scale for increasing risk awareness, developing knowledge and encouraging preparedness. Whereas responses to: *'I act safer to avoid emergencies'* resembled a normal distribution, suggesting that social media plays less of a role for influencing preventative actions (processes carried out to avoid, deter or inhibit something from happening).

In summary, the results from this section imply that social media are promising tools for raising public awareness and helping followers to better prepare and be more risk-adverse; albeit these factors were not previously mentioned as being key motivations for following emergency responders. Arguably, emergency responders are, to some extent, delivering upon their desired outcomes of SMOKE: DO2 (Social Influence), DO4 (Raised Risk Awareness) and DO8 (Informed Audience).

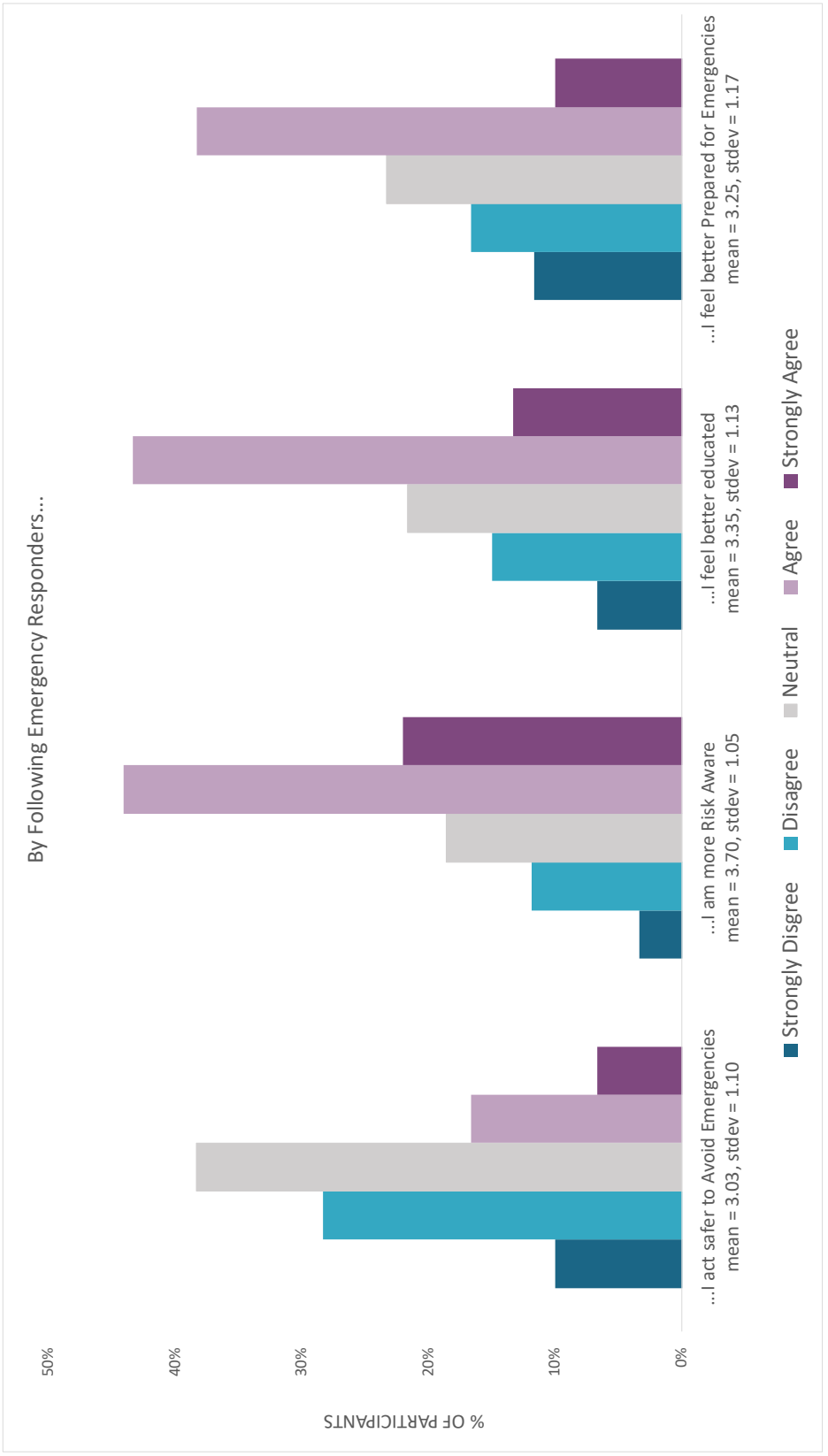


FIGURE 6.12: Survey Participants' Responses to a set of Statements Concerning Emergency Responders' Ability to Support them in Preventing and Preparing for Emergencies through Social Media

6.4 Impact 4: Shaping Attitudes and Initiating Behaviour Change

The interviewed emergency responders (in Chapter 4) stressed their desire to encourage the appropriate *offline* actions of their followers and influence positive *behaviour change* (DO3 of SMOKE). Here, *offline* refers to reality; the 'real-life' actions.

> *"You can put a piece out: 'early doors, we've had a warning we're going to anticipate there is a severe flood warning on [Location] bridge'. If we don't do anything, people's lives are at risk. So we can get ahead of all that, great. But trouble is, people are still inevitably going to go [drive] through the flood waters"*
> – ***Local Authority Interviewee***

Referring back to the Twitter observations, certain types of emergency responders' tweets were aimed at shaping attitudes and encouraging preventative behaviours:

> **Fire Service Tweet:** If you have to travel today, please avoid driving through flood water. It's deeper than you think it is!!
>
> **Police Force Tweet:** Route between [Location] and [Location] is badly flooded. Roads are reported to be impassable so motorists should avoid. #StaySafe
>
> **Ambulance Service Tweet:** Avoid infection! If you have to go into the water, wear waterproof gloves and rubber boots #floods [url]

From a practical viewpoint, such outcomes are extremely difficult to measure. A 'like' or 'share' are merely *impressions*; they do not necessarily constitute a *"real-life"* action. Therefore, it was important in the survey to: 1) explore what behaviour changes might be occurring, 2) trace whether emergency responders' desired changes are happening, and, 3) ascertain if any of these interventions are a consequence of following social media activity by emergency responders.

First, an open-ended question asked participants to provide information about an action that they carried out, or a specific behaviour that they changed, which was directly influenced by an emergency responders' social media post; their recollections are enlightening:

> *'I have altered my approach to patients'* [SP36]
>
> *'Local fire service posted about dangers of 9volt batteries. I am now very careful how I dispose of them and I warn other people'* [SP6]

> *'I recall one or two fires in Southampton (one quite serious) and various times I've been able to prepare for severe weather (eg snow, strong wind)'* [SP20]
>
> *'I changed a route I was driving based on a post I had seen'* [SP37]
>
> *'Not driving on certain dates due to weather warnings'* [SP10]
>
> *'I am more stringent about securing property'* [SP81]
>
> *'Being more mindful about the 2 second gap between cars after seeing a reminder picture'* [SP86]
>
> *'I evacuated an area and avoided other potentially dangerous areas'* [SP98]

Secondly, two survey questions aimed 1) to test if specific behaviours desired by emergency responders are indeed carried out, and 2) to identify if emergency responders' social media posts have played a role in encouraging such behaviours. Through observations of various emergency responders' social media platforms, seven examples were identified of key messages pushed out by emergency responders in an attempt to educate or encourage a specific offline action: see Table 6.7.

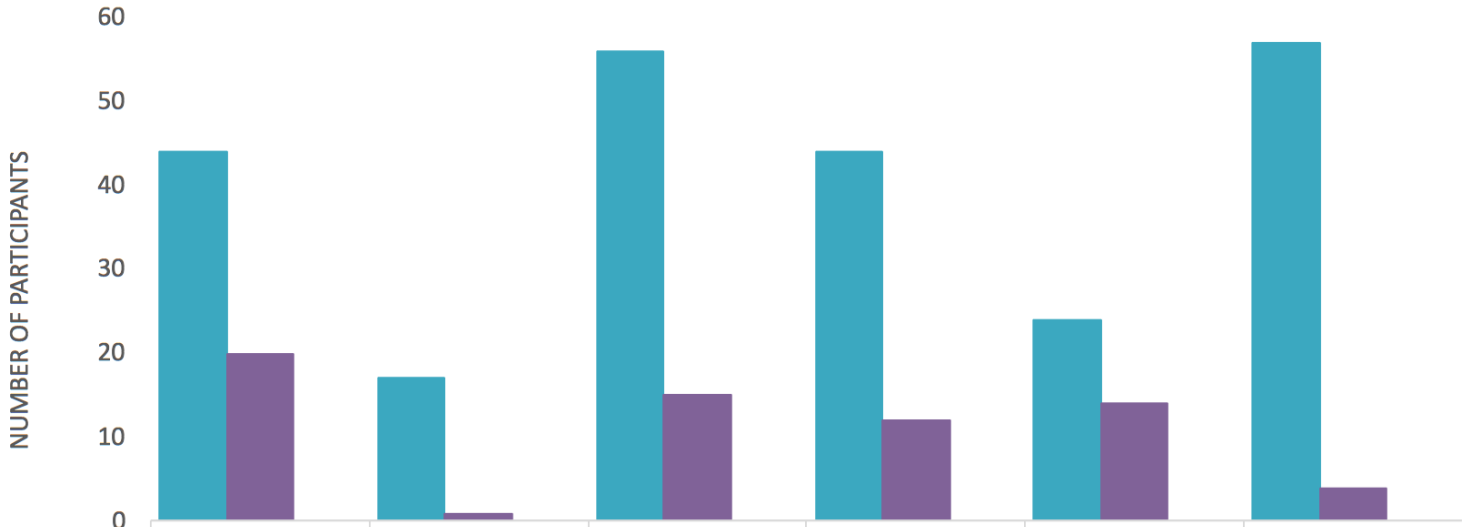
Survey participants were asked to report on whether they actually carried out the listed actions, and then if they had been influenced or encouraged by emergency responders' social media to do so. The results are shown in Figure 6.13, where the 'Positive Answer Given' denotes the correct result for developing knowledge/behaviour (e.g. yes to 'check smoke alarm regularly' and no to 'drive through flood water').

The responses provided some evidence of a positive impact upon behaviour change. There was also a suggestion that followers are receptive to emergency responders' campaigns and attempted interventions. The emergency responders' social media use appears to have had greatest influence upon actions that are centred around social elements of behaviour; for instance, 58% of the participants that claimed to have checked on their neighbours felt they had been influenced by the emergency responders' social media activity.
The 45% of participants that claimed to have been encouraged to check their smoke alarm was also noteworthy in terms of a positive behaviour change.

Undoubtedly, there are valuable returns to be realised from emergency responders' social media use for the shaping of attitudes (DO2 of SMOKE), influencing behaviour (DO3) and increasing safety (DO4). Equally, it would appear that this is an area for emergency responders to develop in order to exploit this opportunity to its maximum potential.

Key Message	**Behaviour Change Desired**	**Source**	**Last Accessed**
To reduce risk of death caused by fire, people are encouraged to test smoke alarms every month.	Check smoke alarm regularly	firesafety.campaign.gov.uk	August 2018
Various hazards threaten property and services we rely on such as utilities. People are therefore encouraged to have an emergency bag prepared with items they might need if they were required to evacuate from their home.	Prepare an emergency 'grab bag' (an emergency, survival kit in case of evacuation)	gov.uk	August 2018
Weather warnings are designed to let people know what weather is in store and what the impacts of that weather may be.	Understanding of Weather Warnings	metoffic.gov.uk	August 2018
Driving through flood water can not only write-off vehicles but also cause death.	Avoid Driving through Flood Water	floodsdestroy.campaign.gov.uk	August 2018
To encourage people to check on vulnerable and elderly people during extreme weathers and ensure that they are well.	Check on Neighbours in Bouts of Extreme Weather	publichealth.hscni.net	August 2018
To reduce risk of fire caused by reflection of sun's rays onto nearby objects (such as curtains, clothing, paper or furniture)	Avoid Keeping Mirror on a Window Sill	cheshirefire.gov.uk	August 2018

TABLE 6.7: Key Messages shared on Social Media to encourage Behaviour Change



	Check Smoke Alarm	Have Emergency Bag	Understand Weather Warnings	Avoid Driving Through Flood Water	Check on Neighbours in Extreme Weather	Avoid keeping a mirror on a window sill
Positive Answer Given*	44	17	56	44	24	57
Action Influenced by SM	20	1	15	12	14	4
% Influenced	45%	6%	27%	27%	58%	7%

**Note: 'Positive Answer Given' denotes the correct actions for increasing resilience (i.e. yes to 'check smoke alarm')*

FIGURE 6.13: % of Survey Participants Influenced by Emergency Responders' Social Media to Change their Behaviour

6.5 Discussion

The results reported in this chapter suggest that through the adoption of social media emergency responders are generating value for UK emergency management and are fulfilling elements of their desired outcomes. This progress is summarised through an annotated version of SMOKE in Table 6.8

DO1: Audience Engagement

In order to maximise the potential impacts of all three key objectives of SMOKE, Audience Engagement (DO1) is fundamental.

Emergency responders were observed to be generating varying levels of engagement. An analysis of the survey responses to the statement: *'I feel engaged with emergency responders on social media'*, revealed that levels of perceived engagement followed a normal distribution. Further, interactions and rates of reaction were found to be low. To an extent this would be expected, given the range of followers' motives and willingness to engage, as identified previously in Chapter 5; a large group of followers - the Information Listeners - often *'listen'* but only a small subset of followers – the Collaborators - were inclined to interact. However, a content analysis of the replies was not carried out as part of this research, and therefore the full extent of engagement was not revealed.

The multiple regression analysis of Twitter Data demonstrated that an improved strategic approach to their social media use could help emergency responders promote their aims to wider audiences and generate further engagement for UK emergency management, for example by increasing the use of media in their posts (Parsons et al., in press). Of note, during the Winter Floods (2013/14) emergency responders' activity that included a photo and video, comprised just 9% of tweets. A lack of strategy was further corroborated by interview quotes from emergency responders.

> *"We need to think a bit more about a strategic way of planning how we deliver and what we deliver"* – ***Fire Service Interviewee***

Twitter have since released upgraded features to their platform, for example the ability to add up to four photos in one Tweet[2], and more recently 'Go Live[3]', whereby users can create and post a tweet that includes live video. Such attributes could make Twitter more appealing and thus generate increased engagement.

The multiple regression analysis also revealed that the choice of subject matter could elicit increased levels of engagement (Parsons et al., in press).

[2] Twitter Blog Article: Photos just got more social (2014) [Last Accessed: Sept. 2018]
[3] Twitter Blog Article: Go Live on Twitter! (2016) [Last Accessed: Sept. 2018]

This resonates with the survey participants' motivations for following emergency responders; relevant and reliable content was considered extremely important.

> [by following emergency responders, followers expect:] *'Updates, tips and news pertinent to our community* [SP47]

KOA: Preparedness and Resilience Building

As part of UK emergency responders' responsibilities under Civil Contingencies Act (2004)[4], they are obligated to inform, advise and educate communities about potential risks and the steps they can take to mitigate them. The results in this chapter indicate that emergency responders are to an extent producing value for preparedness and resilience building through social media, consolidating upon the research by Dufty (2012) and Panagiotopoulos et al. (2016), whereby value to promote alertness, encourage protective behaviour and guide public attention towards mitigating actions was discussed. In particular, the evidence produced in this work demonstrates emergency responders' ability to exert a social influence and promote both individual and community safety (DO2). Survey responses illustrated a receptiveness towards posts that were tailored at raising awareness (DO4), indicating that followers are engaging with emergency responders' campaigns and attempted interventions. It would appear that there is added value over and above what followers might first have expected. Risk awareness and best practices for avoiding/mitigating possible incidents, for example, were not factors previously mentioned as being initial motivators for following emergency responders in Chapter 5.

Fewer participants, however, were influenced by posts that were aimed at changing behaviours (DO3). Nevertheless, the small groups of followers, previously defined as the Collaborators, are not only receptive to posts that enrich knowledge but are also more likely to act upon the advice or demands shared by emergency responders. Undoubtedly, emergency management is benefitting from the added value being created by the small number of followers who choose to engage and then carry out desired behaviours. It would seem, however, that emergency responders should seek to increase the number of collaborators amongst their followers, for which formal guidance is likely to be required.

> *"There's no decent national guidance on the whole kind of bigger picture and drawing it in"* – ***Local Authority Interviewee***

[4] Civil Contingencies Act (2004): Sections 2(1)(f) and (g)

KOB: Relationship Development

Emergency responders interviewed in Chapter 4 expressed the importance of building relationships with the public by increasing trust (DO5) and promoting organisational awareness (DO6).

> *"It is a great way to form a relationship with people"* – ***Local Authority Interviewee***

This chapter's results strongly suggest that such outcomes are being fulfilled by emergency responders in the UK. Moreover, the followers are developing an empathy towards emergency responders, indicating relationship building.

> [by following emergency responders] *'I appreciate and understand workload pressures and priorities'* [SP80]

Crucially, and contrary to existing literature (Briones et al., 2011; Haataja et al., 2016), relationship development is not confined merely to bridging connections between emergency responders and the public, but also links emergency responders themselves. This corresponds with the group of followers defined in the previous chapter as *Community Seekers*. It is acknowledged that whilst comparisons between social media platforms and their relative potential have not been explored in this research, it is an area that warrants inquiry. For example, unlike Twitter and Instagram, Facebook offers the ability to have 'closed' (i.e. private) groups; a feature which emergency responders may find appealing for support, networking and sharing knowledge. Also, the 'Events' feature of Facebook, which can be either public (i.e. open for any user to see) or private (only those invited are made aware of the event), could be a useful way to promote events, including open days for the public.

KOC: Emergency Communications

Referring to the literature review (Chapter 2), both Ehnis and Bunker (2012) and Hughes et al. (2014a) suggest that social media are underutilised by emergency responders. They make this assertion based on a lack of two-way communication. The interviews conducted as part of this research revealed that emergency communications through social media were found not to be a priority for emergency responders during the response phase (Chapter 4). Nonetheless, dependent upon available resources and workload, they will attempt to distribute one-way messages. Thus, emergency communications formed a key objective of using social media (KOC). Aligned with this intention of use, the survey responses indicated that followers did not view social media as a channel for conversation with emergency responders. Rather, they benefitted from the delivery of information and utilised it to inform decision-making and take further action. This suggests that social media can make significant impacts during emergency response, merely from the

distribution of one-way communications. Whilst this resonates closely with KOA of SMOKE, it also strongly indicates that DO8: Informed Audience (of KOC), is being achieved.

> *Such good information, usually pretty up to date and very informative!'* [SP48]

The extent of 'reach' (DO7) was difficult to ascertain given the datasets used. Indications alluded to a low target audience reach, despite several emergency responders having a high follower count (Figure 6.1). Existing literature reinforces this finding, for example: Watson and Finn (2014) found that emergency information regarding heat wave safety and vulnerability were not reaching targeted individuals during the 2013 Heat Wave in the UK. The question of low reach during an emergency could be explained by logistical reasons, interruptions to infrastructure or the emergency responders perceptions; social media are not considered a priority in this phase of emergency management. This corroborates an argument made in the literature review; it is imperative to consider emergency responders' perceptions and experiences before formulating judgements about their social media use.

To conclude, of the eight desired outcomes (DO) in SMOKE, emergency responders appear to be fulfilling five (DOs highlighted green in Table 6.8). Their efforts to engage the public and influence behaviour change on social media are having some impact, but strategy improvements are required (DOs highlighted orange). It could be inferred that the level of reach attained is not necessarily 'large', thus their efforts to achieve a large public reach are currently considered inefficacious (DO2 - highlighted Red). Future work is required, however, to focus on producing deeper insights as to how emergency responders could strategically improve their social media activity to better achieve their desired outcomes.

6.6 Chapter Summary

This chapter has explored the potential impacts upon emergency management resulting from the adoption of social media by emergency responders. Evaluations of impact were made in accordance with the SMOKE framework, which evolved to reflect the represented sample of emergency responders' objectives and desired outcomes. The combined results of Statistical Analyses, a Targeted Survey (part 2) and the FA produced insights into the performance of social media use by emergency responders and yielded an awareness of impact.

	Key Objectives (KO)		
	A: Preparedness & Resilience Building	*B: Relationship Development*	*C: Emergency Communications*
Desired Outcomes (DO)	1: Audience Engagement 2: Social Influence 3: Behaviour Change 4: Raised Risk Awareness	1: Audience Engagement 5: Public Trust 6: Increased Organisational Awareness	1: Audience Engagement 7: Large Public Reach 8: Informed Audience

green font = Fulfilling;
Orange font = making progress but requires improvement; and
Red font = not achieving

TABLE 6.8: Annotated Version of SMOKE illustrating the degree to which each DO appears to have been achieved by Emergency Responders, based upon the findings presented in this research

Four key impacts were found, summarised in Table 6.9, and an annotated version of the SMOKE framework (Table 6.8) illustrates the desired outcomes emergency responders appear to be fulfilling, partially fulfilling, or not achieving. The chapter demonstrated how such a framework can provide structure for exploring potential value created through social media in relation to emergency responders' objectives.

The collection of findings from Chapters 4, 5 and 6 are discussed next. An overall understanding of the potential value of social media for emergency responders will emerge. A model of potential impact will be proposed.

Impact #	**Summary of Potential Impacts**
1.	Varying Engagement
2.	Relationship development
3.	Increased awareness and knowledge amongst followers
4.	Shaping attitudes and initiating behaviour change

TABLE 6.9: High-Level Findings Summary

Chapter 7

Potential Value of Social Media for Emergency Responders in the UK

As part of their responsibilities under the Civil Contingencies Act (2004)[1] UK emergency responders are obligated to inform, advise and educate communities about potential risks and the steps they can take to mitigate them. Social media have been adopted by emergency responders across the UK as reported in Cabinet Office (2013a): *"The news media (radio and TV broadcasting and print) remain the primary means of communication with the public. Digital and social media are also being used widely to provide a further source of information and advice for the public"*. However, guidance on how to adopt social media for emergency management provided by UK Government is outdated. For example, Using Social Media in Emergencies: Smart Practices[2] was produced in 2012 and merely provides tips and basic advice on how to implement social media, particularly for emergency response. Further, the value that its implementation might afford emergency management is open to debate. Accordingly, the overall goal of this research was as below:

Goal: To explore the potential value of social media for UK emergency responders

[1] Civil Contingencies Act (2004): Section 2(1)(f) and (g)

[2] UK Government Guidance Document for Category 1 Emergency Responders: Using Social Media in Emergencies: Smart Practices [Last Accessed: August 2018]

This thesis has garnered a greater understanding as to why emergency responders value social media, what they intend to achieve and the strategies that they employ (**RQ1**, Chapter 4). Emergency communications via social media were found *not* to be a priority for emergency responders during the response phase of the emergency management lifecycle. Instead, the results suggested that they *favour* social media to encourage preparedness, promote resilience building and develop relationships with the public. Subsequently, their key objectives and desired outcomes identified were assembled to form the framework: Social Media Outcomes and Key objectives for Emergency management (SMOKE) (Table 4.7).

Insights into who connects with emergency responders on social media, and their reasons for choosing to follow emergency responders were then presented (RQ2, Chapter 5). Social media were found to be facilitating two key, distinct emergency responder-follower relationships (emergency responder/public and emergency responder/emergency responder). They are valued as information hubs, and followers frequently engage but do not necessarily interact; relevant and reliable content is well received. Broadly, the followers' motives and willingness to engage were categorised into three groups: Information Listeners, Community Seekers and Collaborators.

Evidence has been produced that assists with the identification of the possible impacts upon emergency management resulting from emergency responders' social media use (RQ3, Chapter 6). Evaluations of impact were made in accordance with the SMOKE framework, suggesting that emergency responders in the UK are fulfilling five of their eight desired outcomes. Their efforts to engage the public and influence behaviour change through social media use is having some impact, but strategic improvements are required. Additionally, it was indicated that the level of reach so far attained is not considered 'large'. Nevertheless, the findings strongly suggested that emergency responders' social media use has the potential to be far greater than merely acting as a source of information and warranted further discussion.

In accordance with the Mixed Methods methodology of this thesis (outlined in Chapter 3), this chapter seeks to assimilate the findings of the previous three chapters and present a final discussion. The potential value of social media for emergency responders in the UK was found to depend upon emergency responders' intentions and online behaviour, in combination with the engagement and actions of their followers. This is summarised as a model of potential impact, which advocates three core roles that social media could play in order to produce value for emergency responders; from serving as an information hub, to being an educational platform, and ultimately a channel of influence and community spirit.

7.1 Value: A Combination of Emergency Responders' Intentions, Online Behaviour, and their Follower Engagement

Emergency responders do not have a sole purpose for using social media; rather they see various avenues to pursue across the phases of the emergency management lifecycle and cite a number of desired outcomes. Social media 'success' stories continue to appear in existing literature, for example: Ehnis and Bunker (2012), Watson and Finn (2014), Simon et al. (2014), Acar and Muraki (2011), Rizza and Pereira (2014) and Panagiotopoulos et al. (2016). However, this research has mapped the key objectives and desired outcomes of UK emergency responders into a conceptual, multifaceted framework: SMOKE.

SMOKE comprises three key objectives (KO): KOA – Preparedness and Resilience Building, KOB – Relationship Development, and KOC – Emergency Communications. Given that an overarching aim of social media was to engage the public in emergency management, the concept 'audience engagement' is a prominent component of all three objectives. The key objectives resemble and corroborate the results of a study in Kaminska and Rutten (2014), wherein social media activity by Canada's emergency management community was categorised into three main uses: (1) public information, (2) situational awareness, and (3) community empowerment & engagement. This suggests that such findings are not necessarily restricted to any particular region of the world. Further, the evidence emphasises that in addition to emergency communications, other common aims such as organisational PR, social engineering and building relationships with the public should be considered in future assessments of emergency responders' social media use.

SMOKE can not only assist with the understanding of social media usage in the context of emergency management, but it can help with the development of approaches to explore whether value is being created through social media in relation to emergency responders' objectives. The discussion in Chapter 5 found that followers' motives and willingness to engage are wide-ranging. Additionally, the impacts of social media usage uncovered in Chapter 6 vary. These independent findings, in correlation with SMOKE, demonstrate that assessing value is more complex than simply being able to quantify and present measures of 'success'. This was summarised specifically by one interviewee:

> *"How do we define success? We're scratching our heads about it."* – ***Fire Service Interviewee***

Opportunities of social media for emergency responders to gather and monitor information are ubiquitously documented in the literature (Vieweg et al., 2010; Lindsay, 2011; Hughes et al., 2014b; Plotnick et al., 2015). By contrast, few emergency responders interviewed as part of this research advocated this use. However, an interview theme alluded to pressures of available resource and a lack of governance; emergency responders are stretched thin and this is exacerbated during times of emergency.

> *"This whole social listening thing is the idea I've got which could become best practice, but there's not a lot of national guidance on this for building situational awareness"* – ***Local Authority Interviewee***

> *"It's good to be on it for the information we get, whether in my response role I would have the time to look at it, I doubt it to be quite honest"* – ***Police Force Interviewee***

> *"So there's obviously a monitoring element to it [...] It's a full time job that is for sure, for 2 or 3 people in a situation like that"* – ***Fire Service Interviewee***

These barriers appear to be inhibiting social media use for social media monitoring and information gathering activities, corresponding with findings of existing literature, for example Plotnick et al. (2015). Crucially, there is need for significant management and government 'buy-in' to assist these public bodies with exploiting the full potential of social media for emergency management. While some emergency responders have dedicated social media practice to their communications departments others are relying upon individuals and their interest to pursue social media for emergency management. Further, specific social media training appears to be rare and limited, covering merely the basics of social media rather than focusing on what methods will help achieve their social media goals:

> *"We do [have training], yes. Basically that's me, standing up in front of the team and saying 'This is how you use twitter, this is how you upload a photo, this is how you use YouTube and upload videos and then all our duty officers have access to action cards which we'll go through step-by-step as to how you put a post on twitter, or how you upload something on youtube etc.' So we do it internally."* – ***Local Authority Interviewee***

> *"We only just started last year, we did a little bit of social media but we didn't have a full time Comms. Manager."* – ***Ambulance Service Interviewee***

> *"Because I have an interest in the warning and informing group I tend to organise it. I keep an eye on social media stories"* – ***Local Authority Interviewee***

Increased support and funding is required as well as specific social media training; it may also be wise to delegate social media practice to professionals with communications and technological expertise, as recommended by Latonero and Shklovski (2011) and Meaton and Stringer (2013).

> *"Organizational support and political will to initiate and to support change is paramount if we are to see these kinds of services provided broadly, but it is also important for such organizations to recognize the function and value of information evangelists in their midst."* **- Latonero and Shklovski (2011)**

It emerged from the integrated observations and interviews with emergency responders that an overarching aim for their social media use was to generate engagement in the hope that it would have positive consequences for their other desired outcomes, mapped in SMOKE.

> *"You've got to start at the bottom level and get people engaged"* – ***Local Authority Interviewee***
>
> *"I think it's more about the engagement, you want people to be engaging with you"* – ***Ambulance Service Interviewee***
>
> *"We'd like to tailor the messages we put out there in order for the public to feel that they can engage with us"* – ***Local Authority Interviewee***

Referring back to the literature in Chapter 2, measuring features of interaction on social media can provide insights as to whether emergency responders' strategies for reaching and engaging an audience are successful (Ehnis and Bunker, 2012; Bruns et al., 2012; Hughes et al., 2014a; Guidry et al., 2017). However, consideration to the prevalence of bots, and fake or redundant accounts on social media, are rarely accounted for and can distort the meaning behind these measurements (Chu et al., 2010; Ferrara et al., 2016). Therefore, this research gathered insights into the types of users that have chosen to follow emergency responders before making such assessments of engagement. It was found that emergency responders are making progress with the generation of an audience on social media, and to an extent are reaching their target audience: members of the public. However, efforts to achieve one of the desired outcomes of SMOKE: *large public reach* (DO7), appeared inefficacious. Only 40% of followers in the follower audit (FA) data sample, and 56% of survey participants, were categorised as members of the public. 23% of the FA data sample comprised accounts that could not be identified or were believed to be a bot. However, the remainder of the FA sample included Businesses, Government/Council agencies and Emergency Responders. Such followers could indeed be valuable for building influence networks and helping spread awareness and important posts. Crucially, these results demonstrate the importance of emergency responders

identifying the extent to which their followership is made up of users that are both genuine *and* are part of their target audience. Further, emergency responders should aim to build a balanced followership of both their target audience and users that could help achieve their social media goals. A follower-profiling system could help emergency responders understand who are connecting with them as well as their ability to reach their target audience. Such tools do exist; free and paid versions[3], however, they are unlikely to discern how the activity patterns and differing styles of emergency responders correlate with achieving their specific objectives in SMOKE.

Interactive features of social media (e.g. replies, likes and hashtags) are popular measures used in the literature for interpreting social media impact and engagement as in Bruns et al. (2012) and Guidry et al. (2017). From the Twitter observations it was of note that the number of likes and retweets received compared with replies received were considerably higher. The survey responses in this research help to explain this observation; followers have a tendency not to visibly engage – the *Information Listeners*, but when choosing to interact, are more inclined to invoke the use of likes and shares rather than employ textual features such as comments and replies – the *Community Seekers* and *Collaborators*. This complements the findings of the multiple regression and correlation analyses. Posts including media and local content related to infrastructures and utilities appeared to be most effective for stimulating audience engagement (Parsons et al., in press), which is corroborated by existing literature. Guidry et al. (2017) found image-based platforms may be better suited to emergency responders given that image-based posts on Instagram elicited more engagement than textual posts on Twitter. Newly developed social media tools will undoubtedly have a bearing in this respect. For example, during this research period Twitter released the feature 'Go Live'[4], whereby users can create and post a tweet with live video. Such changes could potentially make platforms more attractive to emergency responders and thus alter engagement levels. Other changes, however, may not be so appealing. Companies create social media platforms based upon unique algorithms, complex logic and usage analytics. These technical elements will evolve and consequently engagement levels may be affected. For example, in 2016 Facebook altered its algorithm to highlight 'informative posts'; but the application of the algorithm was based upon a survey of users' personal interpretation of 'informative', meaning that posts with wide-ranging themes including 'recipes' and 'celebrity gossip' were highlighted in addition to posts concerning 'news'[5]. In 2016, Twitter's "life span" came under threat when a new algorithm was applied, changing the order of a user's timeline so as to present 'top' tweets which the user may have missed whilst offline[6].

[3]Examples of Free and Paid versions of Profiling tools to analyse Social Media Followers include: Social Audit Pro [Last Accessed August 2018], Demographics Pro [Last Accessed August 2018], Followerwonk [Last Accessed August 2018]

[4]Twitter Blog Post Following Release of 'Go Live' Feature [Last Accessed: August 2018]

[5]How Facebook Algorithms work in 2018 [Last Accessed: August 2018]

[6]How Twitter Algorithms work in 2018 [Last Accessed: August 2018]

Therefore, it is vital that efforts are made to ensure emergency responders are appraised of any developments, such as new features and technical changes incorporated by social media providers. This finding reinforces the need for dedicating social media practice to professionals with expertise in both communications and technology. Future works should consider how communication styles and practices of emergency responders might need to change across social media platforms, given their different functionalities, structures and features; specifically they should explore how such differences might affect the value created in relation to emergency responders' objectives and desired outcomes.

To some extent, publications have examined emergency responders' social media practices by categorising the content shared during an emergency, for example Ehnis and Bunker (2012), Denef et al. (2013) and Hughes et al. (2014a). Despite the attractive nature of social media for conversation and interaction, as asserted in existing literature (for example: Hughes et al. (2008), Simon et al. (2015), and Haataja et al. (2016), one-way messages were typically found to be popular and thus conclusions have suggested that emergency responders do not fully exploit these tools Ehnis and Bunker (2012) and Hughes et al. (2014a). However, the use of interviews in this thesis revealed that, contrary to existing literature, emergency responders do not consider two-way communications a priority. Crucially, followers of emergency responders were found to have similar views, substantiated by the small number of replies received, observed as part of the Twitter Observation Study. Several participants of the survey went on to suggest that social media are most valued for serving as a 'hub' of information between emergency responder and follower; breaking news and up-to-date local information were desired, and such posts appeared to have significant impact. Further, as noted above, the results of the survey showed that a significant portion of followers prefer to *'listen'* rather than participate in visible engagement Section 5.2.3; defined in this research as the group of *Information Listeners*. A substantial portion of survey participants (74%) claim to regularly read social media posts authored by emergency responders (Figure 5.8). Specifically, one participant summed this up:

> *'[Emergency Responder] is always posting about different jobs they go to. Normally tweets about the age, symptoms and what clinical pathway they chose. I tend not to repost or interact with the tweet, just read, digest the information and move on.'* [SP39]

The implications of these findings are twofold. Firstly, by simply delivering information, emergency responders are able to increase general awareness and enrich public knowledge. These are desired outcomes for two of the key objectives: A (Preparedness and Resilience Building) and C (Emergency Communications) of SMOKE. Secondly, they emphasise the importance of the *'listening'* community – the *Information Listeners* - and the value that is potentially created, substantiating the reports in Alexander (2014). It is thus important to understand emergency responders' choices of approach to adopting social media, their followers' expectations and what impacts such activity could have in relation to emergency responders' objectives. Further research should build upon SMOKE in order to establish methods for determining the levels of value that is being created. Moreover, interactions are merely *impressions*; a 'like' or 'share' does not necessarily constitute a "real-life" action. An emphasis should be placed on the need for future work that encompasses social media analytics in conjunction with other qualitative methods, similar to those employed in this research; a proposal reinforced by Stieglitz et al. (2014). It may prove sagacious for emergency responders to make use of public open days as an opportunity to glean information about social media usage, whilst promoting or distributing a survey similar to the one used in this study. Such events may help to stimulate a larger survey response rate, which in turn could provide further illuminating insights. Additionally, it is suggested that emergency responders could focus on improving methods by which they can increase the reach of their posts rather than trying to encourage direct engagement. For example, Twitter Alerts[7] was launched around the time of this research, whereby emergency management stakeholders can appoint their emergency tweets as an alert, which will then be sent as a push notification and SMS message to their followers' mobile devices. This could make Twitter more appealing to users for receiving information updates and thus impact levels of reach.

The literature recognises the opportunities of social media for emergency responders to encourage and increase public preparedness and resilience (Dufty, 2012, 2015; Hughes et al., 2014b). As discussed in Chapter 2, Dufty (2012) devised a framework depicting the 'goals and ways' that social media could help to build community disaster resilience, but there was no consideration of emergency responders' perceptions to affirm these aims and uses. Other research, for example Panagiotopoulos et al. (2016) and Guidry et al. (2017), used content analysis to identify what was said by emergency responders on social media so as to convey risks to the public. By means of a literature review and expert opinion, Dufty (2015) explored public awareness strategies communicated through social media, aimed specifically at promoting disaster risk reduction. These papers illustrate that popular uses of social media include promoting alertness, encouraging protective behaviour and guiding public attention towards mitigating actions. The question of whether these uses had any noticeable impact was unanswered.

[7] Twitter blog post: Introducing Twitter Alerts (2013) [Last Accessed: Sept. 2018]

The integrated observations and interview responses received during this research revealed that emergency responders were found to favour social media for preparedness and resilience, which formed key objective A in SMOKE and consolidates the findings in Dufty (2012), Dufty (2015), Panagiotopoulos et al. (2016) and Guidry et al. (2017). However, this thesis sought to build upon previous work by providing insights as to whether the use of social media for preparedness and resilience did indeed produce the desired outcomes. The results of the targeted survey revealed that emergency responders' social media activity appears to be effective in raising risk-awareness and encouraging people to better prepare. Conversely, their social media activity had much less of an influence over their followers' *"offline"* actions, including safety, prevention, and risk mitigation. Only 43% of participants stated that an emergency responder's social media posts had a bearing on their decision to actually change or improve a particular behaviour. Of this particular group of participants, it was discovered that such influence extended mainly to elements of social behaviour. For instance, 58% of the group indicated that they are encouraged to check on their neighbours in extreme weather conditions. Nevertheless, the qualitative data alludes to significant value being produced by the small number of followers – *the Collaborators* - who are encouraged to engage and choose to carry out the *"real-life"* action:

> *'Local fire service posted about dangers of 9volt batteries. I am now very careful how I dispose of them and I warn other people'* [SP6]
>
> *'I recall one or two fires in Southampton (one quite serious) and various times I've been able to prepare for severe weather (eg snow, strong wind).'* [SP20]
>
> *'I am more stringent about securing property.'* [SP81]
>
> *'I feel more informed and more able to keep myself and my friends safe.'* [SP98]

The quotations above illustrate how some participants were found to be collaborators who utilised information shared by emergency responders; they felt empowered to make decisions and take action, resonating with the findings of Bird et al. (2012). Here, empowerment is a reflection of individuals and communities being confident and in control of their actions related to emergency management. Whilst the survey carried out by Bird et al. (2012) was not specifically targeted towards the followers of emergency responders, they found Facebook had played an important role in sharing responsibility for reducing risk and facilitated community involvement (Bird et al., 2012). Emergency responders should therefore ensure that their social media usage is directed to where it can bring most value, encourage behaviour change, and exert influence. The network and connections that users have on social media allow content to propagate quickly and easily. Efforts should be made by emergency responders to increase the size of their desired audience. This could be achieved by increasing the number of awareness and action-based posts and exploiting the connections with followers categorised as being

either Government Agencies or Individual Emergency Responders (as found from the FA, Section 5.2.1). By exploiting these social ties, emergency responders could increase their reach and further extend their influence, thereby leading to the possibility of increased behaviour change.

An important impact of emergency responders' social media usage was for relationship development, which is key objective B in SMOKE. The emergency responders interviewed expressed the importance of building a sense of community with the public by using social media to raise organisational awareness. This was summarised specifically by one interviewee:

> *"It's also a good PR thing for us to say: 'here tax payer, this is what we're spending your money on, this is what it can do, and this is why you're safer."*– ***Fire Service Interviewee***

This resonates with findings of the existing literature. Briones et al. (2011) interviewed American Red Cross responders and found social media was considered to be useful for spreading awareness about the organisation. Haataja et al. (2016) surveyed emergency management experts who alluded to the use of social media to build trust between emergency organisations and users. Whereas these works have identified emergency responders' perceptions of social media for relationship development, responses from the survey in this research expanded upon this understanding by questioning the potential value that is created through social media usage in relation to this key objective. The following quote emphasises that positive impacts are being realised:

> *'I have learned a lot about what our emergency services do and I respect them enormously'* [SP6]

A new contribution to this field, however, was the suggestion of the potential value that could be created through social media use for relationship development between emergency responders themselves. Previous works have predominantly used social media analyses to focus specifically upon the impacts of emergency responders' usage for the public (Ehnis and Bunker, 2012; Bruns et al., 2012; Hughes et al., 2014a; Guidry et al., 2017). The methods used in this thesis allowed for the identification of social media value created by promoting feelings of community and support for individual emergency responders. By combining the results of the FA, whereby a group of followers were categorised as emergency responders, and the qualitative data collected from the targeted survey, individual emergency responders were found to make up a portion of emergency responders' followership, and look for *'support and companionship'* [SP28], *'morale boosting'* [SP66] and *support and confidence builder in my own practice* [SP36]. Many also sought for professional development: *'sharing*

ideas, learning new techniques, recognition within my field, chances to get involved in activities promoted through social media, awareness of the wider world's thoughts on pertinent issues' [SP63].

An awareness of the benefits produced by emergency responder/emergency responder relationships was not revealed during the interview study, perhaps due to the persons posting on behalf of the various emergency organisations failing to appreciate this impact; thus corroborating the earlier argument for increased governance and the delegation of social media practice, within emergency response organisations, to appropriately trained professionals. It is suggested that emergency responders may wish to integrate the finding into their future strategies and accordingly, it would be advised that SMOKE is adapted to include two new desired outcomes under Key Object B (Relationship Development):

> **Desired Outcome 9:** Feeling of Community and Support for Individual Emergency Responders
>
> **Desired Outcome 10:** Professional Development for Individual Emergency Responders

The above contribution strengthens the argument for research that takes the form of a mixed methods approach. Without the adoption of the methods utilised in this research, the discovery of such an important relationship would not have emerged. Further, it suggests the need for in-depth future work specifically focused upon exploring the potential value of this emergent relationship. Identifying what methods and which platforms are best suited to the needs of individual emergency responders warrants evaluation.

7.2 Model of Potential Value of Social Media for Emergency Responders

Figure 7.1 was derived from the discussion so as to provide an abstract model that depicts the potential value of social media for emergency responders. Based on the levels of effective social media use by emergency responders, and the relative size of their likely audience, it advocates three core roles social media could play in order to produce value for emergency responders: from an information hub to an educational platform and ultimately, leading to a channel of influence and community spirit. Whereas "success stories" have been the foundations of frameworks in existing literature, for example in Dufty (2012), Alexander (2014), Kaminska and Rutten (2014), this model reflects the followers' expectations and portrays the impacts that emergency responders' social media activity could have in relation to their key objectives and desired outcomes in SMOKE.

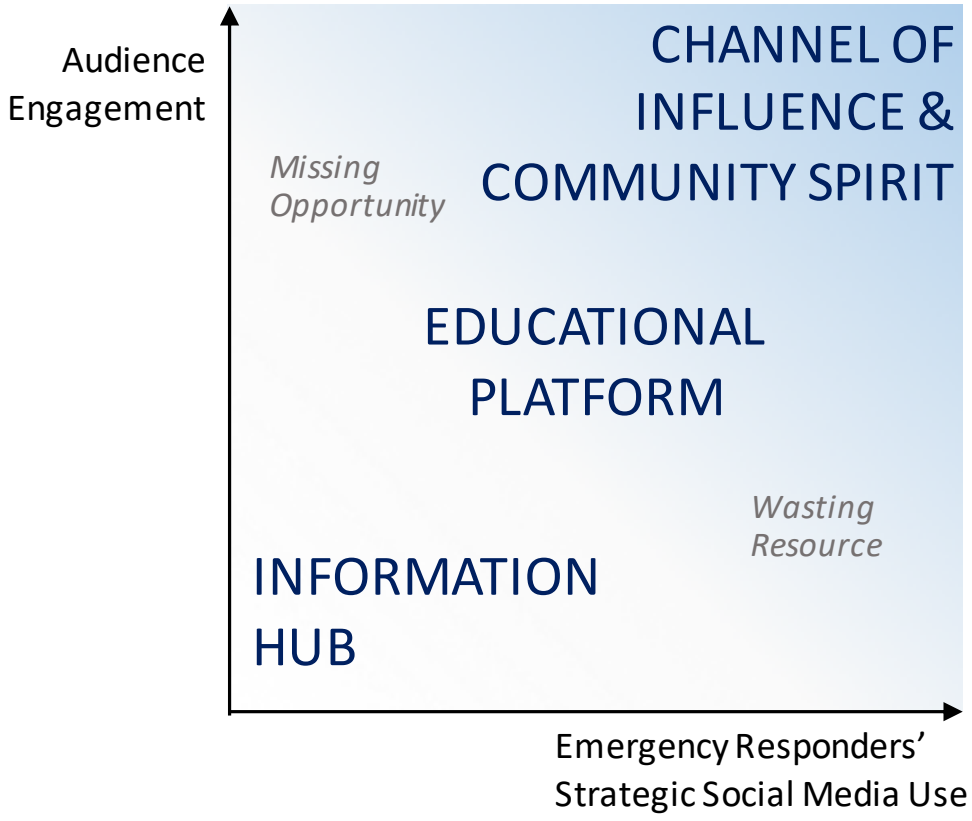


FIGURE 7.1: Model of Potential Value of Social Media for Emergency Responders

Information Hub

The basic level of impact, by which emergency responders' activity will merely be regularly informing their audience with *local* and *up-to-date* information that resonates with their audience. For the most part, engagement may not be visible, but it is important to consider the importance of the value created within the *'listening'* community of followers – *the Information Listeners*. The more active emergency responders are, the more likely the audience will be reached and retain the information shared. Using social media for this purpose is fundamental to providing quality content to their audience, empowering followers with increased general awareness and enriched public knowledge. Specific social media training would help direct emergency responders to social media features available for increasing the reach of their posts.

Educational Platform

A superior level of impact, formed by an increase in social media use by emergency responders, together with a willingness of the audience to engage. Posts that offer expert advice, and accounts with dedicated followers, are likely to achieve higher engagement levels and relationship development between emergency responder and follower. Generally, the audience will have something to *'take away'* by virtue of processing the information, offering opportunities for personal and professional growth as a result of the messages communicated; for example, a key campaign message or perceived understanding of a concept or issue. Leveraging other follower connections such as government agencies and businesses could be valuable for building influence networks and helping spread awareness and important posts.

Channel of Influence & Community Spirit

At the highest level of impact, emergency responders' use of social media *influences* the opinions and behaviour of their followers and fosters a sense of community. Here, community is considered as relationships built upon shared values, responsibilities, attitudes and interests. A group of followers - *the Collaborators* - are not only receptive to posts that enrich knowledge but are also more likely to act upon the advice or demands shared by emergency responders. This could take numerous forms, from changing perceptions of reputation to stimulating behaviour change for the better. While these outcomes are difficult to measure, understanding the quality of the online audience is fundamental to achieving influence; who they *actually* are, and the appropriate behaviours to influence. Strengthening relationships was a key objective that emergency responders had for using social media, which corresponds with a group of followers defined as Community Seekers. However, strategies should not only focus on the public, but should also look to facilitate posts of commendations that help to boost morale and offer comfort for individual emergency responders. This does, however, require a reasonably large community of engaged followers (particularly the Collaborators and Community Seekers) in order to help propagate awareness and encourage suitable behaviour.

7.2.1 Scope of Potential Social Media Value upon Emergency Management

It should be noted that by no means should social media be the only tools used for communication or to replace other traditional methods; they should be seen only as a mechanism to supplement emergency responders' communications toolkit. Social media are reliant on other technologies and network infrastructure. Access can be difficult in rural areas with low availability of electricity (Leetaru et al., 2013) and in times of crisis, regardless of the type of emergency; whether it be a cyber-attack, natural disaster or terrorist attack, it can be difficult to stay online. Power disruptions and blackouts can occur and network congestion can be a problem if too many people attempt to use their mobile devices. Damaged aerials, phone masts and cables can wipe out access to mobile or landline telecommunications and the internet which, depending on the extent of damage, can last for long periods at a time (Lindsay, 2011).

Further, social media users are *"skewed sub-sets of a global population"* (Halford et al., 2017). In 2013, there were 15 million Twitter users in the UK[8] (Statista, 2014). The estimated UK Population UK in 2013 recorded by Office for National Statistics (2018a) was: 53,865,800[9]. Thus, only 28% (estimated) of the UK's population had a Twitter account, and not all accounts would have actually been active. Additionally, many social media users tend to be of a particular demographic; according to the Office for National Statistics (2018b), it was observed that 16-24 year olds were the most likely demographic to use social media in the UK.

Nevertheless, this research has demonstrated that UK emergency management is benefitting from the added value created through emergency responders' social media use and their engaged followers.

[8]The number of users was ascertained from The Statistics Portal. Statista is leading provider of market and consumer data, offering access to statistics, consumer survey results and industry studies.

[9]UK population estimation was retrieved from the Office for National Statistics. This is the UK's largest independent producer of official statistics and the recognised national statistical institute of the UK.

7.3 Chapter Summary

In accordance with the Mixed Methods methodology of this thesis, this chapter has integrated the findings of the previous three chapters to present a final discussion on the potential value of social media for emergency responders in the UK.

Social media value depends on emergency responders' intentions and online behaviour, in combination with the engagement and actions of their followers. This is summarised as a model of potential impact, which advocates three core roles that social media could play in order to produce value for emergency responders; from serving as an information hub, to being an educational platform, and ultimately a channel of influence and community spirit.

In order for emergency responders to increase their capabilities and maximise the potential value of social media as depicted in the model, it would seem that emergency responders should seek to increase the number of collaborators amongst their followers.

Social media are ever evolving. Whilst some guidance has been produced by UK Government on how to use social media for emergency management the tips and advice are outdated. Crucially, there is need for significant Management and Government 'buy-in', formal guidance and training to assist these public bodies with exploiting the full potential of social media for emergency management. Additionally, it may be wise to delegate social media practice to professionals with communications *and* technological expertise.

Chapter 8

Conclusion

Under the Civil Contingencies Act (2004) emergency responders in the UK aim to protect and support communities. As part of their responsibilities under the Civil Contingencies Act (2004), emergency responders are obligated to inform, advise and educate communities about potential risks and the steps they can take to mitigate them. Further, emergency responders must also provide information and advice as necessary at the time of the emergency based on the premise that a well-informed public is better able to respond to an emergency and help to minimise the possible consequences (Cabinet Office, 2013c). Such advice ranges from direction on how to acquire help and assistance to recommendations of precautionary safety measures and guidance on how to stay healthy and avoid health hazards (Cabinet Office, 2013a).

Over the last decade, social media have evolved to become an important part of emergency management communications. In the UK, social media usage is not stipulated within emergency responders' job descriptions, but their use of these tools has been acknowledged (Cabinet Office, 2013a). Many, if not all, have accounts on various social media platforms, and have been found increasingly to use social media for emergency management activities. For example, on 3rd June 2017 London Bridge and Borough Market were targeted by a terrorist attack. Emergency responders initialised their emergency response plan which included directing people to their Twitter feeds to receive the latest information and progress updates as well as messages of support[1]. As a preventative measure, Hampshire Fire and Rescue exploited Twitter as part of their targeted campaign - #INeedMySpace - aimed to increase motorists' awareness of the need to park safely, sensibly and change their behaviours accordingly[2]. However, the actual impacts achieved and the value generated from UK emergency responders' social media use remains relatively

[1]Local Government Association Case Study (June, 2018): Southwark Council: responding to the London Bridge and Borough Market terror attacks [Last Accessed: Sept, 2018]

[2]Local Government Association Case Study (Nov. 2017): Hampshire Fire and Rescue Service – #INeedMySpace driving education campaign [Last Accessed: Sept, 2018]

inconclusive; 'success stories' have been the foundations for justifying and promoting social media use.

Whether social media are a worthwhile investment for emergency responders is a complex question. Social media in emergency management encompasses not only the content that is shared through these technologies, but who it is reaching, how it is used, and if it is effective in achieving emergency responders' goals and objectives. As discussed in Chapter 2, there is ambiguity amongst the existing literature as to what extent emergency responders are indeed using social media for emergency management activities and how it affects their primary duties. There exists a lack of clarity as to who are using social media, whether appropriate training is given, and if adequate governance exists. This research aimed to bridge these gaps by considering the perceptions of both emergency responders and their followers, thus providing evidence about the possible impact of social media upon emergency management. The overall research goal, outlined at the start of this thesis, was to explore the potential value of social media for UK emergency responders, and subsequently three research questions were devised:

RQ1: How, and why, are emergency responders in the UK utilising social media?

RQ2: Why do users follow and engage with emergency responders on social media?

RQ3: What are the potential impacts upon emergency management in the UK resulting from the use of social media by emergency responders?

This chapter presents a summary of the investigations performed as part of this research together with the findings that emerged. The contributions made by this thesis are charted, leading to recommendations and proposals for future work.

8.1 Findings Summary

Different perspectives were needed in order to satisfy the research goals of this thesis. Thus, a Mixed Methods Triangulation approach was required. The research methodology was split into three phases and was comprised of five studies (Semi-Structured Interviews, Twitter Observations, Follower Audit, Targeted Survey and Statistical Analyses). Firstly, it was important to better understand emergency responders' perceptions of social media and what they desire to achieve through the use of these tools; ascertaining their strategies for accomplishing these objectives was necessary. Secondly, it was vital to consider the motivations of their followers and explore their reasons for connecting with emergency responders on social media. Lastly, it was necessary to identify indicators that demonstrate social media is fulfilling the aspirations and desires of the two user groups.

8.1.1 Emergency Responders' Social Media Usage

The integration of quantitative observations and qualitative semi-structured interview data was employed to provide answers to **RQ1** of this research. Encouraging public engagement in emergency management was found to be the overarching aim of emergency responders for using social media. They consider social media to be useful tools. In particular, increasing public preparedness and resilience building, relationship development, and enhancing emergency communications were key motivations for the adoption of the technology by responders. A common issue that was reported during the interview process was the struggle to identify if, and how, their social media efforts have any impact.

It was observed that communication through social media during the emergency response phase was not a priority for all emergency responders, and its use varied significantly. Pressures of resource and a lack of governance appear to be strongly linked to this variance. Emergency responders appear to favour and prioritise social media for resilience and relationship building. Therefore, in order to better understand the value of emergency responders' social media activity, assessments needed to go further than merely judging emergency responders' ability to effectively communicate in an emergency. Their ability to influence behaviour and perceptions towards risk, build public trust, and raise organisation awareness, also needs to be examined. These elements led to the development of the framework: Social Media Outcomes and Key objectives for Emergency management (SMOKE) – see Table 4.7 in Chapter 4. It encapsulates three key objectives (KOA - Preparedness and Resilience Building, KOB-Relationship Development, and KOC - Emergency Communications) and eight desired outcomes. These key objectives resembled the results of Kaminska and Rutten (2014), wherein social media activity by Canada's emergency management community was categorised into three main uses: (1) public information, (2) situational awareness, and (3) community empowerment & engagement, suggesting that such findings are not necessarily restricted to any particular region of the world.

8.1.2 Followers' Perspective on the Value of Social Media for Connecting with Emergency Responders

A Follower Audit and targeted Survey contributed to an overall understanding of the role social media plays in the relationship between emergency responder and follower, and helped to elicit the potential value created through the use of these tools, answering **RQ2** of this thesis. It gave an insight into the types of users that follow emergency responders on the social media platform, Twitter; 13 user categories were identified, with a significant portion (40% of users in the sample) falling under the category: 'Member of the General Public' (Section 5.2.1). This suggests that

emergency responders are, to an extent, obtaining connections with their desired audience. Future efforts and strategies should seek to increase their target followership in order to increase the probability of realising intended outcomes. Nevertheless, many other user types, including business accounts, individual emergency responders and Government Agencies, make up a notable part of their followership.
The targeted survey sought to uncover insights into the followers' motivations and perceptions for connecting with emergency responders via social media. Coupled with the Follower Audit (FA) data, social media were found to be facilitating *two* key distinct relationships, each having varying needs and goals:

- Emergency Responder/Public
- Emergency Responder/Emergency Responder

Whilst many participants primarily follow emergency responders for breaking news and local, up-to-date information, it can also help to foster feelings of community and support for those individual emergency responders who choose to follow their peers. In Chapter 5 for example, a theme that emerged from the qualitative responses was the expectation of *'feeling part of a community'* [SP21]. Participants' expectations revealed that social media are undeniably effective in fostering feelings of *'support and companionship'* [SP28] and they hope for *'morale boosting'* [SP66]. Other participants view social media as a place that facilitates *'mental health support for emergency responders'* [SP29] and the *'feeling of family'* [SP38].
The followers' overriding need for enlightenment led to the second finding that social media are most valued when serving as information hubs. As shown in Section 5.2.2, this was summarised particularly well by one survey participant: *'Social media are the best way to get immediate updates without television or radio access'* [SP98]. Followers were found to engage frequently with emergency responders but are less likely to interact (Section 5.2.3). However, there is considerable value to be gained by those who merely *'listen'* to what emergency responders have to say on social media, with levels of engagement dictated by relevant, timely and reliable content (Figure 5.9, Chapter 5).

Broadly, the followers' motives and willingness to engage allow them to be categorised into three groups of followers: Information Listener, Community Seeker and Collaborator (Section 5.3), which resonates with the findings of Li et al. (2007) who categorised the levels of participation by users of Web Technologies.

A significant portion of emergency responders' followers were found to be *'Information Listeners'* – they utilise social media as a way to seek information provided by emergency responders, but tend not to visibly interact, particularly through textual features. Another set of followers were those who seek feelings of *'Community'*; here,

community is considered as relationships built upon shared values, responsibilities, attitudes and interests. A significant portion of participants were found to value social media use by emergency responders to aid their development through the building of both professional and personal relationships. A small subset of followers emerged and comprised a third group: the *'Collaborators.'* These were followers found to be receptive to posts aimed at educating and enriching knowledge. It is important to emphasise that these groups have no fixed boundaries; a follower could shift between groups dependent upon the emergency responders they are following and the subject matter of that emergency responder's posts.

8.1.3 Impact of Emergency Responders' Social Media Usage

To better comprehend and answer RQ3, results of statistical analyses, the follower audit (FA) and the targeted survey were drawn upon. Here, impact was evaluated based upon the successful attainment of the desired outcomes in SMOKE.

Statistical analyses facilitated an examination of engagement levels through Twitter between emergency responders and their audience during the Winter Floods 2013/14, which proved to be insightful. Whilst social media users did visibly engage with emergency responders on Twitter, the content of posts that prompted engagement varied significantly. Multiple regression analyses in Section 6.1 showed that tweets about affected infrastructures and utilities, as well as those that contained an element of media, appeared to be the most effective for generating audience engagement. By strategically developing their social media activity to include these areas of user interest, emergency responders could potentially increase levels of engagement.

The second part of the targeted survey, distributed to emergency responders' followers, exposed findings regarding the impact on followers' behaviours and opinions in the context of emergency management. Complemented by results of the FA, Twitter observations and interview quotes, emergency responders' social media usage was found to have particular influence on improving individual and community safety, raising public awareness and helping users to better prepare and be more risk-adverse. For example, in Section 6.3 participants explained that they are *'more mindful about the 2 second gap between cars after seeing a reminder picture'* [SP86] and *'more stringent about securing property'* [SP81].

Followers were found to be developing an empathy towards emergency responders, indicating relationship building: *'I have a better understanding of this often-overlooked group of public servants'* [SP67] (Section 6.2). Crucially, relationship development was found not to be confined merely to bridging connections between emergency responders and the public, but also links emergency responders themselves. Finally, whilst emergency responders' social media use appeared only to have an influence on a

portion of survey participants, the findings present promise for the value produced by the small number of followers who choose to engage and subsequently change their behaviour, the *Collaborators* (illustrated in Figure 6.13, Chapter 6).

The results from Chapter 6 strongly suggest that the impact of emergency responders' social media usage has the potential to be far greater than merely acting as a source of information. Rather, it plays a significant role as a platform for exchanging skills and expertise between emergency responders in addition to influencing people's behaviours, attitudes and opinions.

8.1.4 Potential Value of Social Media for Emergency Responders

The findings of the results chapters were combined to form a final discussion on the potential value of social media for emergency responders in the UK; the goal of this thesis. Social media value was found to depend on emergency responders' intentions and online behaviour, in combination with the engagement and actions of their followers. This was summarised as a model of potential impact (Figure 7.1, Chapter 7), which advocates three core roles that social media could play in order to produce value for emergency responders. At the basic level of impact, social media use serves as an information hub by which emergency responders' activity will merely be regularly informing their audience with local and up-to-date information that resonates with their audience. This basic level is fundamental to providing quality content to their audience, empowering followers with increased general awareness and enriching knowledge. A superior level of impact, formed by an increase of social media use by emergency responders, together with a willingness of the audience to engage, leads to social media becoming an educational platform. Generally, the audience will have something to *'take away'*, offering opportunities of personal and professional growth as a result of the messages communicated: for example, a key campaign message or perceived understanding of a concept or issue. At the highest level of impact social media evolve to be a channel of influence and community spirit. Emergency responders' use of social media influences the opinions and behaviour of their followers and fosters a sense of community. This does, however, require a reasonably large community of engaged followers (particularly the Collaborators and Community Seekers) in order to help propagate awareness and encourage suitable behaviour. In order for emergency responders to increase their capabilities and maximise the potential value of social media as depicted in the model, they should seek to increase the number of collaborators amongst their followers. Social media are ever evolving. Whilst some guidance has been produced by the UK Government on how to use social media for emergency management, the tips and advice are outdated. A set of recommendations to support UK emergency responders is provided in Section 8.3.

8.2 Contributions

In view of the findings presented in this work, this thesis makes five key contributions to the field of social media in emergency management research:

1: A description of key objectives and desired outcomes for adopting social media from the emergency responders perspective.
This research focused on the emergency responders' perspective to determine what they actually want to achieve through their use of social media. There has been a lack of consideration given to the emergency responders' perspective until recently, with the majority of research favouring examinations of the types of messages distributed on social media by emergency responders. Emergency responders represented in this research have a range of objectives for using social media. Importantly, communication in the emergency response phase are not a priority for all emergency responders. Instead, they favour social media to encourage preparedness and resilience building and develop relationships with the public.

2: A conceptual, multifaceted framework for mapping objectives to outcomes - SMOKE.
SMOKE (Table 4.7) encompasses UK emergency responders' key objectives and desired outcomes. It serves two purposes: firstly, as a guideline for future systematic assessments of emergency responders' social media activity, by utilising the desired outcomes as tangible measures of impact; secondly, as a training and strategy tool for emergency responders, acting as checklist to help guide their social media activity and self-assessments.

3: A description of emergency responders' audience on social media; an exploration of their views and motivations for following.
This research has provided insights into the types of users who choose to follow emergency responders on social media and their motives and willingness to engage. There was a need to clarify who are engaging with emergency responders on social media and whether emergency responders posts do indeed reach their target audience, which has had little attention in existing research thus far. The integration of the findings from the follower audit, together with the survey responses, allude to the fact that users' reasons for following and engaging with emergency responders vary. Notably, only a portion of followers are in fact the emergency responders' intended audience and a number of their followers are individual emergency responders who look for community spirit and support from their peers. Broadly, the followers' motives and willingness to engage allow them to be categorised into three groups of followers: Information Listener, Community Seeker and Collaborator.

4: Empirical evidence of impact upon emergency management resulting from social media use by emergency responders.
Evaluations of impact in accordance with the SMOKE framework have given an insight into the potential value of social media based on what emergency responders actually want to achieve, whereas existing literature often examines usage and interactions *only* during the period of an emergency and rarely consider the extent of the reactions generated.

5: A model of value incorporating the understanding gleaned from contributions 1-4 above.
A model of potential impact was presented (Figure 7.1), illustrating the possible value of social media usage by emergency responders. Based upon emergency responders' efforts and strategies, in combination with their followers' willingness to engage, its impact could range from being an information hub, to an educational platform or at the highest level, a channel of influence and community spirit. Whereas "success stories" have been the foundations of frameworks in existing literature, this model reflects the followers' expectations and portrays the impacts that emergency responders' social media activity could have in relation to their key objectives and desired outcomes in SMOKE.

8.3 Recommendations

The role of social media in emergency management is ever evolving. The importance placed on utilising social media as a way to seek information and feelings of community spirit and support provided by emergency responders suggests an increasing assumption and dependence that emergency responders will have, and continue to have, a social media presence. Undoubtedly, emergency management in the UK is benefitting from the added value being created by emergency responders' social media use and their engaged followers. However, given that emergency responders do not prioritise social media use during the emergency response phase, there could be potential for a missed opportunity. Moreover, whilst the findings do present great promise for shaping attitudes and initiating behaviour change through social media, influence would appear to be confined to a relatively small number of followers. Whilst these tools should only be viewed as a mechanism to supplement emergency responders' communications toolkit, a collection of recommendations has been developed on the basis of the research presented in this thesis and the related literature. They intend to offer guidance to assist emergency responders with maximising to the full the potential of social media for emergency management in the UK:

1: Increase governance to help institutionalise social media practice, policy and plans in emergency management.
There is a need for significant management and government 'buy-in'. Increased support and funding will be required with more resources needing to be allocated, particularly for meeting demands during the emergency response phase. Establishing and defining their goals and aims is important but policies and guidelines should be agile. This will help to provide structure, direction and coherence whilst allowing for adaption as objectives and desired outcomes evolve.

2: Feasibility assessments to be carried out and logistics regularly reviewed.
Emergency responders and their available resources are evidently under intense pressure and this is exacerbated during times of emergency. As a prerequisite of recommendation (3), feasibility assessments should be carried out so as to assess the practicality and scope of incorporating social media during emergency situations without compromising the responders' primary duties.

3: Dedicate personnel and establish social media roles and responsibilities.
The expectations resulting from emergency responders' social media usage continue to grow. Therefore, emergency organisations need to appoint dedicated personnel, who are both knowledgeable of social media technologies and confident in their use. These personnel should be fully responsible for the organisation's social media activity, and this responsibility should be clearly outlined and recognised as part of the emergency responders' job description.

4: Utilise SMOKE to develop and guide social media practice.
SMOKE is based on a set of emergency responders' shared key objectives and desired outcomes, which could serve as a form of a checklist to initiate and guide their social media practice. It allows for the adaption of objectives and the evolution of desired outcomes. SMOKE could be developed so as to provide assistance with the future governance of social media within emergency management.

5: Regular social media training provided to ensure emergency responders are apprised of social media developments.
Social media are ever evolving. It is vital that efforts are made to ensure emergency responders are apprised of any developments, such as new features and technical changes incorporated by social media providers. This also advocates the idea of dedicating social media practice to professionals with expertise in both communications and technology. Additionally, SMOKE could be used as a training aid and help promote multi-agency collective efforts to inform, advise and educate communities.

6: Social media integrated into response training exercises.
The use of social media could be integrated into response training exercises, possibly incorporating a tool that simulates social media activity.

7: Social media strategies need to be revised and improved upon to help emergency responders promote their aims to wider audiences and generate further engagement.
Emergency responders should focus on improving methods by which they can increase the reach of their posts rather than trying to encourage direct engagement. They should ensure their social media usage is directed to where it can bring most value: encouraging behaviour change and exert influence. They should seek to increase the number of Collaborators amongst their followers. This can be achieved through an improved strategic approach to social media use. Increasing the use of photos and videos in posts and delivering content related to Infrastructure and Utilities, particularly during emergencies, is likely to achieve higher levels of engagement.

8: Emergency responders should aim to build a balanced followership of both their target audience and users that could help promote their social media goals.
Increasing the number of awareness and action-based posts, and leveraging the connections with followers categorised as Government Agencies could increase the reach of their posts and further extend their influence. A follower-profiling system may help emergency responders understand who are connecting with them as well as their ability to reach their target audience. Perhaps emergency responders should refocus one of their desired outcomes from that of reaching a large audience (DO7 of SMOKE), to ensuring instead that their follower network comprises members of their local community, including their peers.

9: Adapt SMOKE so as to support individual emergency responders seeking a sense of community and support.
It was evident from this research that individual emergency responders seek a sense of community and support from their peers through social media and utilise these tools for exchanging skills and expertise. It is advised that strategies devised consider stakeholders other than members of the general public and that SMOKE is adapted to include two new desired outcomes under Key Objective B (Relationship Development):

> **Desired Outcome 9:** Feeling of Community and Support for Individual Emergency Responders
>
> **Desired Outcome 10:** Professional Development for Individual Emergency Responders

10: Emergency Responders should utilise public open days to gain feedback about their social media usage.
This could be achieved by promoting or distributing a survey similar to the one used in this study (Appendix C). Such events may help to stimulate a larger survey response

rate, which in turn could provide further illuminating insights into the impacts of their social media use.

8.4 Future Work

This thesis has indicated a number of possible directions where future work could build upon this exploratory research. Investigations into the value of emergency responders' social media use are both rare and complex.

Many industries use social media to increase product sales, whilst other organisations adopt them to fundraise. Such uses offer opportunities to quantitatively measure success. By contrast, the value of emergency responders' use of social media is much more difficult to quantify. As iterated under governmental policy, emergency responders aim to protect individuals and communities; much of their social media activity derives as a consequence, with many of their desired outcomes related to perceptions and behaviour in the 'offline' world (real-life action). It is vital that these outcomes are accounted for in impact assessments. This thesis provides guidelines for assessing the value of emergency responders' social media use. SMOKE (Table 4.7) not only assists with understanding social media usage in the context of emergency management, but can help with the development of approaches to explore whether value is being created through social media in relation to emergency responders' aims. Measuring added value is more complex than simply being able to quantify and present measures of 'success'. Such measures will be limited to generic representations that demonstrate only *processes* of use, with little context to the emergency responder or emergency event in question. The fact that many followers tend not to visibly interact, particularly through textual features is also a problem. Utilising a Mixed Methods approach to exploit social media analytics in conjunction with other qualitative methods, similar to those employed in this research, is vital; a proposal reinforced by Stieglitz et al. (2014). Crucially, future assessments must go further than merely judging emergency responders' ability to effectively communicate in an emergency. Their ability to influence behaviour and perceptions on social media (for example raising risk awareness and improving reputation) also needs to be examined. Such investigations would be difficult to conclude without semantically meaningful data. There is potential for the survey study of this thesis to be replicated and distributed by all emergency responders, thus gaining a larger response rate and permitting a deeper impact assessment to be performed. In a similar vein, logistics led to the interview process being confined to a specific geographical area. Future work could seek to test SMOKE across a wider range of LRFs.

SMOKE demonstrates that emergency responders' key objectives for social media vary. Whilst the interviews and surveys captured perceptions and strategies of both emergency responders and their followers across the many global applications, future work should make detailed comparisons between these social media platforms. Greater collaboration between academia and the social media companies may yield opportunities to utilise their data banks to conduct more quantitative and in-depth comparisons. Additionally, research could further investigate how communication styles and practices might change between social media platforms given their different functions, structures and features, and explore how such differences might affect the value created in relation to emergency responders' objectives and desired outcomes.

This research discovered that through the use of social media, emergency responders create value for their colleagues and peers by providing a sense of community and support. There is a need for future work specifically focused upon an in-depth exploration into this potential value. Identifying what methods and which platforms are best suited to meet the needs of individual emergency responders warrants investigation. How should emergency responders strategise their activity to appease both audience types? Are specific platforms better adapted towards the public, whilst others are more beneficial to the emergency management community? Do emergency organisations in the UK need private and internal tools to help support and foster the community spirit that individual officers desire? These are but a few of the emerging questions that need to be explored.

8.5 Concluding Statement

Social media has the potential to produce significant value for emergency management. This value is dependent upon a combination of emergency responders' intentions, online behaviour, and the engagement and actions of their followers. The adoption of SMOKE provides a systematic structure to determine the value of social media in emergency management and help emergency responders maximise impact in relation to their aims and followers' expectations. Social media should complement rather than replace traditional methods for communications. The implementation of the recommendations made in this thesis could facilitate the fulfilment of a constructive and, more importantly, *valuable* utilisation of social media for emergency management in the UK.

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Appendix A

Questionnaire to Recruit Emergency Responders for Interview

This questionnaire aimed to acquire emergency responders based in the UK for the interviews study. A few questions on their use and perceptions of these tools were collected.

Section 1: Your Details

1. Name:
2. Please select your Age group (18-24, 25-39, 40-55, 55+):
3. Please state the organisation you work for:
4. Can the organisations' name be published? If no, your organisation will be kept anonymous. (Yes/No)
5. What is your job position:
6. Is your organisation involved in a Local Resilience Forum (LRF)? (Yes/No)
   (a) If Yes: Please state which one/s:
7. Does your organisation use social media? (Yes/No) **IF YES:**
   (a) How long has the organisation used social media (under a year, 1 year, 2-3 years, more than 3 years, unknown)
   (b) Is it managed by a Social Media team or left to the individuals? (Team, Individuals)

(c) Which platform/s are used? (Twitter, Facebook, Flickr, Youtube, Other - please state)

(d) Does your organisation have a set policy for social media practice in emergency management? (Yes/No)

(e) Do you believe your organisation has an impact on the community by using social media during an emergency? (Yes/No)

(f) In your opinion, how do you rate the use of social media for emergency management? (5 = Very useful, 1 Not useful)

(g) Do you think, if used correctly and appropriate, social media could play a role in enhancing emergency response? (Yes/No)

Interview Participation

1. Thank you for providing your answers to the above questions. I would like to conduct interviews to investigate these research questions in depth. Would you be happy to participate in an interview? We will arrange it to suit your needs - it can be face-to-face or virtual (e.g. telephone or Skype.) *(Yes/No)*

   (a) **IF YES:** Could you please select which preference you'd have (Face-to-Face/Skype/Telephone)

   (b) Please provide an email address I can contact you on. I will not use this email address for any other purposes, and I will not pass it on to anyone else.

   (c) Please confirm you're happy for me to contact you via email to arrange the interview(*Yes/No*)

      i. *[tickbox]* Yes I am happy for you to contact me in the future to arrange the interview I have agreed to participate in.

      ii. Email:

Appendix B

Interview Codebooks

Code ID	Name of Codes
1.	**Reasons for Social Media Presence**
	Reasons Emergency Responders believe their Organisation has a Social Media Presence
1.1.	**Reasons for Using Social Media**
	Why Emergency Responders use social media
1.1.1.	**Motivations for Using Social Media**
	What Emergency Responders use social media for
1.1.1.1	**Motivations for Using Specific Social Media Platforms**
	Reasons Emergency Responders use specific social media platforms
1.1.1.2.	**Advantages of specific Social Media Platform Features**
	Social Media features Emergency Responders state as motivation for using a specific Social Media platform
1.1.2.	**Incentives for Using Social Media**
	Factors that the Emergency Responders are influenced by to use social media
1.1.3.	**Perceived Value of Social Media**
	How Emergency Responders believe social media benefits the organisation
1.1.4.	**Desired Return of Investment**
	What Emergency Responders want in return from using Social Media
1.2.	**Reasons for Adopting Social Media**
	Why Emergency Responders adopted social media
1.2.1.	**Drivers for adopting Social Media**
	Factors that influenced Emergency Responders decision to adopt
1.2.2.	**Social Media Vision**
	Aspirations of what Emergency Responders want to achieve

Table B.1: Codebook 1: Reasons for Social Media Presence

Code ID	Name of Codes
2.	**Social Media Management**
	How Emergency Responders manage Social Media
2.1.	**Set Up**
	How social media use is organised and arranged
2.1.1.	**Platforms Registered With**
	The Social Media platforms emergency responders are registered with
2.1.1.1	**Number of Accounts and Purpose**
	How emergency responders strategise the set up of social media
2.2.	**Administration**
	How Emergency Responders administer social media
2.2.1.	**Users**
	Who uses social media on behalf of the organisation
2.2.2.	**Working Hours**
	The working hours emergency responders state the organisation operates on social media
2.2.3.	**Resources for Using Social Media**
	Resources Emergency Responders state they use to support social media usage
2.2.3.1.	**Software**
2.2.3.2.	**hardware**
2.3.	**Preparation**
	How Emergency Responders prepare social media use

Table B.2: Codebook 2: Social Media Management

Code ID	Name of Codes
3.	**Social Media Strategy**
	How Emergency Responders are currently using Social Media
3.1.	Posting Strategies
	Strategies for posting on social media used by emergency responders
3.1.1.	**Types of Content**
	The types of content Emergency Responders state they post on social media
3.1.2.	**Post Themes**
	Themes Emergency Responders state they use to tailor posts/messages on social media
3.1.3.	**Language Style**
	Use of language Emergency Responders state they exploit on social media
3.1.4.	**Tone**
	Tone of messages Emergency Responders attempt to portray on social media
3.1.5.	**Persona**
	How Emergency Responders wish to come across on Social Media
3.2.	**Methods**
	Specific procedures the Emergency Responders state they conduct on social media
3.2.1.	**Communication Strategy**
	How Emergency Responders communicate on social media
3.2.1.1.	**Communication Models**
	Communication processes emergency responders state to uphold on social media
3.2.1.2.	**Types of Communication**
	Types of communication Emergency Responders state they execute on social media
3.2.2.	**Methods for Collecting Information from Social Media**
3.2.3.	**Social Media Techniques**
3.2.3.1.	**Frequency of Use**
3.2.4.	**Audience**
3.2.4.1.	**Target Audience**
3.2.4.2.	**Perceived Audeince**
3.2.5.	**Use of Social Media Platform Features**
	Social Media features that Emergency Responders state they use
3.2.6.	**Methods for Promoting Social Media**
	How the Emergency Responders promote that they are on Social Media
3.3.	**Approaches**
	How Emergency Responders tackle social media
3.3.1.	**Specific Social Media Platforms Approach**
3.3.2.	**Social Media Priority**
	How the Emergency Responders prioritise social media
3.4.	**Possible Future Strategy/Needs**
	How emergency responders believe they will strategise social media use in the future
3.5.	**Anecdotal Evidence of Social Media Use**
	Evidence of how Emergency Responders have used social media

Table B.3: Codebook 3: Social Media Strategy

Code ID	Name of Codes
4.	**Perceptions of Social Media Impact**
	Perception of Impact Emergency Responders believe their social media activity achieves
4.1	**Perceived Impact**
	What the Emergency Responders believe the use of Social Media impacts
4.1.1.	**Anecdotal Evidence of Perceived Impact**
	Stories Emergency Responders used to support their perception of Social Media Impact
4.1.2.	**Perceived Level of Impact**
	The extent to which the Emergency Responders believe their social media activity is effective
4.1.2.1.	**Confidence in Level of Social Media Impact**
4.1.3	**Perceived Impact on Organisation**
4.2	**Perceived Measures of Impact**
	How the Emergency Responders believe they can measure the organisations social media impact
4.2.1	**Perception of Measuring Impact**
	How Emergency Responders describe measuring social media impact
4.3	**Perceived Requirements for Using Social Media to Increase Social Media Impact**
	What Emergency Responders believe they require to increase chances of making an impact through the use of social media
4.4.	**Perceived Use of Social Media Features for Increasing Social Media Impact**
	How Emergency Responders interpret the use of of Social Media features for increasing chances of having an impact
4.5.	Perceived Strategies for Increasing Social Media Impact
	Strategies to using Social Media the Emergency Responders believe will increase chances of having an impact
4.5.1.	**Perceived Approach that Should be Employed**
	Perceived approach that should be employed when using social media
4.5.2.	**Perceived Message Tone that Should be Used**
	Perceived tone of messages the emergency responders believe they should use
4.5.3.	**Perception of How often Posts Should be Made**
	How often emergency responders believe they should post
4.5.4.	**Perceived Length of Posts**
	How long emergency responders believe their posts should be
4.5.5.	**Perceived Availability**
	How available emergency responders believe they should be on social media
4.5.6.	**Perception of how to build Following**
	How emergency responders believe they can build a following
4.5.7.	**Perception of how to exploit social media**
	How emergency responders believe they should exploit social media

Table B.4: Codebook 4: Perceptions of Social Media Impact

Code ID	Name of Codes
5.	**Perceptions of Social Media Experience**
	How the Emergency Responders experience and cope with Social Media
5.1.	**Perception of Organisations Social Media Presence**
	How emergency responders' perceive the organisations social media presence
5.1.1.	**Perception of Social Media Activity**
	How emergency responders' perceive the organisations social media activity
5.1.2.	**Perception of Users Social Media Ability**
	How emergency responders' perceive the users of the organisations social media ability
5.1.3.	**Perception of Social Media Profile/s**
	How emergency responders' perceive the organisation's social media profiles
5.1.4.	**Level of Confidence shown towards social media**
	Level of confidence emergency responders showed towards using social media
5.1.	**Perception of Organisations Social Media Presence**
	How the emergency responders' perceive the organisations social media presence
5.2	**Perception of Social Media**
	How emergency responders perceive social media
5.2.1.	**Understanding of Others Attitudes towards social media within Organisation**
	Opinions towards social media by other staff within the organisation
5.3.	**Perception of Using Social Media**
	How emergency responders perceive using social media
5.3.1.	**Perception of Using Specific Social Media Platforms and Analytical Tools**
	How emergency responders perceive specific social media platforms
5.3.2.	**Limitations to Using Social Media**
	Perceived limitations to using social media
5.3.3.	**Perceived Understanding of Audience Uses and Requirements**
	Emergency responders understanding of their social media audience's social media uses and requirements
5.3.3.1.	**Content Requirements**
5.3.3.2.	**How the Audience Use/Interact with the Emergency Responders Social Media**
5.3.3.3.	**How the Audience Approach Social Media**

Table B.5: Codebook 4: Perceptions of Social Media Experience

Appendix C

Targeted Survey

This questionnaire was aimed at followers' of emergency responders based in the UK. The purpose of the survey was to establish underlying reasons, opinions and motivations of social media users following emergency responders on social media. It had two main aims:

- To yield insight as to why users choose to follow emergency responders (RQ2)
- To discover the potential impacts of emergency responders' social media usage (RQ3)

Definitions for the purpose of this survey:

As defined by the Civil Contingencies Act (2004), an *emergency* is defined as an event that threatens, or causes, serious damage to human welfare or the environment, or war or terrorism that threatens or causes serious damage to the security of the UK. A few examples include:

- Fires
- Flooding
- Storms
- Traffic Incidents
- Terrorism
- Flu pandemic

In this research *emergency responders* refer to the organisations that are at the core of emergency management. They are responsible for emergency preparation, response and recovery. These include:

- The Emergency Services; Fire, Police, Ambulance;
- Local Authorities – District and County Councils
- Health Bodies – the NHS, Public Health England
- Maritime and Coastguard Agency
- Environment Agency

Furthermore, the term *'posts'* is used in this research to refer to the many different types of messages you, as social media users, can post on the various social media platforms. For example:

- **tweets** on Twitter
- **statuses** on Facebook
- **posts** on Instagram
- **snapchats** on Snapchat

Instruction:

1. To gain the most out of your survey responses, please could you not look at your social media accounts whilst completing the survey – even if you do not know the answer.

Section 1: About the Participant:

The questions in this section are about understanding who the emergency responders' followers actually are. By understanding your age group, home location and work location, I can begin to understand the type of audience the responders are possibly reaching. Please refer to the Participant Information sheet which will explain more about how your data will be handled. However, if you are unhappy about entering this information, there is an option 'I'd rather not say' available. Please can I encourage you to use that option rather than giving a fake answer if you do not want to say. Thank you.

1. Please can you select your age group? *Under 16, 16-19, 20-24, 25-30, 30-39, 40-49, 50-59, 60+*
2. Please can you select the County you live in? *(County only required and option to not disclose is offered)*
3. Please can you select the County you work in? *(County only required and option to not disclose is offered)*

4. Which social media platforms do you use? *Twitter, Facebook, Instagram, FlickR, Snapchat, Other (please state)*

5. How would you describe your social media usage (not just how much you post, includes browsing/reading timeline/news feeds)?

   - *Very Frequent User (i.e. numerous visits a day)*
   - *Regular user (i.e. a few visits a week)*
   - *Occasional user (i.e. a few visits a month)*
   - *Rare User (i.e. a few visits a year)*
   - *Never (i.e. I have an account but haven't been on it for over a year)*

6. How would you categorise yourself as a Follower on social media?

   - *General Member of the Public*
   - *Stakeholder of the Organisation/s*
   - *Partner to the Organisation/s*
   - *Another Emergency Responder*
   - *Press/Media*
   - *Staff Member of the Organisation*
   - *Other (Please State)*

Section 2: Motivations for Following Emergency Responders:

1. How many emergency responders do you follow? *1; 2; 3; more than 3*

   - Which Social Media platforms do you follow Emergency Responders on? *Twitter, Facebook, Instagram, FlickR, Snapchat, Other (please state)*
   - What type/s of Emergency Responders do you tend to follow on social media?
     Fire, Police, Ambulance, Local Authorities (County and District Councils), HM Coastguard, NHS Bodies, Public Health Organisations, Environment Agency
   - Can you list the names of the Emergency Responders you follow?
     Please avoid going onto your social media accounts to look up who you follow. If you cannot remember all or any of the emergency responders your follow, please can you indicate this here: I can't remember all/any of the responders I follow on social media

2. What motivated you to initially follow Emergency Responders on Social Media?

3. What do you want/expect to gain by following emergency responders on social media?
    - Is there an Emergency Responder or type of Emergency Responder that you prefer to follow on social media? *(Yes/No)*
    - **[IF YES]:** which emergency responder and why?
4. What is important to you for staying engaged with Emergency Responders on social media?
5. What benefits, if any, do you feel you gain by following the Emergency Responders on social media?
6. Have you ever unfollowed an emergency responder on social media? *(Yes/No)*
    - Could you explain why?
7. Of all the emergency responders you follow, approximately how often do you read their posts?
   Very Frequently; Regularly; Occasionally; Rarely; Never

Section 3: In Times of an Emergency:

1. Where would you go for information in an emergency?
2. During an emergency would you use monitor the Emergency Responders social media activity to gaining information and understand developments of an emergency? *(Yes/No)*
3. Have you used the Emergency Responders social media activity in a past emergency to get information about the incident? *(Yes/No)*
4. Could you state the emergency/emergencies you have used the Responders social media activity?
    - Why did you use their social media activity?
    - Did you get what you wanted? *(Yes/No)*
    - Did you use it to communicate with the Responders? *(Yes/No)*
    - Overall, was their social media activity useful to you during the emergency? *(Yes/No)*
        - Can you provide some details such as Why? How? Example?
5. Do you actively change how often you read the Emergency Responders social media posts in an emergency?

- How often do you read the Emergency Responders posts in an Emergency? *Very Frequently; Regularly; Occasionally; Rarely; Never*

Section 4: Interactions with the Emergency Responders social media activity:

1. How do you stay informed of Emergency Responders' posts?
   - *Go directly onto their profile*
   - *Search by Hashtags*
   - *As and when the posts appear on your personal home timeline*
   - *All of the Above*
   - *Other means – please state*
2. Can you remember a recent post you have seen on social media posted by an emergency responder? Please could you briefly describe what the post was about? From which emergency responder was the post uploaded by? Did you like or share the post? Did you interact with the post e.g. did you forward on the post or reply to it? Did it have an image or video attached? Is there anything else you think may be valuable to know?
3. Do you use social media to:
   - Contact or have a conversation with an Emergency Responder on Social Media *(Yes/No)*
     - **[IF YES]:** Could you please briefly describe your experience of having a conversation with the responders on social media. What was it about? Were they quick to respond? Was the response helpful? Would you use social media again for that purpose?
   - Respond to Emergency Responders such as answering polls or replying to posts *(Yes/No)*
   - Collaborate with Emergency Responders on Social Media? *(Yes/No)*
4. On social media, do you:
   - Reply/Comment to Emergency Responders' posts?
     All the Time (5); Quite Often (4); Sometimes (3); On a Rare Occasion (2); Never (1)
   - Direct/Private Message Emergency Responders?
     All the Time (5); Quite Often (4); Sometimes (3); On a Rare Occasion (2); Never (1)

- Pass on Emergency Responders' Messages to Non-Social Media Users?
  All the Time (5); Quite Often (4); Sometimes (3); On a Rare Occasion (2); Never (1)
- Mention/Tag Emergency Responders?
  All the Time (5); Quite Often (4); Sometimes (3); On a Rare Occasion (2); Never (1)
- Do you try to pass on information to Emergency Responders on Social Media?
  All the Time (5); Quite Often (4); Sometimes (3); On a Rare Occasion (2); Never (1)
- Do you ask Emergency Responders questions on social media?
  All the Time (5); Quite Often (4); Sometimes (3); On a Rare Occasion (2); Never (1)
- Do you like (e.g. selecting the 'thumbs up' button on Facebook, or the Heart button on Twitter, or Heart button on Instagram) emergency responders' posts?
  All the Time (5); Quite Often (4); Sometimes (3); On a Rare Occasion (2); Never (1)
  - **[unless never was selected]:** Can you remember a recent post that you liked? Please can you state what it was about.
- Do you share (e.g. via retweets on Twitter, shares on Facebook) the emergency responders posts? *All the Time (5); Quite Often (4); Sometimes (3); On a Rare Occasion (2); Never (1)*
  - **[unless never was selected]:** Can you remember a recent post that you shared? Please can you state what it was about.

Section 5: Social Media Impact:

1. How would you rate the following about the Emergency Responders social media messages?
   - Funny?
     Extremely (5) Very (4); Quite (3); Somewhat (2); Not At All (1)
   - Trustworthy?
     Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
   - Understandable?
     Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
   - Supportive?
     Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
   - Approachable?
     Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)

- Interesting?
  Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
- Useful?
  Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
- Informative?
  Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)

2. The Emergency Responders use social media as a means of helping people to prepare, respond and recover from emergencies, by warning and informing and promoting and building resilience. Considering this, how effective do you feel their social media activity is?
   Extremely Effective (5); Very Effective (4); Quite Effective (3); Somewhat Effective (2); Ineffective (1)

3. In your opinion, where 1 is Not effective and 5 is Extermely effective, how effective do you think social media are for the following activities:

   - Emergency communications with the emergency responders?
   - Understanding what the emergency responders job role entails?
   - Improving relationships with emergency responders?
   - Satisfying information thirst about your local area from the emergency responders?
   - Engaging with Emergency Responders?
   - Increasing awareness on risks and hazards by the emergency responders?
   - Improving/increasing your perception of the emergency responders?

4. Do you do something, or have *changed* your behaviour, as a result of something you've seen on social media posted by the emergency responders? *(Yes/No)*

   - **[IF YES]:** What behaviour do you do or have changed?
   - **[IF YES]:** What encouraged you to carry out/change this behaviour?

5. Do you:

   - Check your smoke alarm regularly? *(Yes/No)*
   - Have an Emergency/Grab Bag? *(Yes/No)*
   - Have a mirror on your window sill? *(Yes/No)*
   - Know what the different weather warnings mean? *(Yes/No)*
   - Always avoid driving through flood water? *(Yes/No)*
   - When it is either extremely hot temperatures or cold temperatures, do you check on your neighbours, particularly if they are elderly, to ensure they are okay? *(Yes/No)*

6. Are any of your answers above a result of something you've seen/read on social media, posted by an emergency responder?

    - Check your smoke alarm regularly? *(Yes/No)*
    - Have an Emergency/Grab Bag? *(Yes/No)*
    - Have a mirror on your window sill? *(Yes/No)*
    - Know what the different weather warnings mean? *(Yes/No)*
    - Always avoid driving through flood water? *(Yes/No)*
    - When it is either extremely hot temperatures or cold temperatures, do you check on your neighbours, particularly if they are elderly, to ensure they are okay? *(Yes/No)*

7. Do you feel the Emergency Responders social media activity has been useful to you in an emergency? *(Yes/No)*

    - **[IF YES]:** can you provide some details such as Why? How? Example?

8. As a result of following Emergency Responders on Social Media, how would you rate the following?

    - I am kept well informed?
      Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
    - I feel more Resilient?
      Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
    - I act safer in order to avoid emergencies?
      Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
    - I have a Good Relationship with Emergency Responders?
      Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
    - I feel better prepared for emergencies?
      Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
    - I feel better educated about emergencies?
      Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
    - I feel engaged with the emergency responders?
      Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)
    - I have a better understanding on what the Emergency Responders do?
      Extremely (5); Very (4); Quite (3); Somewhat (2); Not At All (1)

Thank you for your time to participatie in this survey. Your responses will be invaluable for this research.

Appendix D

Full Overview of Observation Data

Emergency Service	No. Tweets	Tweets that are Retweets	Tweets that are Replies	Tweets that are Quote Retweeted	No of Retweets Received	No. of Favourites Received	No. of Replies Received	No. of Tweets with a URL	No of Tweets containing a Photo	No of Tweets containing a video	No. of Tweets containing Mentions	No of Tweets containing Hashtags
Police Force A	2	0	0	0	19	8	0	2	1	0	0	2
Police Force B	4	0	0	0	6	0	0	1	0	0	3	1
Police Force C	7	0	1	0	40	1	4	0	0	0	2	0
Police Force D	14	0	1	0	154	15	8	2	0	0	1	5
Police Force E	17	0	0	0	227	19	15	3	0	0	3	12
Police Force F	17	0	0	0	188	19	6	11	1	0	6	12
Police Force G	23	0	3	0	230	13	19	7	0	0	3	7
Police Force H	29	0	1	0	286	66	8	18	0	0	4	13
Police Force I	32	0	0	0	316	36	13	13	0	0	10	25
Police Force J	43	0	4	0	500	123	24	28	4	0	13	27
Police Force K	43	1	0	0	531	130	46	11	8	2	10	30
Police Force L	63	0	8	1	845	178	79	30	9	1	15	20
Fire Service A	2	0	0	0	0	0	0	1	0	0	1	0
Fire Service B	3	0	0	0	8	0	0	2	0	0	0	0
Fire Service C	7	0	1	0	35	4	1	5	1	0	1	5
Fire Service D	26	17	0	0	151	20	1	14	3	0	18	17
Fire Service E	14	0	1	0	73	11	2	8	0	0	6	7
Fire Service F	20	0	2	0	133	12	2	15	0	0	5	4
Fire Service G	20	0	0	1	120	23	4	2	1	0	9	9
Fire Service H	66	30	0	17	291	40	10	46	1	1	9	31
Fire Service I	27	0	0	0	336	75	13	20	6	0	7	16
Fire Service J	45	18	0	0	370	53	13	19	10	0	5	15
Fire Service K	34	0	0	0	207	28	18	14	3	0	11	24
Fire Service L	45	0	1	0	170	31	35	34	7	0	7	7
Fire Service M	69	0	0	0	264	67	16	5	3	0	14	4
Fire Service N	82	5	3	0	304	63	17	49	9	0	52	55
Ambulance Service A	8	0	0	0	14	2	2	4	0	0	0	0
Ambulance Service B	17	0	0	0	116	22	3	4	0	0	1	14
Ambulance Service C	21	2	0	0	278	33	10	10	0	0	1	20

FIGURE D.1: Sample of Emergency Responders' Use of Twitter Features during UK Winter Floods 2013/14

Emergency Service	Caution and Advice	Infrastructure and Utilities	Donations and Volunteer	Sympathy and Support	Affected Individuals	Flood Related Information	Rescue	Other Information
Police Force A	2	1						
Police Force B	4	2				2		
Police Force C	3	4						1
Police Force D	5	9				3		
Police Force E	8	11			1			
Police Force F	9	9		1		1		1
Police Force G	6	12			1	2	1	5
Police Force H	25	5				6	1	2
Police Force I	31	1				6		
Police Force J	24	2	1		1	1	5	11
Police Force K	13	11				3	6	15
Police Force L	28	24	1		1	6	4	13
Fire Service A							1	1
Fire Service B	1						2	
Fire Service C	4					1	1	2
Fire Service D	85	2		1	1	15	2	1
Fire Service E	14	1				1		
Fire Service F	10		1		1	2	2	6
Fire Service G	10	1				5	3	8
Fire Service H	50	6			4	6	2	5
Fire Service I	14	5			2	2	2	5
Fire Service J	28	7				5	4	5
Fire Service K	40	8		1		22	14	21
Fire Service L	18	6			6	4	11	10
Fire Service M	23	26		1	7	8	18	11
Fire Service N	27	1		1	3	25	12	25
Ambulance Service A	7					3		
Ambulance Service B	20	1	1			1		1
Ambulance Service C	18				3	5	3	10

FIGURE D.2: Sample of Content Shared by Emergency Responders during UK Winter Floods 2013/14